Project briefs about governance system in each case-study

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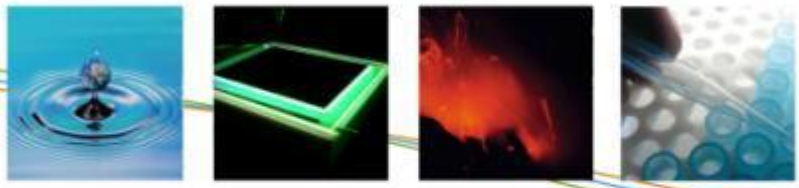

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Version	Date	Description
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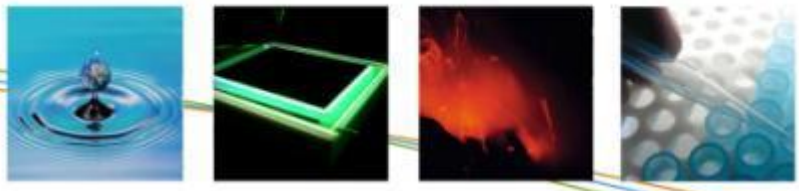

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List of abbreviations & acronyms

ACA	Catalan Water Agency
ACP	Agricultural Catchments Programme
ADBPO	Po River Hydrographic District Basin Authority
AFBI	Agri-Food & Biosciences Institute
AGEA	Agenzia per le erogazioni in agricoltura
AGREA	Agenzia regionale per le erogazioni in agricoltura della Regione Emilia Romagna
AMB	Area Metropolitana de Barcelona
APHA	Animal and Plant Health Association
ARERA	Autorità di Regolazione per Energia Reti e Ambiente
ARMA	Agency for Restructuring and Modernization of Agriculture
ASPCAT	Agencia de Salut Pública de Catalunya
ASSAP	Agricultural Sustainability Support and Advisory Programme
ATERSIR	Agenzia territoriale dell'Emilia Romagna per i servizi Idrici e Rifiuti
BMP	Best management practice
CAA	Centro assistenza agricola
CAP	Common agricultural policy
CBPC	Consorzio di Bonifica di Piacenza
CC	Consell Comarcal Baix Llobregat
CIA	Agricoltori Italiani
CPABLL	Consorci del Parc Agrari del Baix Llobregat
CPGENDLL	Consorci Protecciò I Gestiò Espais Naturals Delta del Llobregat
CUADLL	Comunitat d'Usuaris d'Aigües del Delta del Llobregat
DAFM	Department of Agriculture, Food and the Marine
DANVA	Association of Danish Water and Waste Water
DHPLG	Department of Housing, Planning and Local government
DWTP	Drinking water treatment plant
EIP	European Innovation Partnership initiative
EPA	Environmental Protection Agency
ESAB-UPC	Escuela Superior de Agricultura de Barcelona – Universidad Politécnica de Cataluña
EU	European Union
GAP	Good Agricultural Practice
GLAS	Green, Low-Carbon, Agri-Environment Scheme

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IDAEA-CSIC	Instituto de Diagnóstico Ambiental y Estudios del Agua – Consejo Superior de Investigaciones Científicas
IFA	The Irish Farmers' Association
IFFPG	Irish Farms Film Producers Group
ILVO	Research Institute for Agriculture, Fisheries and Food
ISTAT	National Institute of Statistics
ITP	Institute of Technology and Life Sciences
LAWCO	Local Authority Waters and Communities Office
NFGWS	National Federation of Group Water Scheme
NVZ	Nitrate Vulnerable Zone
PGI-NRI	Polish Geological Institute – National Research Institute
PHS	Public Health Secretary
POM	Program of measures
PPP	Plant protection product
RDOŚ	Regional Directorate for Environmental Protection
RDP	Rural Development Programme
RESET	Regulation, Education, Social pressure, Economics, Tools
TAMS	Targeted Agricultural Modernisation Scheme
UB	University of Barcelona
UMA-UPC	Agricultural Machinery Unity (UMA) of the Polytechnic University of Catalonia (UMA-UPC)
UU	Ulster University
VIEP	The Voivodeship Inspector of Environmental Protection
VITO	Flemish Institute for Technical Research
VLM	Flemish Land Agency
VMM	Flemish Environmental Agency
WFD	Water Framework Directive
ZUT	West Pomeranian University of Technology

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Management summary

WaterProtect conceptualizes water resource systems as complex socio-ecological systems, consisting of a resource system and a governance system. In the management of these water resource systems, focus in often on the resource system, whereas the impact of the functioning of the governance system is often underrated. However, analysing and improving water governance in areas with water quality problems could give new impulses to different actors and incentivize them to take action. Therefore, the WaterProtect project pays special attention to governance and assumes a multi-actor approach to bring change in the action labs. In this context, WP2 was designed to assess the current governance state and governance progress in the different action labs. As most action lab leaders have no expertise with how to assess and improve governance, a framework for analysing and improving water governance systems was developed, which is extensively described in D2.1.

This deliverable, D2.2, follows on D1.1 by showing how the different action labs used the framework to analyse and improve governance in their action lab .The main part of this deliverable exists of seven project briefs, one for each action lab, that describe the governance state and progress of that action lab. Moreover, these project briefs include extensive information on (1) the general characteristics , (2) the start situation and local context in the action lab (3) the process with the different actions and measures taken, and (4) the achievements. It includes both quantitative (e.g. how many and which kind of meetings have taken place, and which actors were present or involved?) as qualitative information (e.g. which type of actions work best to attract the attention or increase the involvement of different kind of actors?). This information was collected by the respective action labs, which had to report on a regular basis on topics concerning water governance.

The project briefs show that action labs are very different, and that a local context-specific approach to governance is of paramount importance. This means that the effectiveness of specific solutions might differ, even though action labs sometimes struggle with the same problems. In deliverable D2.4 (expected May 2020), the project briefs are compared and explanatory factors for the differences in achieving solutions are discussed such as the type of agriculture that is practiced, the willingness of different actors to cooperate, the availability of monitoring data, the availability of resources to help farmers to implement practices, etc.

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1 Introduction

The aim of the WaterProtect project was to improve the quality of drinking water sources suffering from agricultural pollution. Farmers were motivated to implement suitable measures to better protect and enhance the water quality. However, farmers are not the only type of actors that have a role to play in the protection of drinking water sources. Therefore, a multi-actor approach was strived for, i.e. tackling the problem by developing solutions on multiple levels and by involving multiple stakeholders and sectors. In order to support the development of these holistic water governance systems, i.e. that include horizontal and vertical value chains in which the different actors cooperate, a governance framework was designed (Deliverable D2.1 - Framework for developing and analysing water governance systems). The different action labs were invited to analyse the water governance system in their action lab according to this framework. On the basis of this analysis they were expected to design and implement suitable actions and measures to enhance the functioning of the water governance system in their respective action labs.

The aim of this deliverable is to give an overview of the whole process in each of the different action labs, including (1) the start situation and local context, (2) the specific ambitions and objectives, (3) the different actions and measures taken and (4) the achievements. This deliverable can then be used to draw some learned lessons and conclusions, which will be presented in deliverable 2.4.

The different project briefs of this deliverable showcase the course of the WaterProtect process in the different action labs. How these project briefs are structured and on which data they are based, is presented in the following subsection of this introduction.

1.1 Structure of the project briefs

Action labs went through a whole process with as ultimate and long-term goal an improvement in the water quality. However, the situations in the different action labs cannot be compared in a simple way. We have to take into account that each action lab is different, shaped by a diverse set of interacting actors and environmental conditions. For this reason achievements should not be seen as stand-alone results, but interpreted in its broader water system context by comparing them to the initial system context and linking them to the series of actions that were organised. In order to draw conclusions about the results in the different action labs, we thus collected and pooled four different types of information for each action lab. These are:

(1) the general characteristics;
(2) the start situation and local context;
(3) the process with different actions and measures taken;
(4) the achievements.

These are explained briefly in the following subsections.

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1.1.1 General characteristics

In a first part, the action lab is presented briefly by some important characteristics, including (1) territorial features, like the surface area of the action lab or landscape characteristics (rural, peri-urban, urban); (2) agricultural features, like the main farm structure or main production output; and (3) water system features, like the type of water source (surface or groundwater). It also includes a schematic representation of the water quality problem in the respective action lab (Figure 1). This representation gives a quick view on the type of pollutant that was focused on during the project, i.e. the type of pollutant targeted by best management practices (BMP's) and how agricultural production affects the measured concentrations of this pollutant in the water.

In order to give a complete picture of the water quality problem, the schematic representation also includes other types of pollutants, i.e. pollutants not in focus during the project, which are present in the action lab. As water quality is influenced by several factors, there exist no a linear relationship between agricultural production and the pollutant concentrations monitored. Other actors, such as private individuals using pesticides in their garden, or environmental factors, like the weather, could also have an impact and therefore also should be inventoried.

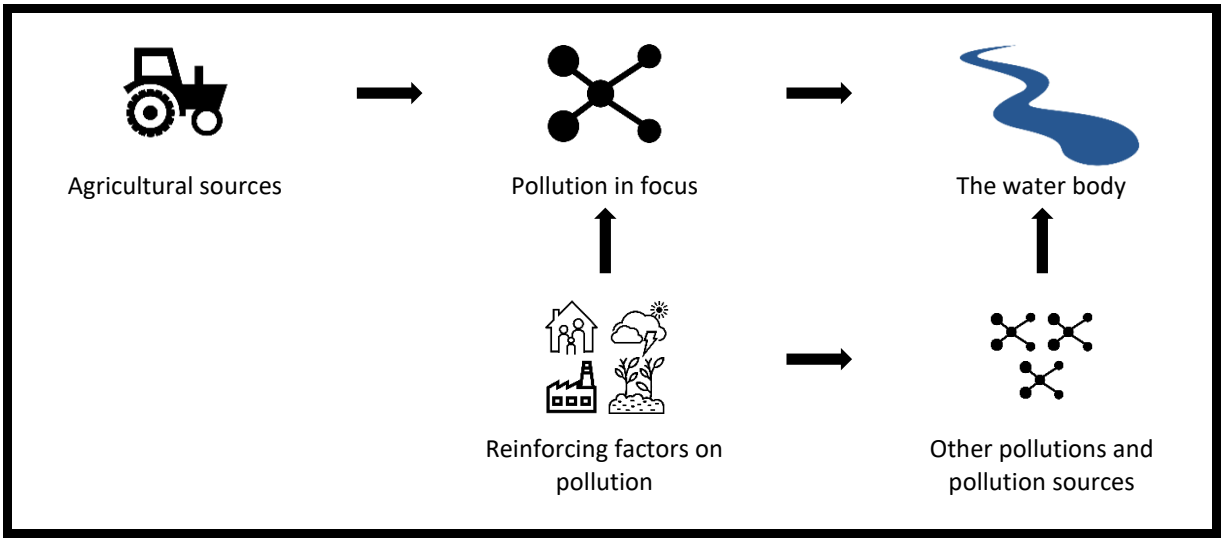

Figure 1: Schematic representation of the water quality problem.

1.1.2 The start situation and local context

The second part exists of an analysis of the starting situation, including an analysis of the relevant actors and the functioning of the water governance system in the beginning of the project.

First, a list was made of all relevant actors present in the action lab and their specific role. For each group, the actor type was indicated, supplemented by the specific actors present in the action lab that fall within this type and their specific role in the system. Five groups of actors were defined, which are shown in figure 2 based on their positions in relation to the agricultural production chain:

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- production and distribution of plant protection products;
- agricultural production;
- processing and selling food products;
- drinking water production;
- context factors and societal preferences over the entire system and all subsystems.

All the actors identified above are interacting in a broader water governance system. The extent to which this system provides a good environment for the development and implementation of measures depends on several factors. First, identified actor types will differ in their knowledge of water quality, their motivation to achieve a better water quality and their capacity to properly influence water quality. As actors will have to work together in order to tackle the water quality problem, it is crucial to keep those differences in mind. Second, the degree to which the environment enables good water governance is also important. In order to cooperate in a constructive environment, six building blocks must be present, i.e. transparency and trust, coherence, leadership, appropriate scale, inclusive participation and clear roles and responsibilities (Deliverable D2.1 - Framework for developing and analysing water governance systems). In addition to these building blocks, it is important to acknowledge the more general system context in which the action labs are working. Cultural and social systems and mechanisms and customs contribute to the complexity of the system.

If there is an enabling environment, it will be easier to increase actor awareness and put in place specific actions to improve the water quality. The functioning of the water system as explained above is summarised in figure 3. In the different project briefs, every indicator of the scheme is analysed with the aim of getting a full picture of the initial functioning of the system in the different action labs.

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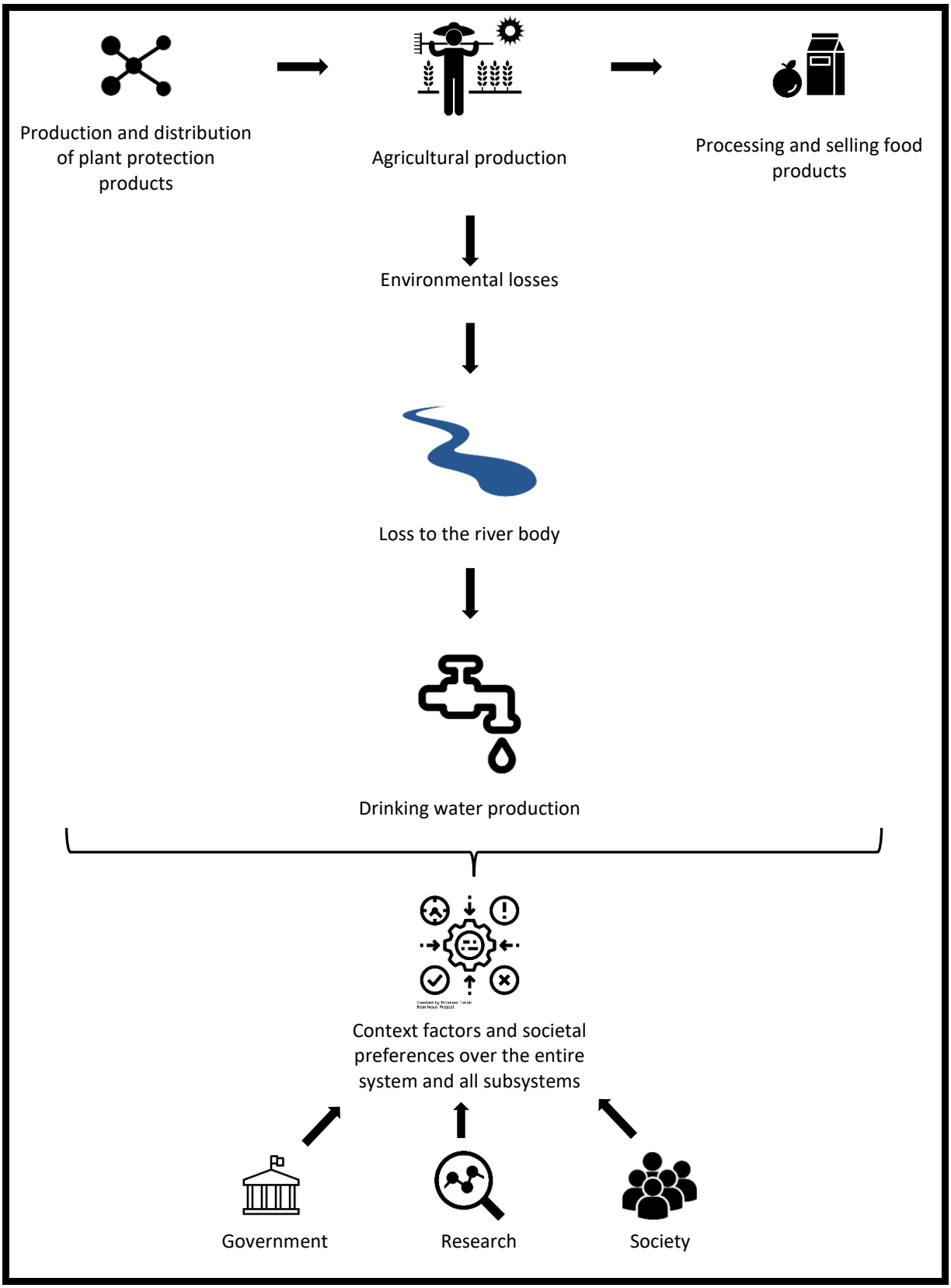

Figure 2: The actors and their roles.

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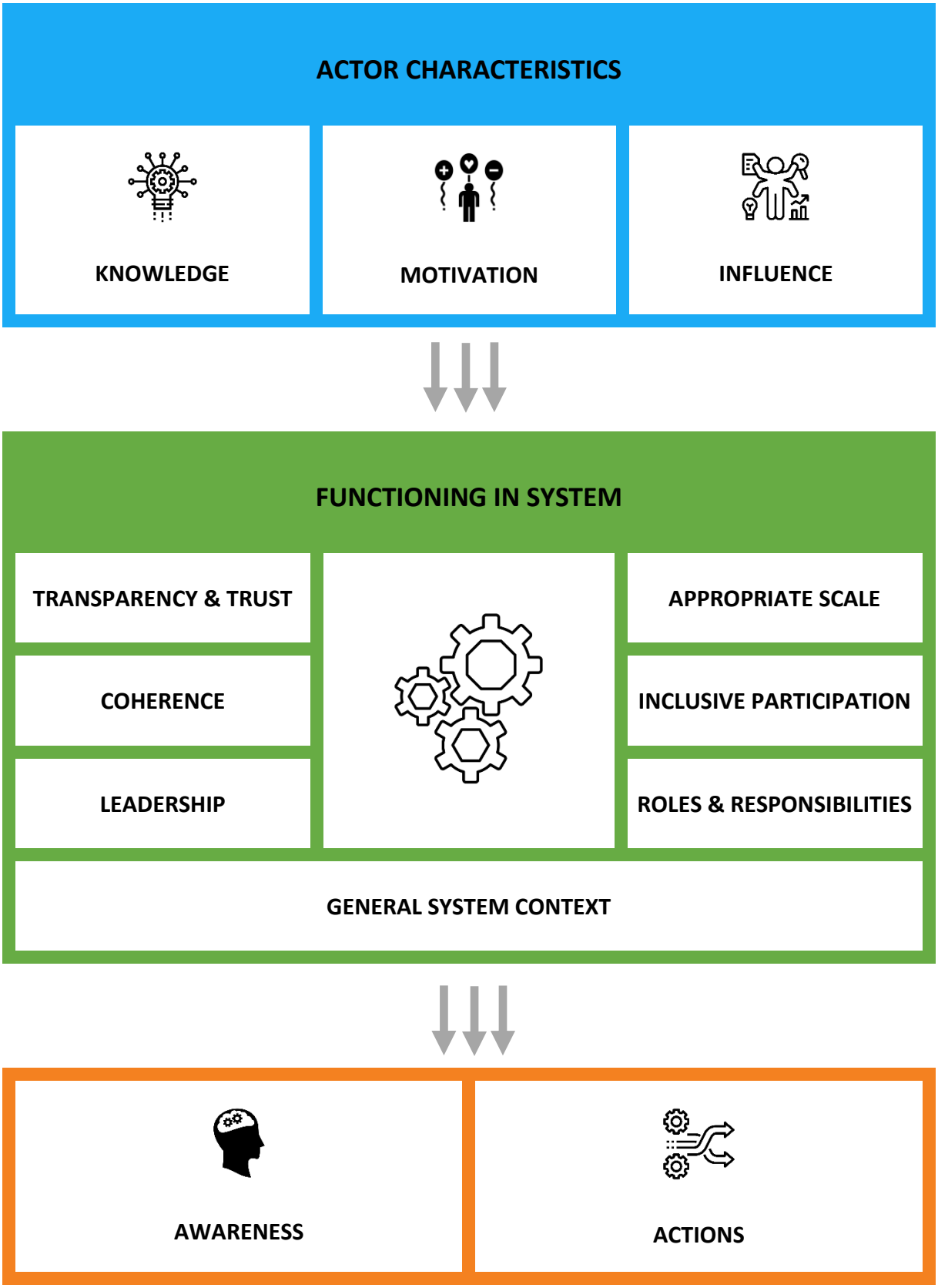

Figure 3: Functioning of the water governance system.

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1.1.3 The process with different actions and measures taken

In a third part of the project briefs, the process is summarized and evaluated. This process includes all meetings and actions that have taken place in the action lab with as long-term goal the improvement of the water quality. In this deliverable, the process is visualised in a scheme, which reports each action/meeting that has taken place, as well as its methods of contact used, actors involved and ambitions pursued (figure 4) This allowed for a quantitative analysis of the process in the different action labs (e.g. “How many times was an interactive workshop organized?”). This was complemented by a qualitative analysis of the observations of the action lab leaders, which reported on their experiences with using different methods and with involving different stakeholder groups (e.g. “What was perceived positive or negative about this method?”).

1.1.4 Achievements

In a fourth and final part of the project briefs, the achievements are reported. These achievements are structured according to the ambitions that were formulated by the respective action labs. These ambitions were chosen based on the analysis of the start situation, and have to be understood as key aspects on which the action labs want to work in their action lab and in the context of which they want to achieve concrete results at the end of the project. Although there are differences between the action labs in the set of ambitions that were chosen, there were five ambitions that all action labs focused on. We discuss briefly those ambitions that were common among the action labs, which are (1) network formation, (2) exchange and continuation, (3) knowledge building, (4) actor awareness and (5) farmer practices. Extra ambitions where then formulated based on specific problems that were identified during the analysis of the start situation in each action lab.

A first ambitions is ‘network formation’, which includes the formation of a network and a platform to support project partnerships and improve communication among partners. The second ambition ‘exchange and continuation’ comprises general project management, such as the development of a work plan and protocols, the distribution of tasks, the dissemination of information and the organization of trainings. Attempts to continue local operation in the areas after the WaterProtect project also belongs to this achievement. These first two ambitions have to be understood as intermediate ambitions, which are necessary to reach more specific ambitions with concrete impacts on the water quality. A third ambition is ‘knowledge building’ and includes actions of the project partners to learn more about the water quality problem. This can include monitoring of the water quality and its environmental impact, but also learning about the farmer population and their habits with respect to handling plant protection products and/or nutrients. A fourth ambition is ‘awareness raising’, and in order to reach this objective, the results of knowledge building activities are distributed among the relevant stakeholders. As farmers are often not aware of the bad water quality and the simple actions they can take to avoid pollution, this ambition is key in many action labs. Some practices however are more elaborate and need more efforts from project partners to get them implemented

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by farmers. These efforts are bundled under a fifth ambition, i.e. 'farmer practices', which are chosen carefully based on the analysis of the local situation in each action lab. The other, action lab specific ambitions are further explained in the project briefs.

METHOD	ACTORS	AMBITION
 Exchange – bilateral conversation	Action lab leader(s)	 Network formation
 Information – presentation	Research	 Exchange and continuation
 Exchange – interactive workshop	Chemical producers	 Knowledge building
 Exchange – questionnaire - survey	Distributers of plant protection products	 Actor awareness
 Informing – newsletter	Representatives of chemical producers	 Farmer practices
 Exchange – multi-actor conversation	Spraying machine dealers	 Rewarding system/common water fund
 Exchange – demonstration - field visit	Farmers	 Water provision infrastructure
 Informing – leaflet	Contract sprayers	 Sanitation safety plan
 Informing – conference	Farmer advisory and unions	
	Water producers and suppliers of drinking water	
	River basin/environmental protection agency	
	Regional – national government	
	Local government	
	Food processors and distributers	
	Inhabitants – consumers	
	NGO's	

Figure 4: Legend of visualisation of the process.

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1.2 Methodology

The project briefs contain extensive information on the actors and actions taken in each action lab over the course of the WaterProtect project. This information was collected by the respective action lab leaders, which had to report on a regular basis on topics concerning water governance. The exact timing of the different documents is represented in table 1. The different formats in which action lab leaders reported about their action lab, and the different topics about which they had to report are explained in this section. Action lab leaders were encouraged to use different sources in their reporting, including face-to-face contacts with stakeholders, formal written communication and electronic communication (figure 5). Differences in the degree of detail to which action lab leaders have been reporting, is reflected in difference in comprehensiveness of the final project briefs.

Table 1: Timing of different reporting documents.

	Completed by the action lab leaders
Reporting on the start situation	March 2018
Reporting on the ambitions and objectives	November 2019
Reporting on the multi-actor process	Two-monthly (at every core group meeting)
Reporting on the achievements	April 2019, August 2019, December 2019
Evaluation and reflection	December 2019

Face-to-face	**Formal written**	**Electronic**
• Meeting • Workshop • Discussion group • Interview • Questionnaire • Bilateral conversation	• Scientific papers and reports • Legislation • Guidelines • Books	• E-mails • Official databases • Websites of organisations

Figure 5: Methods used by action lab leaders to gather requested information.

1.2.1 Reporting on the start situation

First, action lab leaders were asked to provide an extensive description of the start situation of their action lab. ILVO made a fill-in table based on the elements of the water governance framework (figure 6) developed in deliverable 2.1 (Deliverable D2.1 - Framework for developing and analysing water governance systems). The water governance framework consists of three key elements (1) the water system and its related problems; (2) the governance system and (3) the building blocks. Each element was elaborated in detail, supplemented by in-depth questions.

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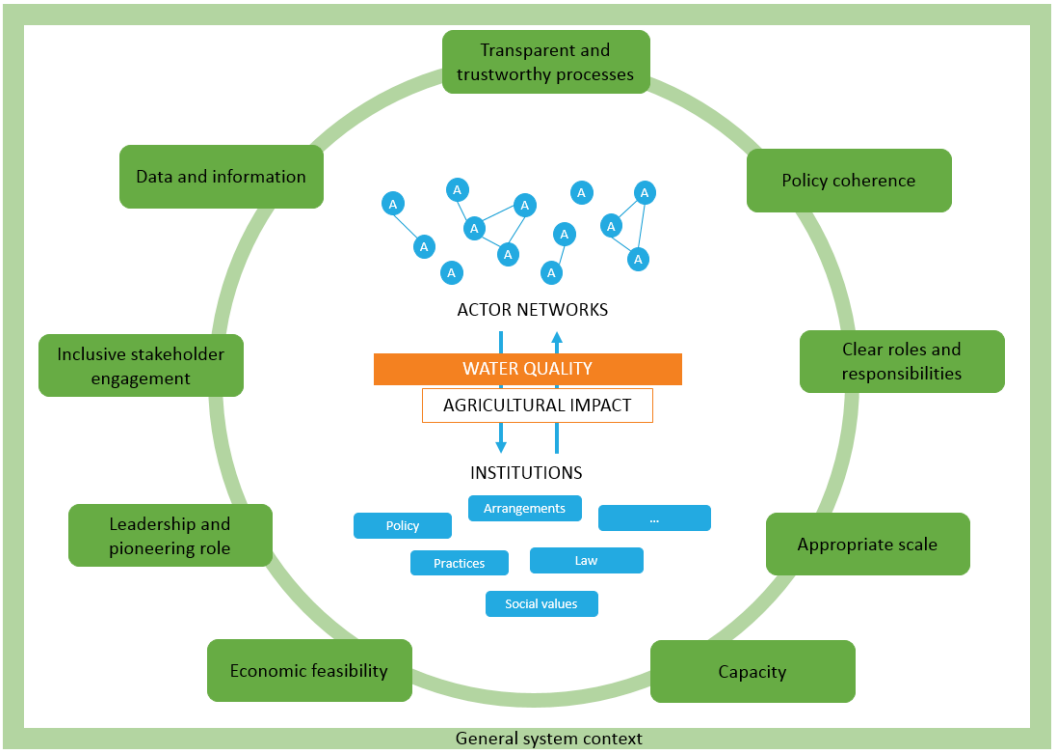

Figure 6: The water governance framework. The framework can be used as a tool to analyse and improve water governance systems. The focus in our project is on the pollution of water systems by agricultural sources (point and diffuse pollution) (orange in figure). In order to improve the water quality and prevent further pollution from agriculture, all kind of actors could interact and formulate institutions, e.g. incentives to stimulate behavioural change (blue in figure). A last element of the framework are the building blocks. When those building blocks are present and well-functioning, the implementation of the proposed solutions or arrangements will be enhanced (green in figure).

1.2.2 Reporting the ambitions and objectives

Action lab leaders were asked to fill in a questionnaire concerning the ambitions and objectives of their action lab. The aim of the several in-depth questions was to guide action lab leaders through the process of formulating ambitions and objectives by drawing their attention to several important aspects. Figure 7 lists the main topics of the questionnaire.

Knowledge building	Awareness	Local context	Incentive programs	Building blocks
• What techniques will be used to improve actor knowledge on the problem? • Who will be responsible for the knowledge building?	• Which actors will be targeted for increasing their awareness on the problem? • Which methods will be used? • Which results are expected from the awareness campaigns?	• Are the current or adapted way of agricultural production and the production of drinking water compatible? • Are pollution sources and individual polluters identifiable? • What are appropriate agricultural measures in your action lab?	• Who are you going to target in your action lab and why? • Which incentive mechanisms are you going to use and how are you going to do this? • Which actors will be involved and what do you expect from them? How are you going to approach them?	• Which actions are you going to take to ensure building blocks of a well-working system are present? • Which advantages and disadvantages do you expect on the catchment scale?

Figure 7: Summary of the main topics covered by the questionnaire 'ambitions and objectives'.

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1.2.3 Reporting the multi-actor process

During the project, action lab leaders were asked to report on the meetings and actions taking place in the action lab. This was done through a comprehensive excel file, which had to be updated regularly. Figure 8 shows the structure of the excel file.

	INTERACTIVE MOMENT:	INTERACTIVE MOMENT:
PREPARATION		
How did you motivate/convince stakeholders to participate? (direct email, letter, phone, through associations, involving persons with good reputation, invite established connections,		
OBJECTIVE		
What were the goals of the meeting?		
Which questions were discussed?		
ACTORS		
Which actors were invited?		
Which actors were responding?		
Which actors were missing? Why?		
METHODS		
Which methods were used?		
Who managed the techniques?		
GROUP PROCESS		
Was there a common objective for the actors?		
Was there a conflicting situation between the actors?		
What were the major challenges you were faced with? (identify relevant stakeholders, language issues, time constraints to organize and to present, selecting the right channel for		
Were the activities relevant and interesting to all members?		
RESULTS		
What were the main advantages or positive results of organizing this session? (gathering quicker and deeper insight in the topic, establishing long-term relationships, contribute to networking, sharing knowledge, ensuring dialogue between stakeholders, feedback, etc.)		
What have you learned from the actor meeting?		
OTHER		
Other practical (or theoretical) experiences that you want to share with the partners with regards to the stakeholder		

Figure 8: Structure of the excel file that was used to inform the work package leader of new updates concerning the process of the action lab.

1.2.4 Reporting on the achievements

Similarly as the reporting on the process, the action lab leaders were asked to report on the achievements in their action lab in the corresponding excel file. Figure 9 shows the structure of the excel file.

(date dd/mm/yyyy)	ACHIEVEMENT April 1 2019
Improved water quality	
What improvement did you measure?	
What explains the improvement?	
Extra BMP's implemented by local stakeholders	
Which BMP is implemented? By who? Amount of people implementing?	
What was the incentive for this?	
Mitigation system installed or demonstrated by WaterProtect partners	
Which system is installed/demonstrated? By who? Amount of people reached?	
What was the incentive for this?	
Harmonised datasets being used by local stakeholders	
Which dataset is available? In what format (web, report, ...)?	
Who uses the dataset? For which goal? Amount of people?	
What was the incentive for this?	
Participatory webtool being used	
Who uses the webtool? How many users? How many	
What was the incentive for this?	
Positive change of behaviour with local stakeholders	
Who changed his/her behaviour? In what way? Amount of people involved?	
What was the incentive for this?	
New/adapted regulation that facilitated better water quality	
Which regulation has been developed/adapted? How does this help? How did it improve policy coherence?	
What was the incentive for this?	
Financial system developed/implemented	
How does the financial system works? Who pays? Who gets paid? For which actions? Number of people involved?	
What was the incentive for this?	

Figure 9: Structure of the excel file that was used to inform the work package leader of new updates concerning the achievements of the action lab.

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1.2.5 Evaluation and reflection

Finally, action lab leaders were asked to answer a list of reflection and evaluation questions. The questions were centred on three important aspects:

- the multi-actor process;
- building blocks for a well-working governance system;
- success, failure and learned lessons in the action lab.

Figure 10 lists the main questions of the questionnaire.

Multi-actor process	Building blocks for a well-working governance system	Success, failure and learned lessons in the action lab
• Looking back at the multi-actor process you have been through in your action lab, how effective were the different methods (to involve different stakeholders, to create interaction and innovative ideas, to realize your ambitions, considering the time and/or money invested)? • Based on your experiences in the action lab, what are important barriers/levers to reach and involve farmers in water governance? Do you think most of the farmers are aware of the problem, and willing to take action and avoid pollution? • Based on your experiences in the action lab, what were other important actors to involve in the process, in order to find solutions to the water quality problem? What are important barriers/levers to reach and involve them? Are these actors that could not be reached? Why not? What do you think could be done to reach them?	• To what extent is trust and transparency improved during the process? How do you see this improvement? How has it been reached? • Is there an actor/organization that can take the lead when dealing with the problem in the action lab (other than the action lab leader)? Who? If no: why do you think no one takes up this role? • Are there pioneering farmers or pioneering actors in the action lab to take the lead in implementing best management practices? • Are there still important contradictions in opinions related to the state of the water quality and the necessary actions to improve the water quality? Are the actions clear to and agreed upon by the different actors? • Was the scale of your catchment workable? Would you recommend other regions to work on the catchment scale?	• What do you consider successful in your action lab? • What do you consider as a failure in your action lab? • Can you speak of a changed system within the timing of the WaterProtect project? • What did you learn? •What would you do different next time? • What would you do/leave the same?

Figure 10: Questions of the 'evaluation and reflection' reporting document.

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2 Belgian action lab – Bollaertbeek

2.1 General characteristics and description of the problem

- 22,6 km²
  Small townships (Voormezele and Wijtschate) + borders with Kemmel and city of Ieper
- Southern part is a bit hilly and erosion sensitive
- 81% agricultural land: Stock breeding, arable crops and vegetable production (emerging sector)
- Surface water capturing area (reservoirs 'Verdronken Weide' and 'Zillebeke vijver')

Pollution in focus

- Plant protection products
- The peaks become more pronounced through the years.
- The problem reflects the spraying season. During winter time, there are little problems with plant protection products, the concentration increases in spring, and decreases again in September.

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 **Agricultural sources**	• Research figures for Flanders indicate that more than 50% of the pollution is caused by point pollutions, 5% by drift and 30% by runoff (Source: Topps project) • Point pollution: could be caused by filling and cleaning of tank on paved surface without reservoir for remnant water, by application too close to the stream, by foaming (turbulence of the substances), by being careless with the cap of the bottle, etc. • Run-off and erosion: is a problem in the southern (steeper) part. • Conversion of meadows to arable land, which causes more runoff.
 **Reinforcing factors on pollution**	• Weather conditions: runoff after a heavy rain shower, dry periods (same pollution will lead to higher concentrations). • Climate change: more dry periods and extreme rainfall (more erosion/runoff). • Private individuals: treatment of private gardens with plant protection products, hobby farmers • Treatment of the train tracks • Garden contractors • Maintenance of war cemeteries in the area, where local regulation with respect to PPP does not apply
 **Other pollutions and pollution sources**	• Domestic waste water due to incomplete sewage system • Phosphorous (algae problem) • Medicines, contraceptives, drugs, etc. • Car accidents

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2.2 Start situation

2.2.1 The actors and their roles

Production and distribution of plant protection products

Actor type	Actor in action lab	Role
Chemical producers	Bayer, BASF, etc.	Production and distribution of plant protection products + spreading information on correct use of their products.
Distributers of plant protection products	Deva Fyto, Sanac, Demagri, Agro Boeraeve and Intergrow	Sell plant protection products to farmers + give advice to the farmers on how to use their products.
Actor responsible for the collection of the packaging	AgriRecover	Collection of packaging materials.
Representative of chemical producers	PhytoFar	Promotion of good use of PPP to ensure sustainable agriculture.
Representative of chemical distributers	PhytoDis	Promotion of a correct distribution and storage of plant protection products.

Agricultural production

Actor type	Actor in action lab	Role
Farmer	164 farmers	Production of food in the area.
Seasonal farmer	Seasonal farmers	Production of food in the area on temporarily (seasonal) rented parcels.
Contract sprayer	Contract sprayers	Spraying on behalf of the farmers.
Spraying machine dealers	Dauchy and Agri Lemahieu	Sell sprayers to the farmers and provide maintenance of the sprayers.
Farmers unions	Boerenbond and ABS, Agrobeheercentrum, ‘t Boerenlandschap	Listen to problems and concerns of farmers + influence on policy + providing information to farmers + follow up of local projects.
Farmer advisory	Inagro	Support for farmers, research for farmers.

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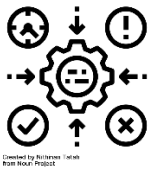
Union of contract sprayers	VOLSOG	Support of the contract sprayers + spreading information to contract sprayers.

Processing and selling food products

Actor type	Actor in action lab	Role
Processing industry	Example: potato and frozen vegetable processing industry	Quality analysis of the products (residues on the agricultural products) before processing and selling the products to the consumers.
Retailers	Example: REO veiling + supermarkets	Quality analysis of the products (residues on the agricultural products) before selling the products to the consumers.

Drinking water production

Actor type	Actor in action lab	Role
Water producers and supplier of drinking water	De Watergroep	Monitoring of the water quality at the intake to the reservoir Provider of drinking water to certain parts in Flanders.
Water treatment plants	Aquafin	Responsible for water treatment infrastructure in the Flemish region.



Context factors and societal preferences over the entire system and all subsystems

Actor type	Actor in action lab	Role
Supranational government	European Commission	Responsible for the Common Agricultural Policy + responsible for the approval of active ingredients + Responsible for the Water Directive.
Regional or national government	Department of agriculture	Agricultural legislation + Flemish implementation of CAP.
	Department of Environment	Policy related to environmental quality.

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	VLM (Flemish Land Agency)	Implementation and control of manure legislation + responsible for agri-environmental agreements.
	FOD Volksgezondheid	Approval of Plant Protection Products in Belgium.
	VMM (Flemish Environment Agency)	Monitoring of water quality in Flanders. Responsible to report the water quality to the Flemish government and the EU in function of the Water Directive + Catchment agency – management of the intake of water to the reservoirs in case of good quality.
	Province West-Flanders	Catchment agency - Management and maintenance of the infrastructure of the Bollaertbeek + infrastructural works
	Regionaal landschap	Committed to preserve the important natural and landscape assets of the region + active involvement of government, interest groups and citizens.
Local government	Heuvelland	Local policy and priorities implementation of BMP in agriculture + Local policy and priorities related to water issues
	Ieper	Local policy and priorities related to implementation of BMP in agriculture + Local policy and priorities related to water issues + management of the reservoir + follow-up of water quality in general
Research	Inagro	Support to and research for farmers. In WaterProtect: action lab leader
	VITO	In WaterProtect: support the monitoring campaigns and the development of the web tool
	ILVO	In WaterProtect: support the actor involvement and act as facilitator in the multi-actor process.
Civil society organisations	VELT, Natuurpunt, etc.	Influence on private individuals on the use of plant protection products.
Inhabitants	Inhabitants of the region	They can use plant protection products in their own gardens

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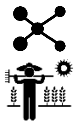
2.2.2 Functioning of the water governance system

KNOWLEDGE		
Monitoring		• Monitoring is regularly done by VMM (3 measuring points for Bollaertbeek) and De Watergroep (1 measuring point): detailed information about water quality exists.

MOTIVATION		
Image		• Lower level governments want to/have to do their best for higher level government. This can improve their image or prevent sanctions.
		• The image of agriculture is important for all actors in the food chain.
Use of the water		• If the water is clean, local farmers can use the river water for irrigation and as drinking water for their animals.
		• To use the water for the production of drinking water for the whole year round (intake of water at any time of the year).
Use of PPP		• The actors related to the production, distribution and use of the plant protection products want to avoid further prohibition of plant protection products in order to ensure their profession and their way of working the land. Development and licensing of new products is very expensive. Farmers prefer to continue using the products they know and already bought.
Economics		• Some measures require an investment or a change in land use (for example buffer strip or plantations along the watercourse). These measurements contradict with the aim of maximization of production of crops and hence income. In that way, this counteracts the farmers' willingness to take action.
		• De Watergroep currently has a cost to purify the water. The cleaner the water, the lower their cost to produce drinking water (minimization of the purification cost to produce drinking water).

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Attractive and healthy environment		• To ensure a good, attractive and liveable environment is important for the local actors like inhabitants, farmers and local government.

INFLUENCE

Implementation of BMP's		• Farmers are responsible for the effective implementation of best management practices on farm level.
Information and education programs		• Application 'Plant protection products': Combination of information about the control of diseases, pests and weeds in more than 50 crops. The application also contains information on the warning systems for different pests and diseases and preventive measures. (Inagro) • Application 'Spraying aid (Spuithulp)': Exchange of information concerning spray techniques, products and buffer zones along watercourses (ILVO, Inagro, PCA, PIBO)
		• Campaign 'Bluft e beke van de beek': Sensitization campaign for farmers to respect the distance rules, organized by province West-Flanders (2015).
		• There are organized trainings in the context of the 'spraying license'. Farmers who want to spray have to follow a basic course on how to use plant protection products safely. Only by following this course, they can obtain a spraying license. Farmers who have a spraying license have to follow follow-up course.
		• Web application 'Fyteauscan': A scan is made of locations at the farmyard where point pollution might occur
		• Campaign 'MAP-man': Sensitization campaign for farmers about fertilization and water quality organized by many organizations (2016).
		• Civil society organizations can have an influence on the perception of private individuals related to the water quality

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		and on the influence of farming on the water quality. They can also influence the willingness of the consumers to pay for a higher price for food products
		• Inspection of the sprayer: sprayers are checked every 3 year (obligatory) for proper functioning. During the sprayer inspection, all parts influencing the distribution of the crop protection products are tested, e.g. the pressure gauge, nozzles, pressure distribution, spray boom stability, etc.
Control		• Cross-compliance is a mechanism that links direct payments to compliance by farmers with basic standards concerning the environment, food safety, animal and plant health and animal welfare, as well as the requirement of maintaining land in good agricultural and environmental condition. Some measures are checked for the cross-compliance (used of approved PPP, 1 meter buffer strip).
Economics		• Agri-environmental management agreements: depending on the kind of agreement (environment, water, etc.) they may contribute to a better environment or a better water quality • Flemish Agricultural Investment Fund: Financial support of the national government in order to support investments on farms. • GMO (gemeenschappelijke marktordening – common organization of the market) funding: GMO funding by farmer cooperatives for environment-friendly vegetable production among which treatment systems for remnant water and reducing nozzles. • Erosion measures: For erosion sensitive municipalities, measures are for 75% funded by the Department Environment, 15% by the province and 10% by the municipality.
Consultation and cooperation		• Catchment meetings: Consultation of all water managers to discuss problems and projects. • Gebiedsgericht thematisch Overleg (area-specific thematic meetings): Meeting to discuss the situation of the water state and discussion on actions including all stakeholders (Farmer organisations, province, municipalities, nature organisations, etc.)
		• Processing industry has an influence on farmers' behaviour concerning spraying (e.g. last spraying data depend on when a

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		crop will be harvested, which happens in accordance with the processing industry, they also determine quality standards). • Retailing industry has an influence on farmers through the specifications they impose and on the prices paid for agricultural products.
		• The government of the municipalities has personal contacts with both farmers and inhabitants and can in that way have an influence on them.
		• Farmers often work together with the same spraying machine dealers over long periods, which also often serve as consultants on new techniques. In that role they can have an influence on the knowledge and willingness to take action to prevent point source pollution.
		• Farmer unions and advisory organisations have personal contacts with the farmers and can influence their application of plant protection products and their social norms in general. They try to improve the knowledge of farmers on the water quality and BMP's.
Policy		• European level: ▪ Directive 2009/128/EC on Sustainable Use of Pesticides: Aims to achieve a sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on human health and the environment and promoting the use of Integrated Pest Management (IPM) and of alternative approaches or techniques, such as non-chemical alternative to pesticides. ▪ Common agricultural policy: is set up to guarantee minimum levels of production and to ensure a fair standard of living for those dependent on agriculture, includes a system of subsidies for farmers. ▪ Directive EU Water Framework: Aims to achieve a good status of the water resources in Europe and a sustainable use of the water. ▪ EU legislation on the approval of active substances. • National and regional level: ▪ Decree on sustainable use of pesticides: Conversion of Directive 2009/128/EC to Flemish legislation. Describes

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	the obligation of sprayer inspection, the obligation of integrated pest management for farmers, the spraying license for professional users of PPP, … ▪ Federal legislation on the approval of pesticides: to approve trade products at a national level. ▪ Integrated water policy in Flanders: gives the legal framework for the integral water policy in Flanders. It includes the local implementation of the Water Directive.

FUNCTIONING IN SYSTEM

General system context	• The interpretation of 'good water quality' can be different for different actors: The standard for drinking water is very strict (important for the Watergroep). The environmental standards are for many products less strict (sometimes stricter, depends of the active ingredient) (important for VMM). For farmers, it is important that the water quality is good for irrigation and for drinking water for their animals. • The water quality data are difficult to interpret: the VMM reports describe 'active substances', for farmers it is not always clear which products are responsible for which active substances in the water. • The standard norm for the drinking water quality is 0,1 µg/L for all active substances, which is very low. As a result, there is not much needed (of PPP) to exceed this standard. • Many actors expect that farmers undertake action to improve the water quality.
Transparency and trust	• The monitored data of De Watergroep are only ment for internal use to decide to take in water from the Bollaertbeek to the reservoir. • The monitored data of the VMM is publicly accessible, but only available after a year. The reports are not actively communicated. • Farmers trust farmers' organizations and Inagro (because their goal is to support farmers) There is a good connection between Inagro and the farmers. • There is a low level of trust between farmers and environmental organisations.

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	• There is almost no direct communication to the farmers about the problem and possible solutions.
Coherence	• Some plant protection products are still available and accessible in France, while they are prohibited in Belgium. The national level of each country can decide to impose extra measures in the context of problems with water. • There are many regulations that farmers have to take into account (besides water, there is a diversity of environmental, food safety and animal welfare regulation). It is difficult for farmers to keep the overview
Leadership	• There is no contact between the Flemish Land Agency and the Flemish Environment Agency in relation to the water quality impacted by plant protection products. • There are no leaders in this context. Everyone looks to the other. • Financial resources to work on these issues are mostly project based. There are little structural financial resources.
Inclusive participation	• A lot of decisions are made on a higher level. It is often expected that the local level ensures implementation. The difficulties met in application of the rules at the lower level, are not always well known at the higher decision level. • There is little or no cooperation between agricultural organisations and water organisations.
Roles and responsibilities	• There is no direct communication of the monitoring results to the farmers. It is unclear who is/should be responsible for the communication about the problem of the water quality. Both De Watergroep and VMM do not consider it their task to communicate their monitoring data to farmers. • The Flemish Land Agency has contact with farmers in function of the water quality, but only related to the manure legislation. They do not advise farmers about how to avoid water pollution which is related to the application of plant protection products. • There is a multitude of water players, for people or organisations who are less familiar with the water problems, it is unclear who has which responsibilities (VMM, De Watergroep, province, municipality, etc.: they all have their own task related to the water problems). • The role of enforcement of the 'distance rules' is unclear. • There is currently little or no enforcement, which can cause non-compliance with or misuse of measures (for example: misuse of the filling points).

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AWARENESS AND ACTIONS	
Awareness	• Farmers are little aware of the problem in their area. They know water quality is important, but they think local water quality is sufficient and they do not think that their agricultural activities have a negative influence on water quality. • Some contract sprayers do know the situation is bad, others didn't know the situation. • The other actors (interviewed at the start of the project) know the quality of the water is bad.
Actions	• /

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2.3 Process

2.3.1 Representation of the process

METHODS OF CONTACT

Informing – newsletter

Informing – presentation

Exchange – bilateral conversation

Exchange – multi-actor conversation

Exchange – questionnaire/survey

Exchange – demonstration/field visit

Exchange – interactive workshop

INVOLVED ACTORS

Action lab leader(s)	Inagro (farmer advisory and research) ILVO (research) VITO (research)
Chemical producers	Bayer
Distributers of plant protection products	Phytodistributers
Representatives of chemical producers	Phytofar
Spraying machine dealers	Dauchy Agri Lemahieu
Farmers	Famers of the bollaertbeek catchment
Contract sprayer	Contract sprayers
Farmer advisory and unions	Boerenbond ABS Boerenbond – Agrobeheercentrum 't Boerenlandschap

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Water producers and suppliers of drinking water	De Watergroep
Regional/national government	Province West-Flanders VMM VLM Regionaal landschap De Westhoek
Local government	Ieper Heuvelland

AMBITIONS

Network formation	• Stimulate involvement of various actors • Stimulate cooperation with and between various actors
Exchange and continuation	• Discuss and report difficulties and limitation experienced by farmers to appropriate legislative and regulative instances. • We searched for possibilities to collaborate and to continue some activities/ideas of WaterProtect after the ending of the project
Knowledge building	• Improve knowledge on the water system
Actor awareness	• More awareness on the problem and solutions in general • Convincing farmers to step into the story and take action to do something about the problem. • Better sharing of data between project partners • More and clearer communication about the monitoring results of the water quality (increasing the transparency about the monitoring results)
Farmer practices	• Stimulate safe cleaning and filling places on farms (on the field or on an equipped filling and cleaning place with collection of spray remnant water) • Grass buffer strips • Interridge bunding • Mechanical weed control
Rewarding system	• Financial incentives for farmers that take action • Rewarding system when a certain level of the water quality is reached.

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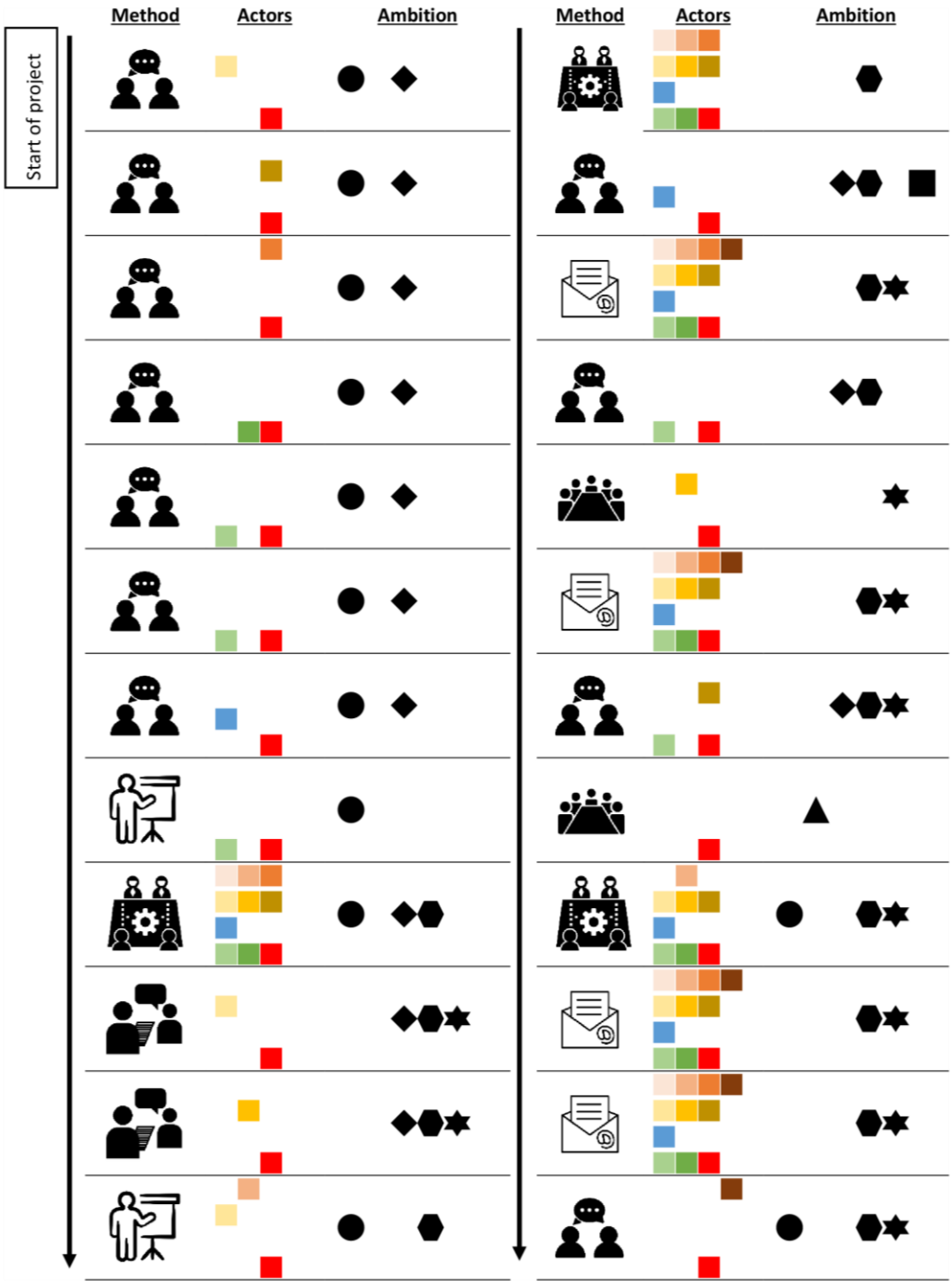
COMBINED VISUAL REPRESENTATION



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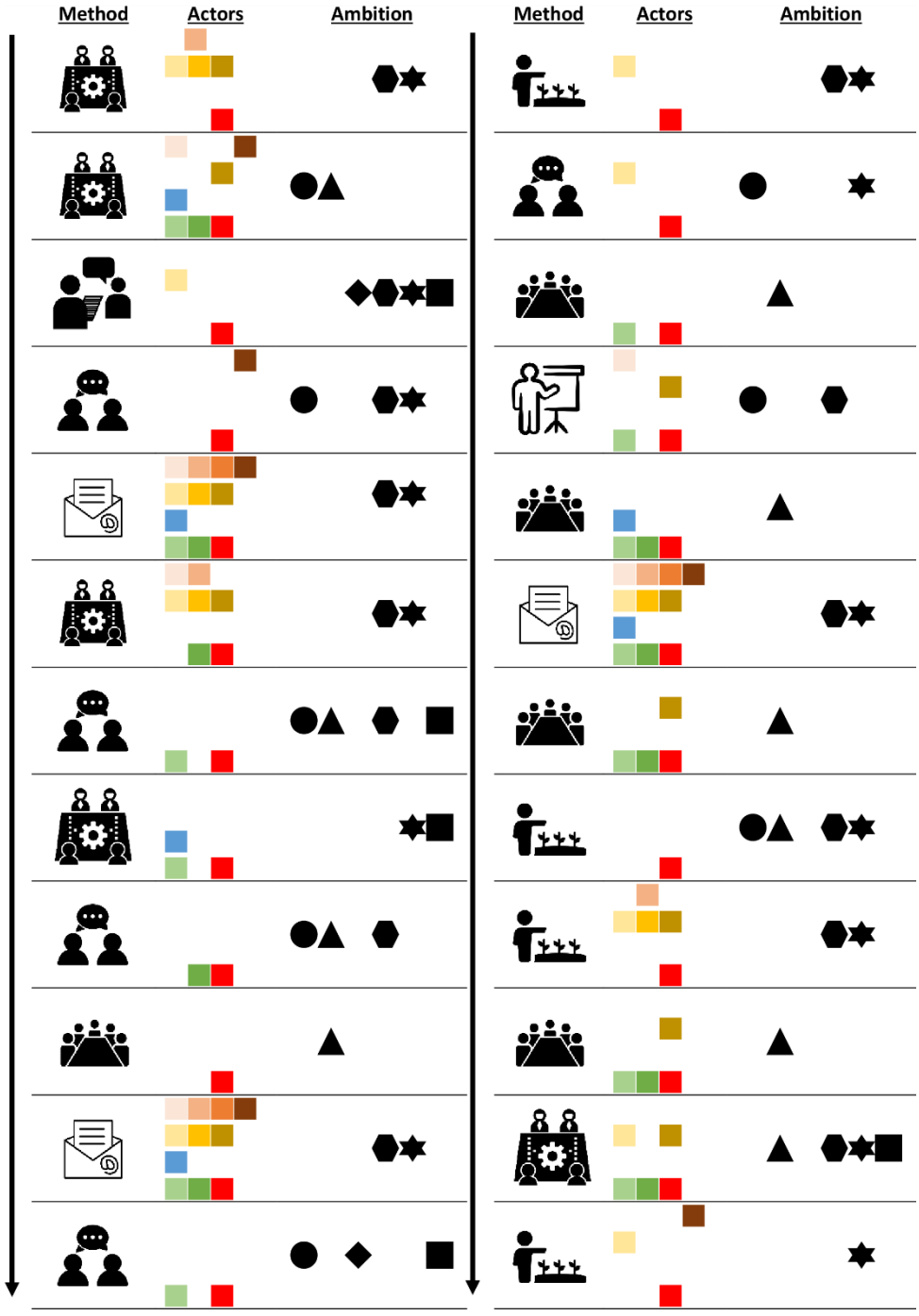

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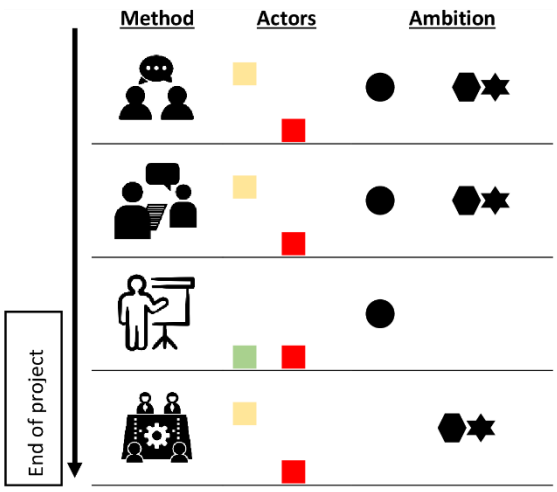

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PROCESS SUMMARIZED IN FIGURES

		METHODS						
								
		17	4	9	4	7	7	4
ACTORS INVOVLED	Action lab leader(s)	17	4	9	4	7	7	4
	Chemical producers		1	4		7		
	Distributers of PPP		1	5		7		1
	Represent. of chemical producers	1		2		7		
	Spraying machine dealers	2		1		**7**		1
	Farmers	3	1	7	3	7		3
	Contract sprayer			5	1	7	1	1
	Farmer advisory and unions	2	1	7		7	2	1
	Water producer	2		5		7	1	
	Regional and national gov.	6	3	6		7	4	
	Local gov.	2		6		7	3	
AMBITIONS	Network formation	14	4	3	1			1
	Exchange - continuation	2		2			6	1
	Knowledge building	11		1	3			
	Actor awareness	8	2	7	4	7		3
	Farmer practices	5		6	4	7	1	4
	Rewarding system	3		2	1			

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2.3.2 Evaluation and lessons learned of the process

METHODS

						
17	4	9	4	7	7	4

- Farmers talk very well in private conversations when it is assured that it's an anonymous and trusted interview.
- Interviews with the different actors gave good insights in the views and perspectives on the water quality, and the motivations of farmers to take action
- Bilateral conversations with all farmers in a catchment are very time consuming and expensive.
- Collective actions are less stimulated and generally there is no exchange on good practices between the farmers.

- It was a new concept, meetings were not yet organized in the region in this way, farmers were not used to discuss much in group.
- The farmers who attended the meetings were discussing well and searching for positive solutions for all actors.
- A workshop or discussion moment is essential to have an idea of the thoughts of farmers and actors.
- Interactive sessions work well to stimulate peer-to-peer learning.
- By putting together the different actors during interactive sessions, there can be exchange on the roles and responsibilities of the different organizations. In that way, false expectations of roles can be eliminated and difficulties regarding certain roles can be clearly stated.
- If there is no moment of discussion included during the demonstration moments, there is no certainty that a discussion will take place.
- There is often an uncertainty about the number of participants, which makes the organization a bit more complex. Farmers do not have the habit of letting know in advance if they come or not.
- Working in smaller groups requires more moderators, which is a certain time investment, which means costs.
- The most difficult part is to get the farmers and stakeholder to the organized events.

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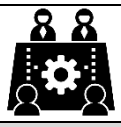
- Newsletters with local and up-to-date information on the water quality and written in an easy and effective way to reach awareness.
- The use of accessible language is necessary and has to be understood as a condition for success.

- Multi-actor meetings allow to share in an effective and fast way the expertise present among the different stakeholders, as such contributing to the creation of a network.

- Demonstration moments are effective to show innovative ideas.
- Multi-actor interactive workshop and demonstration/field visits for farmers are effective ways to show good management practices and inspire farmers.

INVOLVEMENT OF ACTORS

								
ACTORS INVOLVED	Chemical producers		1	4		7		
	Distributers of PPP		1	5		7		1
	Represent. of chemical producers	1		2		7		
	Spraying machine dealers	2	1	1		7		1
	Farmers	3	1	7	3	7		3
	Contract sprayer	0		5	1	7	1	1
	Farmer advisory and unions	2		7		7	2	1
	Water producer	2		5		7	1	
	Regional and national gov.	6	3	6		7	4	
	Local gov.	2		6		7	3	

Farmers

- It is easy to reach the 'most interested' farmers from the region in the workshops. However, there are other farmers who are completely not involved, who they do not get the aim of the project and rather feel accused by the efforts of researchers.
- It helps when there is a leading farmer or farmer group, that stimulates other farmers to come to the meetings.

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	• We improved the number of participants by getting the workshop approved as follow-up course for their spraying license. • Farmers that are not coming to workshops are visited personally at their farm to explain the problem and solutions. • To reach many/all farmers, bilateral conversations work well. Most farmers are open for a farm visit by a researcher. • Bilateral conversations with farmers often increase the participation rate to field visits and workshops. • It remains a big challenge to reach all farmers to participate in workshops. We currently reached about 10% of the farmers in the workshops. • Although a lot of farmers want to participate,
Municipalities	• It is difficult to engage the municipalities to take up a more active role. Often there are also tensions between environmental and agricultural views and priorities at municipal level.

2.3.3 Progress of the process, considerations and points of attention

- How can you combine and balance overall awareness raising of all farmers and the support of proactive farmers that want to take action (adapt their farming practices)? Some pro-active farmers want to go to action and want to adapt their farming practices. They don't want to 'talk' anymore.
- How can you balance attention between 'De Watergroep' that follows the discussion about 'possible ways to invest in the region' from a practical point of view, and other stakeholders that want to brainstorm more freely to find new innovative solutions.
- Cooperation and communication between different actors is really important, but really difficult and time consuming. Progress is possible, but will take some time.
- Some farmers had the feeling that they were targeted and pushed in the direction of farming systems without spraying.
- There are often different ideas about the most efficient way to solve the problems and what the main problems are. It can be unclear what exactly needs to be done.

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2.4 Achievements by the WaterProtect process

2.4.1 Ambition 'network formation'

NETWORK FORMATION							
		14	4	3	1			1
ACTORS INVOLVED	Action lab leader(s)	14	4	3	1			1
	Chemical producers		1	2				
	Distributers of PPP		1	2				
	Represent. of chemical producers	1		1				
	Spraying machine dealers	2		2				
	Farmers	3	1	2	1			
	Contract sprayer			2				
	Farmer advisory and unions	1	1	3				
	Water producer	1		3				
	Regional and national gov.	4	3	3				
	Local gov.	2		3				

Achievements

⇨ **Contact and involve all actors that have interest in or influence on the water quality in the action lab**

- All actors that were identified to play a role in the water quality problem were contacted and invited to participate in workshops and meetings. This allowed to compose a small core group that was actively involved and contributed ideas in order to cope with stumble blocks, as well as an extensive network that was available to answer targeted questions of the core group.

⇨ **Create a farmer network that is willing to work on a better water quality**

- The farmer is considered as the actor with the highest impact on the water quality, therefore they were contacted individually, even though individual farm visits are time-intensive. During these farm visits farmers were encouraged to take part in the interactive groups meetings and workshops that were organized in the context of the project. Even

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though only a small share of the farmers participated actively, this allowed to create a network of farmers willing to work on a better water quality and spread the words towards farmers that are not yet involved.

2.4.2 Ambition 'exchange and continuation'

		EXCHANGE AND CONTINUATION						
		2		2			6	1
ACTORS INVOLVED	Action lab leader(s)	2		1			6	1
	Chemical producers			1				
	Distributers of PPP							
	Represent. of chemical producers							
	Spraying machine dealers			1				
	Farmers			1				
	Contract sprayer							
	Farmer advisory and unions			2			2	
	Water producer			1			1	
	Regional and national gov.	1		2			4	
	Local gov.	1		2			3	

Achievements

⇨ **Discuss and report difficulties and limitation experienced by farmers to appropriate legislative and regulative instances**

- Not done during the project.

⇨ **Stimulate continuation within regular operation of actors or in new projects**

- Continuation of the local operation in projects 'Water-Land-Schap' and 'Leader'.
- Discussions about leadership, as there is no clear leader at the moment. Inagro, the current action lab leader, can continue to take up this role, but the major problem is that Inagro needs financial support to do so. This role can also be taken up by the local government or province, but then it has to clearly assigned and set as a priority. Ideally, a local farmer or citizen should take the lead, but we do not think this will happen.

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2.4.3 Ambition 'knowledge building'

KNOWLEDGE BUILDING								
		11		1	3			
ACTORS INVOLVED	Action lab leader(s)	11		1	3			
	Chemical producers			1				
	Distributers of PPP			1				
	Represent. of chemical producers	1		1				
	Spraying machine dealers			1				
	Farmers	1		1	2			
	Contract sprayer			1	1			
	Farmer advisory and unions	2		1				
	Water producer	2		1				
	Regional and national gov.	5		1				
	Local gov.	1		1				

Achievements

⇨ **Improve knowledge on the water system**

- The intensive monitoring campaign improved the knowledge on the water quality. Due to more regular monitoring, more insight was gained in the causes of pollution (e.g. point versus source pollution).
  - 2017: 8 monitoring points in period June – September to measure the pesticide load in the main and side streams
  - 2018: 4 routine measuring points + continuous monitoring at 2 locations

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2.4.4 Ambition 'actor awareness'

ACTOR AWARENESS								
		8	2	7	4	7		3
ACTORS INVOLVED	Action lab leader(s)	8	2	7	4	7		3
	Chemical producers		1	3		7		
	Distributers of PPP		1	4		7		1
	Represent. of chemical producers			2		7		
	Spraying machine dealers	2				7		
	Farmers	1	1	7	3	7		11
	Contract sprayer			5	1	7		1
	Farmer advisory and unions	1	1	6		7		1
	Water producer	1		3		7		
	Regional and national gov.	3	1	4		7		
	Local gov.	1		5		7		

Achievements

⇨ **More awareness on the problem and solutions in general**

- Through newsletters with information on possible solutions.
- Through a local website where all information of the project and actions can be found.
- During workshops and information meetings, information on the current state of pollution in the catchments is given. This has led to better knowledge about point and diffuse pollution sources, both in general (are the causes mostly point or diffuse) and specific (which farmers/contract sprayers/other actors might be important sources of pollution?)
- During workshops and information meetings, information on solutions to prevent pollution are given.
- Most of the farmers are now (after the project) aware of the bad water quality in the Bollaertbeek catchment. A nice example is a meeting last November with farmers of the catchment of the Bollaertbeek, which are already involved in WaterProtect, and farmers of a nearby catchment, which are not involved in WaterProtect. The farmers of the Bollaertbeek are aware and were thinking about possibilities for improvement of the

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water quality, whereas some farmers of the other catchment didn't know that there is a problem on the water quality with plant protection products. We had to explain them the problem as we had to do two years ago at the beginning of Waterprotect to the farmers of the Bollaertbeek.

⇨ **Convincing farmers to step into the story and take action to do something about the problem**

- Farmers who are aware of the problem start to discuss with their colleagues and call them to account for wrong behaviour concerning water quality. Farmers are willing to change their behaviour and actively search for solutions.
- Farmers learned about best management practices, both by the information that has been provided by the project team and while discussing with other farmers.
- Farmers call to the WaterProtect contact person to point out when another farmer is causing (point source) pollution.
- There are 10 farmers who are actively participating and taking actions and trying to solve the problem on their farm. They are also prepared to have demonstrations on their farm.

⇨ **Better sharing of data between project partners**

- Harmonized dataset, shared information between VMM, De Watergroep and VITO
- The drinking water company sends frequently the results of monitoring to Inagro and VITO in order to communicate the water quality easier and faster to the farmers

⇨ **More and clearer communication about the monitoring results of the water quality (increasing the transparency about the monitoring results)**

- WaterProtect app improved interpretation and communication about the results.
- The WaterProtect newsletter gives the results of the monitoring and some interpretation (link to trade products, the crops where the products are used, etc.)
- The WaterProtect newsletter reached 121 farmers and 85 stakeholders. They read the articles (which is monitored by the clicking behaviour) and they started discussions about them.
- There is now a central contact person for all questions about the project and the related problems in the area (Inagro). This contact person became a trusted person for the different actors to report findings and comments about the problem. Trust and transparency is clearly improved after the bilateral meetings with farmers. Farmers call Inagro if they notice a problem or if they have suggestions, which was not at all the case at the beginning of the project.
- More interaction about the problem and solutions in the phytolicense training system

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2.4.5 Ambition 'farmer practices'

FARMER PRACTICES								
		5		6	4	7	1	4
ACTORS INVOLVED	Action lab leader(s)	5		6	4	7	1	4
	Chemical producers			1		7		
	Distributers of PPP			3		7		1
	Represent. of chemical producers					7		
	Spraying machine dealers	2				7		1
	Farmers	2		5	3	7		3
	Contract sprayer			3	1	7	1	1
	Farmer advisory and unions	1		4		7		1
	Water producer			2		7		
	Regional and national gov.	1		3		7		
	Local gov.			3		7		

Achievements

⇨ **Stimulate safe cleaning and filling places on farms (on the field or on an equipped filling and cleaning place with collection of spray remnant water (private or common)) (+ understand why farmers are/are not willing to implement it)**

- Change of cleaning and filling place to unpaved surfaces by some farmers. Farmers want to change habits if it is feasible on their farm and if is not costly
- However, most of the farmers are not willing to install a concrete filling and cleaning place with remnant a purification system, since this requires permits, and since the installation is expensive whereas the financial incentives are too low. A farmer really needs to invest time and money in it, which is too much of an effort for something that is not their priority.
- One actor wanted to improve an existing filling and cleaning place. However, there was a discussion point about the permit that was needed for the building of a biofilter, which gave tensions between project partners and the municipality.
- Farmers present on the 'bio filter workshop' learned how to build a bio filter themselves + learned a lot about purification systems and point pollution

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- Collection of remnant water by 9 farmers.
- Unclear Flemish legislation about the Remdry and Heliosec system as approved purification system.
- Common cleaning and filling place in the region
  - We did not spend further effort on the realization of a common cleaning and filling space since the opinion of different stakeholders was different. They do not all agree that this was a good idea and if it is worth the cost.
  - To explore the possibilities of a common cleaning place, we organized a temporary place with removable mats. The farmers who used this were enthusiastic about the action. This was however only possible in terms of the project, and is not considered sustainable in the long term. And also in terms of legislation about collection and transportation of remnant water, it is not clear what is legal.

⇨ **Grass buffer strips (+ understand why farmers are/are not willing to implement it)**
- 3 extra grass buffer strips
- Open discussions with 'VLM' about the management agreements.
- Reasons why farmers are not willing to implement it:
  - Land is very expensive, so every square meter is important to have an economically viable farm.
  - the financial incentives are also considered too low and the conditions are difficult to meet in practice
  - Difficulties in management of the buffer strips

⇨ **Interridge bunding (+ understand why farmers are/are not willing to implement it)**
- Reasons why farmers are not willing to implement it:
  - Unclear information about the systems for interridge bunding
  - Non-mandatory
  - More time-consuming during planting as the planting machine has a slower speed when making interridge bunding.

⇨ **Mechanical weed control (+ understand why farmers are/are not willing to implement it)**
- Reasons why farmers are not willing to implement it:
  - High investment cost for machinery for mechanical weed control.
  - Mechanical weed control is no priority in some farm managements (for example, for a milk production farm, maize is only necessary as feed for the cows, time that can be spent on management of the crop is then limited).
  - Mechanical weed control requires more work and expertise than chemical weed control.

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- The current subsidy agreement for mechanical weed control in the agri-environmental schemes is mandatory for 5 years, which gives no flexibility for the farmer to intervene chemically in a difficult year (bad weather conditions) where mechanical control fails.

2.4.6 Ambition 'financial support and rewarding system by De Watergroep'

		FINANCIAL SUPPORT AND REWARDING SYSTEM						
		3		2	1			
ACTORS INVOLVED	Action lab leader(s)	3		2	1			
	Chemical producers							
	Distributers of PPP							
	Represent. of chemical producers							
	Spraying machine dealers							
	Farmers			1	1			
	Contract sprayer							
	Farmer advisory and unions			1				
	Water producer	1		2				
	Regional and national gov.	2		2				
	Local gov.							

Achievements

⇨ **Financial incentives for farmers that take action**

- Given that the costs of measures are often seen as a difficult barrier, involving De Watergroep can give a strong signal to farmers. If they want to financially support the farmers, farmers might be more prone to make efforts to improve the water quality.
- De Watergroep has been reached and is willing to test scenarios in which the water company helps to pay for the implementation of some measures by farmers. In the time frame of the project, there was no concrete agreement. However, after approval of the follow-up projects 'Leader Westhoek' and Water-Land-Schap, De Watergroep confirmed money investment for implementation of mitigation measures to prevent point to prevent

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point source pollution (e.g. save filling and cleaning place) and diffuse pollution, like grass buffer strips and vegetative ditches in the next three years.

- The Flemish Land Agency is open to test agro-environmental schemes with adapted conditions (will be tested in the new project Water-Land-Schap).

⇨ **Rewarding system when a certain level of the water quality is reached**

- Open discussions with 'De Watergroep' about a rewarding system
- Set up of an initial plan for a rewarding system.
- The 'polluter pays' principle is still the main principle, but there is some openness to experiment with new governance models.

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3 Danish action lab – Vester Hjerk

3.1 General characteristics and description of the problem

- North-western part of Denmark
- Rural area, close to the medium size town Skive (approximately 20 000 inhabitants)
- Flat area, with plateaus with modest slopes down to the river valley
- Land cover is mainly for agricultural use: livestock herds (dairy farms and pig production), crops for fodder and smaller areas for potatoes and seeds.

- Groundwater – parts of the groundwater reservoirs are used for drinking water extraction
- Groundwater is pumped up, oxygenated and filtered.
- Surface water: Water course of Viummølle Å and Harrevig (part of the Limfjord area)

Pollution in focus

- Nitrate
- The nitrate in the drinking water is at elevated level (but below threshold of 50 mg/l).
- Where the groundwater aquifers are poorly protected due to layers of top soils with a course structure, nitrate can be a problem.

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 **Agricultural sources**	• It is estimated that approximately 65% of the nitrate content in the surface water in the whole Limfjord area has its origin in the agricultural sector. • The main nitrate impact on the groundwater is diffuse pollution from agricultural use of fertilizer (manure and commercial) on rotational crops. • The impact is dependent on many factors including climate conditions (e.g. annual precipitation and timing of precipitation), crop type, fertilizer type, soil conditions, drainage etc. and thus varies over time.
 **Reinforcing factors on pollution**	• Natural pollution – no estimate of this impact currently exists. • The drinking water reservoirs are poorly protected, as they are not deep. They are only protected by a moderate layer of clay from the surface area. • Impact of other human actions (e.g. sewage, industry, etc.) – no estimate of this impact currently exists. • Climate conditions (annual precipitation and timing of precipitation) • Soil conditions. • Climate change: groundwater table has risen due to increased amounts of precipitation.
 **Other pollutions and pollution sources**	• Pesticides

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3.2 Start situation

3.2.1 The actors and their roles

Production and distribution of plant protection products

Actor type	Actor in action lab	Role
Chemical producers	/	/
Distributers of plant protection products	/	/
Actor responsible for the collection of the packaging	/	/
Representative of chemical producers	/	/
Representative of chemical distributers	/	/

Agricultural production

Actor type	Actor in action lab	Role
Farmer	Farmers in the region: 21 farmers that manage 4864 ha of farmland of which 597 ha in capture zone (2019)	Producers of food and fibres in an economically efficient way. They perform farm activities on the land above the groundwater reservoirs, which can have an impact on the water quality.
Seasonal farmer	/	/
Contract sprayer	/	/
Farmers unions	Danish Agriculture & Food Council (Landbrug & Fødevarer)	National NGO organizing Danish Farmers. Their role is knowledge sharing and the protection of members' interests.

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Farmer advisory	Landbo-limfjord	Offer farm advisory services on agriculture and the environment
Union of contract sprayers	/	/

Processing and selling food products

Actor type	Actor in action lab	Role
Processing industry	/	/
Retailers	/	/

Drinking water production

Actor type	Actor in action lab	Role
Water producers and suppliers of drinking water	Danish Water Works	National NGO organizing water works. Their role is knowledge sharing and the protection of members' interests. They support the local water works in their efforts to achieve clean and cheap drinking water.
	DANVA (Association of Danish Water and Waste Water)	National NGO organizing water professionals (association of water and waste water utilities). More than 120 of Denmark's largest water companies are members of DANVA (State of Green, n.d.). Their role is knowledge sharing and the protection of members' interests. Members are primarily utilities, municipalities, consultants, contractors and personal members (State of Green, n.d.).
	Local water works – Vester Hjerk water utility (private owned)	Provides drinking water that meets the quality demands for the supply area at a responsible price. They also decide on the price for water for consumers
Wastewater treatment facilities	DANVA (Association of Danish Water and Waste Water)	National NGO organizing water professionals (association of water and waste water utilities). More than 120 of Denmark's largest water companies are members of DANVA (State of Green, n.d.).. Their role is knowledge sharing and the protection of members interests. Members are primarily utilities,

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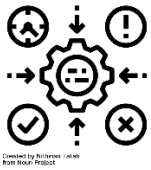
		municipalities, consultants, contractors and personal members (State of Green, n.d.).
	Skive Vand A/S (public water company)	Collects the wastewater in the area and is responsible for cleaning of the water. They have power over the price for clean waste water. They supply drinking water to the town of Skive



Context factors and societal preferences over the entire system and all subsystems

Actor type	Actor in action lab	Role
Supranational government	European Commission	To protect the European water resources by means of EU directives.
Regional or national government	Ministry of Environment and Food – Environmental Protection Agency	Is responsible for the national planning effort, e.g. the 'water area plans', and makes the statutory orders including the designation of water protection areas. Sets environmental goals and standards for good water quality. Is responsible for approving which pesticides are allowed in Denmark.
	Ministry of Environment and food – Danish Agricultural Agency	Is responsible for the regulation of farming through subsidy schemes and regulation of fertilizers, in particular nitrate and phosphorus.
	Ministry for Energy, Utilities and Climate – Danish Energy Agency	Legislates utility services including water and waste water companies.
	Ministry of Industry, Business and Financial Affairs – Danish competition and consumer authority	Benchmarks water companies and sets price ceilings for water taxes.
	Region Midtjylland	Maps, investigates and cleans soil pollutions in the case the polluter cannot be held responsible.
Local government	Skive Municipality	Carries out action programs in practice and has the oversight authority over the water companies. Establishes a coordination forum for relevant interest organisations to contribute to action plans.
Stakeholder advisory group	Advisory group for both WaterProtect and Fairway	Includes members from public and private organisations, and interest organisations (from both the local as the national level), as well as research institutes

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		The results and the progress of the project were discussed on yearly meetings and feedback from the group was taken into account in the project.
Research	Geological Survey of Denmark and Greenland	Maps and monitors national water resources. Provides data for the Jupiter database.
	SEGES	Research Institute with a link to the farmers organization Landbrug og Fødevarer. In the project they delivered tools for measuring nitrate in drainage water at farm level
	University of Copenhagen	Involved in several research projects in the Skive area over the last decades.
Civil society organisations	The Danish society for Nature Conservation	Works on a clean and safe natural environment and resources.
Consumers – inhabitants	Local consumers of drinking water	Uses clean water for household purposes.

3.2.2 Functioning of the water governance system

KNOWLEDGE		
Monitoring		• The Vester Hjerk water works monitors the water quality and quantity. The quality of the groundwater used for drinking water is controlled every half year. The frequency of the control depends on the amount of the water produced (the more water, the more frequent controls).
		• GEUS monitors the groundwater quality and quantity (national ground water monitoring program) • All data are added to the public database: Jupiter • By definition, the source of pollution of the capture zone is the group of farmers within in the capture zone, however the individual contribute is not known. This is due to the fact that detailed local data on crucial variables such as drainage, catch crops and fertiliser application are not available.

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MOTIVATION		
Use of the water		• Farmers are large consumers of water • Especially livestock producers require a lot of water.
		• Consumers of drinking water.

INFLUENCE		
Information and education programs		• Danish water works give courses for members to increase knowledge. • DANVA educates members.
Control		• The municipality of Skive is the legal authority and should approve the control scheme and supervise the control to make sure that the quality demands are met. Furthermore, the municipality should control the technical installations of the water works.
Economics		• Water taxes: are added to the cubic meter price on water and waste water in order to cover the expenses for mapping, planning, and quality control the state incurs. In that way, the cost is distributed proportionally among consumers.
		• Benchmarks: ensures that water supply services operate efficiently. • Price ceiling: ensures that water supply services operate efficiently.
		• Farmers, especially livestock farmers, are large consumers of water and have in that way an influence on local water use and the price.
Consultation and cooperation		• Contact committee: includes relevant interests in the legislation process for the water sector • Water councils: includes relevant interest organisations in water planning for river basins • Coordination forum: includes relevant interest organisations in the making of action plans for designated action areas
Policy		• Consumers let their voice hear in case of problems with water quality. They have a say in the local water work through the yearly General Assembly
		• The Danish Water Works have advisory power: they exert influence on local water works and consumers.

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- DANVA has advisory power: they advocate on the policy level.
- Local water works have the control over drinking water supply and prices.

- European level:
  - The water framework directive: focusses on river basins as the natural geographical and hydrological planning unit for all water management regardless of administrative borders, and national legislation has to accommodate this. One of the main points in the water framework directive is to integrate a general protection of the aquatic ecology with specific protection of unique and valuable habitats, protection of drinking water resources, and protection of bathing water (European Commision, 2016).
  - Directive on drinking water quality: stipulates that "Member States shall take the measures necessary to ensure that water intended for human consumption is wholesome and clean" (Article 4) and defines the minimum standards for clean drinking water in terms of parasites, microorganisms and pollutants such as heavy metals, pesticides and toxins (EUR-lex, 1998). The directive has recently been revised in response to a civic initiative, Right2Water, with the main focus on ensuring safe drinking water for all, especially marginalized and vulnerable groups. Furthermore, the revision proposal updates existing safety standards and provides authorities with more power to deal with risks and deal with polluters. Citizens' rights to information access are strengthened (European Commision, 2018).
  - Groundwater directive: establishes specific measures to prevent and control groundwater pollution with respect to chemical status and specifies threshold values as well as assessment criteria (Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration, 2006).
  - Nitrate directive: aims to protect water quality by preventing nitrates from agricultural sources polluting ground and surface waters (European Commission, 2016).
  - Urban waste directive: is concerned with the collection, treatment and discharge of urban waste water to prevent

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adverse effects to the environment (European Commission, 2017).

- National and regional level:
  - The law on water planning and associated statutory orders: sets the framework conditions for protection and management of both surface water and groundwater and follows directly from the water framework directive. The purpose is to protect (prevent deterioration) and improve the ecological condition of water bodies, to stimulate a sustainable water usage, and to define framework conditions for progressive reduction of harmful emissions, pollution and dangerous contaminants.
  - The law on water supply: regulates water supply services. The purpose of the law is fourfold: 1) to use and protect the water taking into account relevant concerns, 2) to coordinate within the existing water supply sector to ensure a rational use of water reserves, 3) to plan a sufficient water supply of a satisfactory quality and 4) to stipulate the quality standards to protect human health (Vandforsyningsloven, 2018).
  - The Water sector law: sets the framework conditions for all economic aspects of water supply. The law regulates all publicly owned water companies as well as private companies that supply more than 200.000 m^3 water per year (Energi-, Forsynings- og Klimaministeriet 2009).
  - Regulation of agricultural practices: includes a national approval procedure of pesticides which is stricter than EU regulation (Danmarks Naturfredningsforening, 2015), and regulations in terms of how often, when and in what quantities manure and other fertilizers can be applied and how manure may be stored (Miljøstyrelsen, n.d.)
  - The regional level does not have much authority power regarding water governance. The regions do have some responsibilities regarding mapping, investigating and cleaning soil pollutions where the polluter cannot be held responsible (Regionernes Videnscenter for Miljø og ressourcer, n.d.). The regions are collaborating with the state and the municipalities and have also initiated collaboration with the Association of Danish Water and Waste Water (DANVA) regarding pesticide pollution. They aim to improve knowledge sharing and creation, dialogue, coordination and planning possibilities to limit the threat

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from pesticide pollution of groundwater (Danske Regioner; DANVA, n.d.)

- Local level
  - The municipality of Skive is responsible for the local regulation and planning of measures in relation to water basin management planning. All measures to comply with the water framework directive are implemented at municipal level in Denmark. The municipality is responsible for the implementation of actions plans and water supply plans. Which methods are used, is decided on by the municipality.

FUNCTIONING IN SYSTEM

General system context

- What makes groundwater pollution complex, are the delayed effects of pollutants from the surface reaching the groundwater reservoirs. This can take up to 50-100 years.
- All stakeholders are interested in clean drinking water, thus in general there is no conflict of interest. However, the local water works suggest that the large consumers of water, i.e. the livestock farmers, are more price sensitive and have a larger interest in keeping the water prices at low level compared to the general consumer. This implies that farmers may be willing to accept a higher level of pollutant in the drinking water (but still below the agreed thresholds) than the general consumer.
- The quality of drinking water is a topical issue in Denmark at the moment due to an increasing amount in the different pesticide rests in the ground water.
- The agricultural sector sometimes emphasizes that agriculture in Denmark is "over-regulated". From a regulator's point of view it may be the opposite.
- The conflict level between the municipalities, and farmers and their organizations is high. As a result the regulation rights of the municipalities are discussed. The municipalities are claiming a ban on the use of pesticides in ground water extraction areas whereas farmers are claiming that they have the right to use the pesticides which are approved by the Ministry of Food and Environment.
- Recent studies in Denmark have demonstrated a significant correlation between high levels of lifetime exposure to nitrate and colon cancer. From a

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	public health perspective, this calls for actions to assure low levels of exposure to nitrate through drinking water.
Transparency and trust	• Data is shared through the database Jupiter, which is available for the public. • The new information becomes available once it has been uploaded to the Jupiter database. There is no special announcement when data are uploaded as this happens continuously. • The trust between the water works and the municipality is average to high. • The trust between the agricultural sector and the municipality is low to average. • The trust between the l public and the municipality is average. • The municipality is obliged to make action plans for the water extraction areas. As part of the planning process, the municipality invites the public and local stakeholders to participate in a consultation meeting. Behind this is the omnipresent norm that everyone with a stake or interest has the right to be heard and to give input. Formally the process is very transparent, however the public involved in the process may find it complex and therefore also rather inaccessible and non-transparent.
Coherence	• The coherence in the whole legislative framework (from EU level over member state level to municipality) is stimulated by law. • The main priority of the water works and the municipalities of Skive are to assure that the water quality meets the demands set by the legislation. This priority is assumed to be in coherence with the objectives of the other actors. • By means of water planning there is some interaction and/or coordination between the water sector, the agricultural sector and the environmental sector. • Agricultural regulation has currently more focus on the protection of surface waters than on the protection of ground water.
Leadership	• Currently the Nitrate content in the drinking water is at elevated levels. This forces the water works to take action and show leadership to assure that the Nitrate levels decrease fast. In this way, closure of the water works can be avoided. • If the threshold for any of the substances is exceeded, the water works together with the municipality should initiate measures.
Inclusive participation	• The Danish policy system is divided into sectors meaning that policies are often administrated accordingly. However, at country level the Ministry of Agriculture and the Ministry of Environment are integrated in one Ministry

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	with two Ministers. At local level the administration of policies is usually done by different municipality departments. • There is a low level of involvement of people from different levels and sectors in the action lab. • The water utility plant has a board elected by the users/owners. • When public authorities regulate private actors, the relationship is to a large extent authoritative. However there is increased collaboration in regional water councils, as well as through other collaborative fora.
Roles and responsibilities	• The responsibilities of the municipality in assuring clean water are defined by law. This also partially counts for the water utility plant, however they are also governed by their own Articles of Association. • The role of the different stakeholders in assuring clean water is unclear. • The utility is responsible for control and reporting – however also other parties have monitoring responsibilities

AWARENESS AND ACTIONS

Awareness	• The survey showed that there is not a big awareness about the drinking water situation among the public. People are relying on the authorities and waterworks to take action if there is a problem.
Actions	• /

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3.3 Process

3.3.1 Representation of the process

METHODS OF CONTACT

Informing – newsletter

Exchange – bilateral conversation

Exchange – multi-actor conversation

Exchange – questionnaire/survey

Exchange – interactive workshop

INVOLVED ACTORS

Action lab leader(s)	UCPH (research) GEUS (research) SEGES Research
Farmers (consumers)	Farmers of the catchment area
Farmer advisory and unions	Landbo Limfjord
Water producers and suppliers of drinking water	Danish Water Works Waterworks Vester Hjerk
Regional/national government	Stakeholder Advisory Group
Local government	Municipality of Skive
Inhabitants – consumers	Inhabitants of the action lab area The Danish Nature Conservation Organisation
NGO's	

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AMBITIONS

Network formation	• Stimulate involvement of various actors • Investigate the potential of collaboration among the waterworks in Skive Municipality. The focus is especially on the small waterworks, which should help each other in situations of emergency.
Knowledge building	• Model 'delineation of a new capture zone' • Get knowledge about the consumers' attitudes and preferences towards the drinking water quality and the future supply of drinking water • Collecting local data on variables such as drainage, catch crops and fertilizer application. • Model 'leaching in different situations'
Actor awareness	• Sense-making of the capture zone by stakeholders in the local area • Testing the idea of a multi – model approach taking into account the geological conceptual uncertainty in decision making – among national/general stakeholders
Farmer practices	• Investigate potential alternative land use models in collaboration with farmers. • Test if farmers are willing to make adaptations to their land uses on a voluntary basis
Common water fund	• Test the idea of a common water fund to finance future measures to protect groundwater sources.

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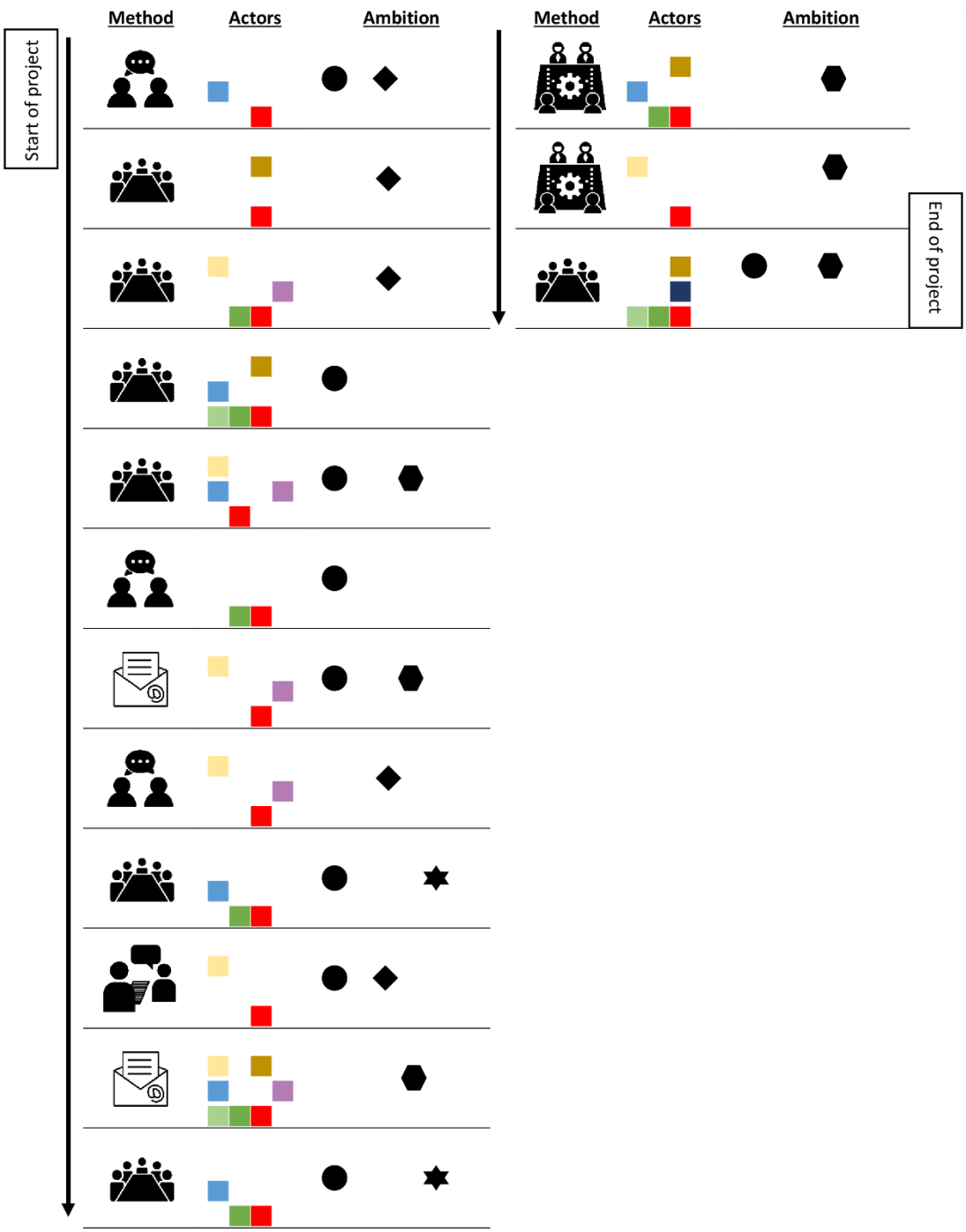
COMBINED VISUAL REPRESENTATION



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PROCESS SUMMARIZED IN FIGURES

		METHODS				
						
		3	2	1	2	7
INVOLVED ACTORS	Action lab leader(s)	3	2	1	2	7
	Farmers (consumers)	1	1	1	2	3
	Farmer advisory and unions		1		1	3
	Water producers and suppliers of drinking water	1	1		1	4
	Regional/national government				1	2
	Local government	1	1		1	5
	Consumers – inhabitants	1			2	2
	NGO's					1
AMBITIONS	Network formation	2		1	1	6
	Knowledge building	2		1		2
	Actor awareness		2		2	1
	Farmer practices					2
	Common water fund					

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3.3.2 Evaluation and lessons learned of the process

METHODS

				
3	2	1	2	7

	• Personal interviews with all consumers (including farmers) in the area to inform and test their knowledge about the drinking water situation and investigate their preference on the future supply of drinking water (only few people refused to participate in the survey). • Face to face meetings with farmers on their farms to collect data on drainage and farming practices worked well. • Bilateral conversations with all farmers in a catchment are very time consuming and expensive
	• Workshops work well to achieve support for the project, and to agree on the ambition to explore the potential of optimizing the land use and farming practices for the protection of the ground water resource. • Workshops were used to explain the difficulties in identifying the exact location and extent of the extraction zone. • Workshops were used to establish a network of farmers in the area to support the project. • Workshops were less successful in gathering local data on drainage, which had been one of the targets
	• Newsletters sent out by the municipal electronic mail system do not work well. Only a few people read their mail regularly.

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INVOLVEMENT OF ACTORS

						
INVOLVED ACTORS	Action lab leader(s)	3	2	1	2	7
	Farmers (consumers)	1	1	1	2	3
	Farmer advisory and unions		1		1	3
	Water producers and suppliers of drinking water	1	1		1	4
	Regional/national government				1	2
	Local government	1	1		1	5
	Consumers – inhabitants	1			2	2
	NGO's					1

Farmers	• We had a first joint workshop, to which all farmers in the catchment area were invited. We had to follow up on mail invitations by calling some of the farmers by phone, but ended up with a good presence of farmers managing the majority of the agricultural land. • Time aspects are very important for farmers and determine involvement. • The farmers were a bit sceptical at the beginning, but through the activities and with the local agricultural advisory service as a partner in the project, trust was established relatively easy. • We adjusted the strategies for both consumers and farmers when some of the planned activities did not give the desired results. In both cases we had to scale down the number of participants in the activities and target issues that attract the attention
National level	• At the national level, authorities and relevant interest organizations have mainly been involved through the yearly Stakeholder advisory group (jointly with FAIRWAY).
Consumers	• We decided to do individual interviews with the consumers to survey their knowledge and opinions on the delivery and quality of drinking water. • Time aspects are very important for consumers. • It has been a problem to involve the consumers, as they trust the Water Work and the Municipality to ensure the delivery and quality of the drinking water.
Water works	• The local authority, Municipality of Skive, is a partner in WaterProtect and has worked alongside the project to initiate a network of Water Works in the municipality and to establish a Water Fund. This has been done in larger

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meetings with all Water Works and a number of smaller meetings for groups of neighbouring Water Works.

- Local water works are managing the water works on a voluntary basis, they thus have normal jobs besides their efforts for the water work, and have thus important time constraints.

3.3.3 Progress of the process, considerations and points of attention

- The new model of the capture zone gave a complete other location of the capture zone with very little overlap with the original. This caused confusion among different stakeholders and especially among farmers whose organisations claimed that the planning process was based on a very unsecure data basis which they could not accept.
- Originally it was the intension in the action lab to start up the project by inviting all stakeholders in the area (farmers, consumers, waterworks and NGOs) to a workshop, to introduce the WaterProtect project and the drinking water situation in the area. This was followed by a session in which people's knowledge and preferences on drinking water distribution and quality were discussed. We consider this a cheap and effective way to raise awareness and to distribute knowledge of the drinking water situation. However, very few people responded to the invitation, so it was cancelled. The invitation to the workshop was sent to people individually by e-post. Using the e-post may be a reason for the low response, however, people mentioned that the reason behind the low response was just a lack of interest.
- The Municipality of Skive (project partner) had more success in inviting citizens, and in inviting Vester Hjerk Water Works and a small group of neighbouring Water Works to discuss a common water fund.

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3.4 Achievements by the WaterProtect process

3.4.1 Ambition 'network formation'

		NETWORK FORMATION				
		2		1	1	6
INVOLVED ACTORS	Action lab leader(s)	2		1	1	6
	Farmers (consumers)			1	1	2
	Farmer advisory and unions					2
	Water producers and suppliers of drinking water	1				4
	Regional/national government					2
	Local government	1				5
	Consumers – inhabitants				1	2
	NGO's					1

Achievements

⇨ **Involve various actors**

- At the local level in the Action Lab we didn't focus on involving a wide range of stakeholders, but kept a focus on the important ones: the farmers, the consumers, the Water Work and the municipality.
- We consider the involvement of these most important local actors as a success.

⇨ **Investigate the potential of collaboration among the waterworks in Skive Municipality. The focus is especially on the small waterworks, which should help each other in situations of emergency.**

- The meetings were very well attended and have clearly succeeded in creating interest in increasing the collaboration between the Water Works.
- The initiative has also created interests in collaboration on other issues between Vester Hjerk and the closest neighbouring Water Works

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3.4.2 Ambition 'knowledge building'

		KNOWLEDGE BUILDING				
		2		1		2
INVOLVED ACTORS	Action lab leader(s)	2		1		2
	Farmers (consumers)	1		1		1
	Farmer advisory and unions					1
	Water producers and suppliers of drinking water	1				
	Regional/national government					
	Local government					1
	Consumers – inhabitants	1				1
	NGO's					

Achievements

⇨ **Model 'delineation of a new capture zone'**
- A new capture zone was delineated. The modelling process contributed to the explanation of the complexity of the capture zone situation.

⇨ **Get knowledge about the consumers' attitudes and preferences towards the drinking water quality and the future supply of drinking water**
- The survey provided detailed knowledge on drinking water issues including preferences for different potential set ups and on the relation between price and quality.
  - There is not a large awareness on the drinking water situation – people are relying on the authorities and waterworks to take action if there is a problem.
  - Consumers are willing to pay a higher price to keep up good quality of water.
  - Consumers are more in favour of a local water fund than a municipality-level fund.
  - Many expressed that they gathered new knowledge through the survey

⇨ **Collecting local data on variables such as drainage, catch crops and fertilizer application**
- Data on groundwater, drinking water, raw materials, environmental and geotechnical data from GEUS database Jupiter

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- Data from hydrological analysis in WaterProtect
- Local data on drainage collected from farmers
- Establishment of a network of farmers in the action lab, which willing to share information and data
- Participatory monitoring at different test points. They have been monitored monthly in the winter of 2019/2020.
- Modelling of leaching in different scenarios of farm management adjusted to the local variations in vulnerability of the groundwater.

3.4.3 Ambition 'actor awareness'

		ACTOR AWARENESS				
			2		2	1
INVOLVED ACTORS	Action lab leader(s)		2		2	1
	Farmers (consumers)		1		2	1
	Farmer advisory and unions		1		1	
	Water producers and suppliers of drinking water		1		1	1
	Regional/national government				1	
	Local government		1		1	
	Consumers – inhabitants				2	1
	NGO's					

Achievements

⇨ **Sense-making of the capture zone by stakeholders**

- Acceptance among stakeholders that the current delineation of the extraction zone needs a revision.
- Through our different events we also made connections to the surrounding water works. Also links to the national level are ensured through meetings with an advisory group including national representatives. In this way we hope to convince that capture zones need to be built on different models to ensure a trustworthy process.

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⇨ **Testing the idea of a multi – model approach taking account of geological conceptual uncertainty in decision making**

- The use of a multi – model approach which takes into account the geological conceptual uncertainty in the future designation of capture zones was discussed in the Stakeholder advisory group. There was, however, no agreement in the group if this uncertainty should be included in decision-making process or not. Some actors thought that it would enhance the cost of the implementation process, as larger protected areas will be delineated. Other actors saw uncertainty as a question of not having enough data.

3.4.4 Ambition 'farmer practices'

		FARMER PRACTICES				
						2
INVOLVED ACTORS	Action lab leader(s)					2
	Farmers (consumers)					
	Farmer advisory and unions					
	Water producers and suppliers of drinking water					2
	Regional/national government					
	Local government					2
	Consumers – inhabitants					
	NGO's					

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Achievements

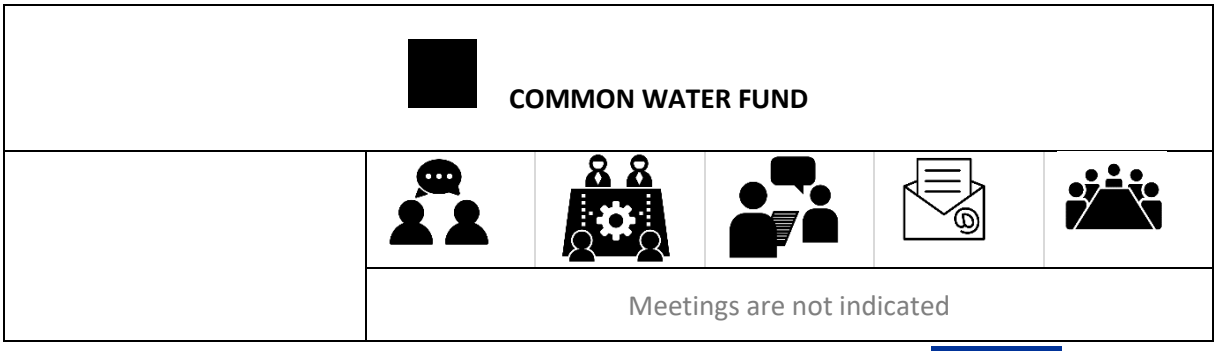
⇨ **Investigate potential alternative land use models in collaboration with farmers**

- Instead of introducing difficult measures, we are convinced that the level of groundwater protection can be raised significantly by smart farming practices with a more optimal spatial allocation of current crops and farming practices.
- The ambitions 'delineation of the capture zone' and 'spatial optimization of land use and farming practices' have been discussed lively and are broadly acknowledged.
- Spatial optimization of land use and farming practices can be considered as an approach to overcome barriers that prevent the involvement of farmers in water governance.
- It is still unknown how this will work out in the future, when agricultural land use and farming practices have to be changed.
- We would have liked to have more results within the duration of the project about farmers changes with respect to land use and farm management. For several reasons, these effects cannot be seen until august 2020 (for catch crops) and until spring 2021 (for other crops)

⇨ **Test if farmers are willing to make adaptations to their land uses on a voluntary basis**

- The farmers have accepted the idea of optimizing the land use and farming practices for groundwater protection.
- We believe that the narrative we have created around the process and the problems (nitrate and the delineations of different capture zones) has made farmers to understand and accept the complexity of ground water protection in the area. We hope that they will implement on a voluntary basis measures to protect the ground water and make the management of the capture zone in line with the Action Plan for the protection of the capture zone.
- There are clearly farmers that are more interested in new ideas and new practices than other farmers. So there will be pioneers and farmers adapting more slowly. However, in the action lab, we do not see any of the involved farmers engaging in the promotion of new measures to other farmers. Such a task rather should be initiated from the local agricultural advisory service.

3.4.5 Ambition 'common water fund'



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Achievements

⇨ **Test the idea of a common water fund to finance future measures to protect groundwater sources**

- The establishment of a Water Fund is still under discussion
- The main reason for the delay, is most likely a lack of common priorities in the municipality.
- At municipality level the situation is still unclear because the largest Water Work did not want to participate in the Water Fund.
- The initiative has stimulated interest among Vester Hjerk and the other closest water works to collaborate on relevant issues in an informal way.

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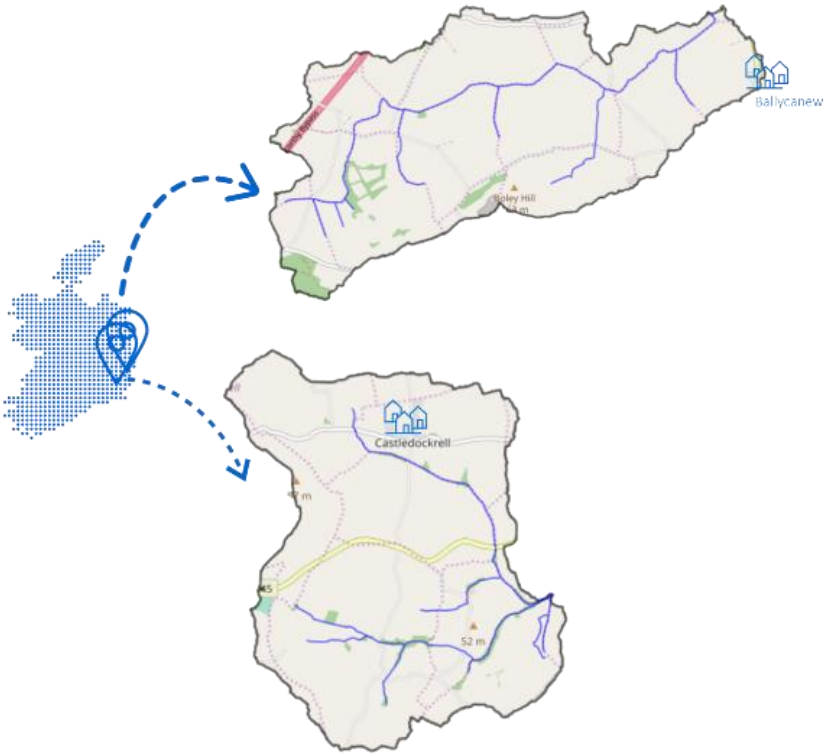
4 Irish action lab – Wexford County

4.1 General characteristics and description of the problem



- Two catchments within County Wexford (south-east of Ireland):
  - Ballycanew catchment – 12 km² - poorly drained soils
  - Castledockerell catchment – 11 km² - well drained soils
- 40 farms in each catchment – family farms
  - Beef production – dairying with sheep production
  - Barley (malting and animal feed) – wheat – maize – rapeseed oil
  - Ballycanew – 15% arable land use, 78% grassland (dairy, beef, sheep, sport horses)
  - Castledockerell – 54% arable land use, 39% grassland (beef, dairy and sheep)
- Surface water: Castledockerell river catchment flows into the Slaney river; Ballycanew river catchment flows into Owenavorragh river
- Groundwater: In both catchments, all one-off rural housing and farms have private wells. This results in a large number of small scale abstraction points of groundwater to supply individual households and farms. The village of Castledockrell has a publically managed water supply system servicing the village. Additionally, there are a small number of clustered households within both catchments that have a common water supply from groundwater within the catchments.

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Pollution in focus	• MCPA (2-Methyl-4-ChloorPhenoxyAcetic acid) • In recent years the main issues with drinking water supplies in Ireland have been associated with MCPA and there is little monitoring of MCPA as well as underlying knowledge in how to mitigate the loss to water. The Irish Action lab has therefor focused on herbicides and in particular MCPA and its metabolites.
Agricultural sources	• Nationally, agriculture has been identified as a significant pressure in 729 (64%) of river and lake water bodies that are at risk of not meeting their water quality objective under the Water Framework Directive (draft River Basin Management Plan for Ireland 2018-2021). • While the sources of common contaminants (e.g. MCPA) are known in principle, the individual polluters are not necessarily identifiable. This is confounded by a lack of understanding around the catchment scale pathways and processes and persistence of many acid herbicides.
Reinforcing factors on pollution	• In Ireland, climate change is expected to cause warmer summers and more rain or more frequent winter storms. • There are many confounding factors such as changing weather patterns, heterogeneity in soil hydro biogeochemical properties and associated time lags.
Other pollutions and pollution sources	• Nitrates • Phosphates • Pesticides • Faecal bacteria: It is a social norm on many Irish farms for animals to drink from drains & streams - Causing pollution by faecal and urine deposits and also sediment disturbance and bank erosion • Pharmaceutical veterinary products • Septic tanks • Municipal waste • There is a quarry in Ballycanew which has caused events with acidity in the nearby river and with the potential to affect drinking water quality in nearby private wells.

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- There is a single, central wastewater treatment plant in Castledockerell, based on a batch reactor facility for up to 75 people with the remaining population (approximately 208 people) on septic tank systems.
- In Ballycanew, wastewater is generally treated by single housing septic tank systems.

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4.2 Start situation

4.2.1 The actors and their roles

Production and distribution of plant protection products

Actor type	Actor in action lab	Role
Chemical producers	NUFARM	Produce agrichemical products such as MCPA.
Distributers of plant protection products	Glanbia	Agricultural retail outlet.
Actor responsible for the collection of the packaging	Irish Farms Film Producers Group (IFFPG)	IFFPG is the national farm plastics recycling compliance scheme.
Representative of chemical producers	Animal and Plant Health Association (APHA)	APHA is the representative body for manufacturers and sole distributers of animal health (veterinary medicines) and plant health (plant protection/agrochemical) products in Ireland.
Representative of chemical distributers	/	/

Agricultural production

Actor type	Actor in action lab	Role
Farmer	Farmers in the area	Production of food.
Seasonal farmer	/	/
Contract sprayer	/	/
Farmers unions	The Irish Farmers' Association (IFA)	IFA is a national organisation to represent the interests of all sectors of farming in the Republic of Ireland.
Farmer advisory	Teagasc	Contribute to the objective of achieving good water status for Ireland by different research and advisory programmes.
Union of contract sprayers	/	/

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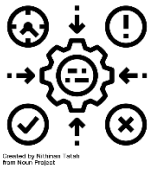
Processing and selling food products

Actor type	Actor in action lab	Role
Processing industry	Glanbia	Committed to protecting the environment while increasing their output by more than 50% by 2020.
Retailers	Glanbia	Committed to protecting the environment while increasing their output by more than 50% by 2020.

Drinking water production

Actor type	Actor in action lab	Role
Water producers and supplier of drinking water	Irish Water	Irish Water is a water utility company in Ireland. Eighty-two percent of people in Ireland get their drinking water from Irish Water. The company was created by the Irish Government through the Water Services Act (2013) to provide "safe, clean and affordable water and waste water services" to water users in Ireland. Irish Water plan, develop and operate their water service functions in line with the requirements of prevailing relevant national and European legislation. Irish Water must notify the EPA of drinking water quality failures or risk to public health from a public water supply.



Context factors and societal preferences over the entire system and all subsystems

Actor type	Actor in action lab	Role
Supranational government	European Union (EU)	The EU protects water resources, of fresh and salt water ecosystems and of the water we drink and bathe in is one of the cornerstones of environmental protection in Europe.
Regional or national government	Department of Agriculture, Food and the Marine (DAFM)	DAFM expends significant resources across many of its divisions and agencies on a range of activities, that directly and indirectly protect and enhance water for sustainable agriculture.

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	Department of Housing, Planning and Local Government (DHPLG)	Responsible for policy and legislation in relation to water quality issues and, together with other relevant authorities, for the implementation of EU legislation.
	Environmental Protection Agency (EPA)	The EPA's role is to ensure that Ireland's water-environment is protected by monitoring and assessing environmental data and through enforcement activities. They license and regulate activities such as intensive agriculture and waste facilities that may harm the water environment.
Local government	Wexford County Council	Local authorities are responsible for implementing the programme of measures under the Water Framework Directive, for monitoring river water quality for the EPA, for acting as agents for Irish water in the operation and maintenance of water and wastewater services.
Research	Agricultural Catchments Programme (ACP)	The core objectives of ACP are to: i) measure the effectiveness of the Good Agricultural Practice (GAP) measures implemented under the Nitrates Directive, i.e. the Nitrates Regulations, at catchment scale, ii) evaluate the efficacy of the nitrates derogation, and iii) provide scientific basis (both biophysical and socio-economical) for policy reviews, with a view to adopting modifications where necessary.
	Teagasc	Research and advisory programs contributing to the objective of achieving good water status for Ireland.
	Ulster University (UU)	UU provides research collaboration with researchers in ACP.
Civil society organisations	National Federation of Group Water Scheme (NFGWS)	NFGWS is the representative and negotiating organisation for community-owned Rural Water Supplies in Ireland.
Inhabitants	Inhabitants	
Consumers	Consumers	Consumers can choose to only purchase sustainably sourced food, such as those with the Origin Green label on them.
Consumer organisations	Bordbia	BordBia is leading the Origin Green initiative (see further by capacities)

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4.2.2 Functioning of the water governance system

KNOWLEDGE		
Monitoring		• Teagasc research provides the main scientific basis for national agricultural policy decisions in relation to water quality. • There is little knowledge and information on MCPA in water and the underlying mobilisation/transport processes and there is much interest in learning more. • There are several databases with information about pesticide usage and professional users.

MOTIVATION		
Use of the water		• Department of Agriculture, Food and the Marine: "Clean water is a fundamental requirement for the safe production of food and for ensuring consumer safety, and is also a key indicator of a healthy, sustainable environment" • Compatibility (drinking water and agriculture) is likely due to the intrinsic value placed on water quality within the study catchments. The rural nature of the catchments necessitates the use of private water wells for water provision. This places a specific emphasis on the need to protect local water quality.
		• Irish Water: the provision of clean drinking water and the disposal of wastewater in a manner that protects the environment is vital to our daily lives, and for economic and social development
		• Use of the water in the food production system: drinking, washing (dairy collecting yards), milk cooling, spraying crops.
		• Consumers: clean, safe drinking water. • Domestic use: drinking, washing, cooking and sanitary use.
Ensure agricultural production		• Water is a valuable resource, but also a potential threat for agriculture if it doesn't improve (cause of new regulations). • Protecting farm incomes.

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		• Farmers have a good (but varying) interest in water quality. However, they are fearful of increased restrictions that will either not be required or are not effective.
		• Bordbia: "As populations grow, the need for food also grows. So too does the pressure on limited natural resources such as soil and water. Therefore, it's vitally important that food is produced in a way that protects these natural resources rather than depleting them, while also being respectful to the community, now and into the future.".
Economics		• Farmers receive annual payments from Europe under the Common Agricultural Policy which are contingent on complying with the Nitrates Directive measures, GAEC measures and Greening measures which are all designed to protect water quality. The remaining funds for works carried out in relation to water resources come from general taxation. • Department of Housing Planning and Local government: "Water is essential for life and for our natural environment. It is also critical to our wellbeing and our economy and provides essential services supporting people and communities, agriculture, industry, transport and tourism". • Environmental Protection Agency: 'Clean and well-protected water is also a key national asset and supports many important economic activities such as agriculture, manufacturing and tourism.".
		• There are no water-related public funds in Ireland. Due to the recent economic recession there has been a lack of resources in government to invest in water resources and their protection. • Domestic water charges were introduced in 2015 for homes that are connected to a public water supply or public wastewater services. Irish Water, the national water utility, was given the task of administering the water charges. However due to a high level of public outrage, this system of domestic water charging has now been repealed.
		• Glanbia: Supplier benefits – rural economic benefits, intensive farming can be 'good' farming, other rural dwellers benefit via walkways, fishing, etc.; better animal drinking water (better performance); international image is protected; more

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		marketable products that could command price advance if the consumers recognised it as a differentiator; fewer regulation threats and more contenct NGO's.
Attractive and healthy environment		• Wexford County Council and Southern Regional Assembly: "Improved quality of life for the local people.". • European Union: "Water must be managed and protected. It is not merely a consumer product, but a precious natural resource, vital to future generations as well as our own. Without water, no life can survive" and "Water also plays a fundamental role in the climate regulation cycle.". • Environmental Protection Agency: "Water is part of what we are as an island people and there are few of us who do not have a personal connection to water, be it our favourite beach, river or lake, the well that supplies our family with drinking water or our favourite spot for a bit of fishing or a quiet walk.".
		• Consumers: Recreational – bathing, canoeing, fishing etc. + biodiversity/nature value – contribute to a positive sense of well-being.

INFLUENCE

Implementation of BMP's		• Improvements/changes in agricultural practices could significantly contribute to water quality improvements and the achievement of water quality targets. • Teagasc advisors have a strong influence on the uptake/adoption of water quality protection measures on Irish farms.
Information and education programs		• Glanbia has an interest in promoting awareness and assisting suppliers to protect the environment.
		• The Origin Green Initiative: the programme aims to encourage farms and businesses throughout Ireland to sign up to the sustainability agenda, making measurable commitments to producing food in a sustainable manner.

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- Septic tanks awareness campaigns: the first strand of the National Inspection Plan is a national public awareness campaign to promote best practice relating to the operation and maintenance of septic tanks. The campaign is rolled out by the Water Services Authority. Messages will be communicated via a series of channels e.g. web-based, videos, animations, FAQs workshops, presentations, TV, local radio interviews, etc.

- Agricultural Sustainability Support and Advisory Programme (ASSAP): the 'Sustainability Support and Advisory Programme' is a new approach (2018) to achieving improvement in water quality involving the establishment and joint funding of a resource of 30 Agricultural Sustainability Advisors. The Programme supports the goals of the Food Wise 2025 strategy, facilitating increased productivity hand-in-hand with a more sustainable sector. This sustainability and efficiency will be achieved through improved nutrient management with more targeted use of fertiliser, better farmyard practice, more widespread use of sustainability approaches developed by Teagasc and the development of new approaches in critical source areas.
- Teagasc Knowledge Transfer Programme: the Knowledge Transfer Programme is funded under the Rural Development Programme (RDP) 2014-2020 and involves group interaction complemented by one to one advice across a range of sectors. Funding of €100m is allocated under the RDP for Knowledge Transfer Groups across the dairy, beef, equine, sheep, tillage and poultry sectors. Almost 20 000 farmers in 1200 Knowledge Transfer Groups have attended meetings and approved Knowledge Transfer events which, together with a tailored Farm Improvement Plan, will support farmers in addressing a range of competitiveness and sustainability challenges facing the sector.
- Agricultural Catchments Programme (ACP): funded by the Department of Agriculture, Food and the Marine and is operated by Teagasc. Its core objective is to measure the effectiveness of the Good Agricultural Practice (GAP) measures implemented under the Nitrates Directive, i.e. the Nitrates

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		Regulations, at catchment scale while also evaluating the efficacy of the nitrates derogation. • The farm advisors receive in-service training annually. The farmers receive training via attendance at discussion groups and by completing an agricultural qualification (called the green cert) which is required to receive tax breaks and grants. The scientists regularly attend scientific conferences (national and international).
Control		• Wexford County Council has the power to prosecute individuals/companies for causing pollution. • Wexford County Council has a supervisory role in relation to group water schemes and small private supplies. • The drinking water regulations provide the EPA with supervisory powers for public water supplies. The EPA can direct Irish Water to improve the management or quality of a public water supply. • The Department of Agriculture inspects a small percentage of farmers nationally for compliance with agri-environmental regulations and schemes.
Economics		• The Department of Agriculture provides 100% of the funding for the ACP. • CAP Basic Payment Scheme: to gain funds the farmer has to cross comply with the Nitrates Directive measures, the GAEC measures and the Greening measures outlined above. • Rural Development Programme (GLAS, EIP, TAMS): to promote the adoption of environmentally sustainable farming practices through the provision of funded schemes such as the Green, Low-Carbon, Agri-Environment Scheme (GLAS), the Targeted Agricultural Modernisation Scheme (TAMS), the European Innovation Partnership initiative (EIP). • Grants for septic tank improvement works: to financially support owners of septic tanks who have failed certain environmental criteria during an inspection. • Discharge Licenses – License fees and prosecution for non-compliances: effluent discharges to waters and sewers, with a few exceptions, require a licence in accordance with section 4 and 16 of the Local Government (Water Pollution) Act. In

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		addition, discharges of greater than 5 m^3 of sewage effluent to groundwater require a licence under section 4 of the above Act.
		• Glanbia can refuse to accept milk from suppliers or offer them a lower price if they fail to reach certain sustainability criteria.
		• If consumers refuse to purchase food that is not sustainably sourced then those producers may eventually be forced out of the market.
Consultation and cooperation		• The Local Authority Waters and Communities Office (LAWCO) was set up in February 2016 to promote better management of the streams, rivers, lakes, estuaries, coastal waters and groundwater for the benefit of present and future generations. The two key objectives of LAWCO are: i) to coordinate the water quality work of Local Authorities through agreed regional structures, thereby providing a collaborative approach to river catchment management, and ii) to engage local communities and promote public participation in the management of our water environment. • LAWCO has established regional committees to organize regional work programmes under the Water Framework Directive.
		• Tidy Town Community Groups: most towns and villages in Ireland form community groups aimed at keeping the town/village clean and pollution-free. This involves removing litter from nearby streams and rivers. It enhances community linkages and ownership of local environmental issues.
Policy		• European level: ○ EU Water Framework Directive & River Basin Management Plan: Protect/enhance all waters (surface, ground and coastal waters) and achieve 'good status' for all waters by 2015/2021/2027. ○ Good Agriculture and Environmental Conditions: (GAEC): a set of European Union standards defined at national or regional level, aiming at a sustainable agriculture, keeping land in good agricultural and environmental conditions.

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- Sustainable Use of pesticides Directive: aims to achieve a sustainable use of pesticides in the EU by reducing the risks and impact of pesticide use on human health and the environment and promoting the use of Integrated Pest Management (IPM) and of alternative approaches or techniques, such as non-chemical alternatives to pesticides.
- European Union (Drinking Water) Regulations 2014: has the objective to protect human health from adverse effects of any contamination of water intended for human consumption by ensuring that it is wholesome and clean.

- National/regional level:
  - S.I. No. 148/1998 – Waste Management (Use of Sewage Sludge in Agriculture) Regulations, 1998 & 2001 - Prescribes standards and limits on sludge used in agriculture subject to the carrying out of nutrient management plans.
  - Department of Environment, Community and Local Government Code of Good Practice for the Use of Biosolids in Agriculture - Sets out mandatory guidelines for producers, end-users and local authority regulators of sewage sludge used in agriculture.
  - Local government (water pollution) act 1977/1990 - To provide for the control of water pollution and for other matters connected with water pollution.
  - Water Services (Admendment) Act 2012 and associated regulations. - Provides for the introduction of a registration and inspection system for domestic wastewater treatment systems. It has been introduced to address the European Court of Justice ruling against Ireland in October 2009, and even more importantly, to protect ground and surface water quality (particularly drinking water sources) from the risks posed by malfunctioning systems.

Initiatives

- Dairy Sustainability Ireland: operating under the Dairy Industry Ireland umbrella, Dairy Sustainability Ireland is a collaborative

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		project with BordBia, the Department of Agriculture and a number of Ireland's dairy processors. This initiative has been established to help farmers meet environmental targets, improve profitability and to copper fasten Ireland's reputation as a world leader in grass-fed dairy production. Dairy Sustainability Ireland was very involved in setting up the Sustainable Dairy Assurance Scheme and also promotes sustainable dairying through open days, farm demonstrations and facilitating 10 ASSAP advisors through dairy co-ops.
	•	The Sustainable Dairy Assurance Scheme (SDAS) (led by BordBia): a national dairy scheme that sets out requirements for best practice on Irish dairy farms in animal health and welfare, land management, biosecurity, safe farming practices and the production of safe milk. It also provides a framework for measuring the continuous improvement of each participating farmer, recording and monitoring sustainability credentials at the farm level. Now being implemented on effectively all of Ireland's 18,000 dairy farms, the Sustainable Dairy Assurance Scheme is a rigorous, independently verified and internationally accredited programme. (European Standard for Product Certification – ISO 17065: 2012)

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FUNCTIONING IN SYSTEM

General system context	• The catchment farmers and the Department of Agriculture want to increase production, whereas the EPA and local authorities are concerned that this would have a negative impact on water quality. • The milk quotas for dairy farms were abolished in 2015 resulting in both expansion and intensification in the dairy herds in Ireland. • The FoodHarvest 2020 and FoodWise 2025 food growth strategies were launched with the aim of increasing farm output with 65%. • Dairy farming is the only financially viable farm enterprise in Ireland. Most of the other sectors (sheep, beef and tillage) are heavily reliant on the subsidies from Europe to stay viable.

Transparency and trust	• The Teagasc Agricultural Catchment Programme (ACP):
	  ○ Teagasc has via the advisors an established and trustworthy relation with farmers. The Agricultural Catchments Programme (ACP) is hosted by Teagasc and has their own dedicated advisors collaborating with ca. 300 farmers within the monitored catchments since 2008.
	  ○ Teagasc-ACP hold open days which are free for the entire community to attend.
	  ○ The Department of Agriculture Food and the Marine (DAFM) oversees and sometimes directs the work of the ACP. The ACP informs DAFM about their scientific findings which are often used to substantiate policy decisions.
	  ○ The EPA (Environment Protection Agency) is part of the steering committee for the ACP. The ACP provides scientific information and insights to the EPA to inform their national water quality monitoring and assessment programme.
	  ○ There are full-time farm advisors employed by the Agricultural Catchments Programme in each catchment.
	• Data sharing:
	  ○ Managed via written requests .
	  ○ Raw data is rarely shared to protect the originality of the published papers which are the main currency of the ACP.

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	○ There is no common database to share data and experiences between stakeholders. Each agency/organisation takes responsibility for their own data sharing. ○ Meteorological data from the catchment is available from the ACP's webpage (www.acpmet.ie). ○ Data is shared with other agencies where it doesn't compromise the integrity of the unpublished papers. • Communication strategies ○ A strong communication strategy by the ACP raises the profile and awareness of the programme in this area so that the public and relevant companies and agencies are aware of the work being done in this catchment. ○ Meetings/conferences/workshops ○ Published papers/reports/press articles ○ Webpages, social media. ○ Any people/groups who are interested in visiting the catchment sites are facilitated. ○ None of the farmers are identified in the project outputs to protect confidentiality. • The monitoring is not participatory. • Power imbalances are being mitigated to some degree trough the engagement and community work of the new LAWCO office.
Coherence	• Policy coherence is stimulated by the use of common water quality standards. • The integration between the agricultural and environmental policy is improving a lot in recent years. There is a strong integration of these in the Water Framework Directive's draft River Basin Management Plan (2018-2021).
Leadership	• There are numerous roles of leadership on the ACP team in this catchment: ○ The programme manager: takes the lead by making decisions on the activities of the programme. ○ Administrator ○ Research scientists: take the lead in relation to the monitoring data and research outputs. ○ Farm advisor: takes the lead in relation to engagement with the catchment farmers. ○ Communications specialist.

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	○ Field technologist. ○ Data technologists. • Eighty farmers take charge of the implementation of the Nitrates Directive measures and nutrient management plans provided for them. • At the highest level, the department of agriculture takes the lead by implementing agricultural policies and funding the work of the ACP. • Participation at scientific conferences and collaborations with other research organisations stimulate leadership among research scientists. • The free soil samples and nutrient management plans stimulate farmers to take the lead in relation to soil fertility on their farm. • Discussion groups, farm walks, workshops and meetings with stakeholders stimulate leadership within the whole ACP team. • The funding for the ACP has been cyclical (every four years). Currently they are in the fourth funding cycle which started in January 2020. This type of cyclical funding has resulted in high staff turnovers and an inability to make long-term plans (> 4 years)
Inclusive participation	• There is little commitment from the residents and the local businesses/schools in the river catchment. • The decision-making process tends to be top-down, from either the Department of Agriculture, Food and the Marine or the Department of Housing planning and the local government (who is responsible for water). • There is a gap in relation to participatory monitoring/citizen science. • The integration between agricultural and environmental policy is improving a lot in recent years. There is a strong integration of these in the draft River Basin Management Plan. • A team of 35 scientists has been recruited nationally in order to form a regionally based water assessment team which is a local authority shared service. This team is supported by 30 agricultural sustainability support advisors from Teagasc and the COOP's as a part of the Agricultural Sustainability Support and Advisory Programme (ASSAP). Over 4 years, this team is working in priority catchments to identify and implement the right measure in the right place.
Roles and responsibilities	• The perception of roles and responsibilities of Irish Water are unclear, including their interaction with local authorities.

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AWARENESS AND ACTIONS	
Awareness	• There is a good awareness of pesticides such as MCPA causing a problem for Irish drinking water. The number of pesticide failures has increased in recent years. Seven supplies, serving; 60,500 people have been reported to have a problem with MCPA. • There is a poor knowledge on the underlying processes of MCPA reaching water. It was recognized that we need more knowledge on the transfer pathways and the residence time/breakdown. • There was a perception that MCPA is only incidentally lost to water via surface pathways. • Due to the heterogeneity of the landscape a targeted approach supported by science is needed to mitigate MCPA loss to water
Actions	• An evidence based and collaborative approach are recommended. • Much focus is on creating more awareness of the risks in handling MCPA (particularly in terms of sensitive sites and time) and to inform users on BMP's. • DAFM Pesticide Registration & Control Divisions requested APHA to conduct a detailed monitoring of MCPA in identified problem areas. • APHA has arranged training days for all stakeholders involving DAFM, Teagasc/ACP, EPA, Irish water and WaterProtect project partners. • A stakeholder working group has been established to discuss actions for problem areas.

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4.3 Process

4.3.1 Representation of the process

METHODS OF CONTACT

Exchange – bilateral conversation

Exchange – multi-actor conversation

Exchange – questionnaire/survey

Exchange – demonstration/field visit

Exchange – interactive workshop

INVOLVED ACTORS

Action lab leader(s)	Teagasc
Chemical producers	Animal and Plant Health Association (APHA) Hygeia Chemicals Ltd NUFARM
Research	Ulster University Teagasc Students Agricultural Catchments Programme
Farmers	Famers of the catchments
Farmer unions and advisories	Teagasc advisors Agricultural Sustainability Support Advisors (ASSA)
Water producers and suppliers of drinking water	Irish Water National Federation of Group Water Scheme (NFGWS)
Regional/national government	Department of Agriculture Food and the Marine Local Authority Waters Programme (LAWPRO) Environmental Protection Agency (EPA) Pesticide Control Division of the Department of Agriculture Food and the Marine

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	Local government	Wexford County Council
	Food processors and distributers	Glanbia
	Inhabitants – consumers	Citizens – rural dwellers

AMBITIONS

Network formation	• Stimulate involvement and cooperation with and between various actors
Exchange and continuation	• Stimulate exchange of experiences and findings
Knowledge building	• Provide information for targeted measures for MCPA in critical times, places and pathways
Actor awareness	• Use of the WaterProtect tool • More awareness of the problem among farmers, rural dwellers, agricultural advisors, the Agricultural Sustainability Support Advisory Programme (ASSAP) and governmental organisations
Farmer practices	• Avoid spreading at sensitive times and sensitive places • Sowing winter cover crops • Measures associated to handling of MCPA (safe storage and transport, safe stands, safe disposal, etc.)

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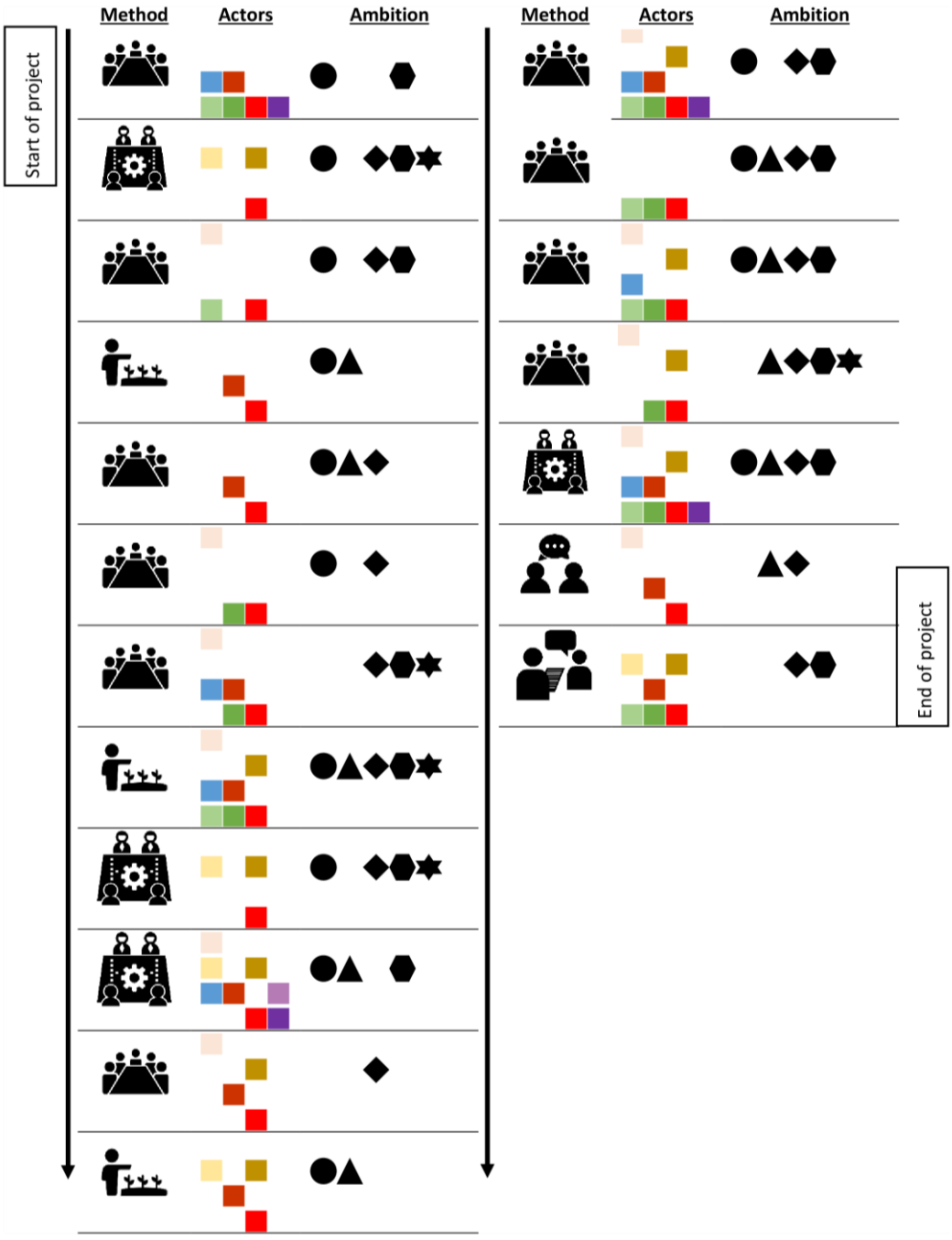
COMBINED VISUAL REPRESENTATION



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PROCESS SUMMARIZED IN FIGURES

		METHODS				
						
		10	4	1	1	3
ACTORS INVOLVED	Action lab leader(s)	10	4	1	1	3
	Chemical producers	7	2	1		1
	Famers		3		1	1
	Farmer unions and advisories	4	4		1	2
	Food processors and distributers	2	2			
	Water producers and suppliers of drinking water	4	2			1
	Regional – national gov.	5	1		1	1
	Local government	7	1		1	1
	Research	5	2	1	1	3
	Inhabitants - consumers		1			
AMBITIONS	Network formation	7	4			3
	Exchange – continuations	4	2	1		3
	Knowledge building	9	3	1	1	1
	Actor awareness	7	4		1	1
	Farmer practices	2	2			1

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4.3.2 Evaluation and lessons learned of the process

METHODS

				
10	4	1	1	3

- Many stakeholders did not say anything or contribute anything. Other stakeholders talked a lot but may not have had useful information. A forum to bring out all the stakeholder ideas and opinions would be useful to see if we can decipher how these stakeholders interact with each other. This may overcome guarded responses to questions.
- Kildalton Sustainable Farm Open Day: the open day was designed to facilitate discussion between farmers, advisors, scientific researchers and industry. The event allowed WaterProtect to be presented to a large number of specialists and non-specialists outside of the usual channels of dissemination.
- Participants were "reading each other" and seeing who is who.
- Time always needs to be considered. To ask each one to gather their group for a period of time and to keep them motivated during the session is not that easy.

- One-to-one meetings are suitable for farmers and advisors approaching specific issues.

- Briefing meetings can reach active and interested stakeholders.
- Interviews with groups of three to five people of each stakeholder category caused good discussions on the different ideas and opinions. Sometimes actors had contrasting views on a single subject which then resulted in a new idea.
- The sessions took some time and it was therefore difficult to gather a group for such a period of time and to keep actors motivated.

- The field visit allowed for better understanding of the experimental design and the protocols being employed at the Agri-Food & Biosciences Institute (AFBI) in Northern Ireland, UK. This contact identified current gaps in knowledge and research questions that could be examined by the WaterProtect team in Teagasc and build upon the work being done by AFBI. The meeting also facilitated networking and better communication.
- Meetings in the catchments provided a better perspective to interpret the monitoring results.

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INVOLVEMENT OF ACTORS

						
ACTORS INVOLVED	Action lab leader(s)	10	4	1	1	3
	Chemical producers	7	2	1		1
	Famers		3		1	1
	Farmer unions and advisories	4	4		1	2
	Food processors and distributers	2	2			
	Water producers and suppliers of drinking water	4	2			1
	Regional – national gov.	5	1		1	1
	Local government	7	1		1	1
	Research	5	2	1	1	3
	Inhabitants - consumers		1			

Farmers	• Teagasc has via the advisors an established and trustworthy relation with farmers. The Agricultural Catchments Programme (ACP) is hosted by Teagasc and has their own dedicated advisors collaborating with ca. 300 farmers within the monitored catchments since 2008. • The Irish Action lab is nested in the ACP and the action lab leader can avail on the already transparent and trustworthy reputation of the ACP together with an establishment of a stakeholder platform via WATERPROTECT.
Farmer unions	• We have not engaged farmer organisations as there are many organisations and it may become political to only represent one or few. • A Farming Consultative Group meets regularly (currently 4 times a year) to engage farmer unions with the activities of Teagasc's ACP and ASSAP. The farmer unions are well engaged with both programmes and voice concerns, give approval and reach understanding in advance of proposed actions.
APHA	• APHA is a stakeholder the project partners were previously not aware of. Project partners learned about APHA's role in water monitoring in Ireland.
Government	• It was difficult to reach higher level actors because they are less approachable, have some limitations to participate and they are busy with other duties.
Hygeia Chemicals Ltd	• Having suppliers of the pesticide of concern present (Hygeia Chemicals Ltd) provided greater balance and further dialogue. The severity of the MCPA contamination was evident and the urgency for action was clearly portrayed.

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		Meeting in the catchments also provided a better perspective to interpret the monitoring results.
NUFARM	•	A stewardship group from NUFARM with representatives from Ireland, UK and Germany contacted the Irish action lab for discussion on research needs for MCPA. A number of meetings were held over the phone and in person.

4.3.3 Progress of the process, considerations and points of attention

- The major challenge was to maintain interest in the WaterProtect project as this introduction was using another event as a route to access the target audience. If the sole purpose of the meeting was the WaterProtect project there would not have been as many involved.
- Farmers have a good (but varying) interest in water quality, however they are fearful of increased restrictions that will either not be required or are not effective.
- It was necessary to describe the goals of both the WaterProtect project and the specific sampling regime to a non-technical audience.
- Research into this area is necessary but also desired by industry and the scientific community alike.
- This was the first time representatives from all stakeholders were in the same room to discuss emerging issues with MCPA. It was good for all stakeholders to meet and see who is who, and to have the WaterProtect project as a common platform.
- The WaterProtect project plays an important role in handling the issues around MCPA and the complex water governance in Ireland. Results from the survey were encouraging.
- Regarding water quality there are some differences in the viewpoints. Each group thinks the features related to their work is the most important; for example ASSAP thinks ''BMPs uptake'' as the most important factor, whereas, researchers believe this goes to ''Applied MCPA''.
- One stakeholder had many ideas on what the project should include. However, often outside the scope of the WaterProtect project.
- There were some conflicts relating to pesticides of interest and locations of sites.
- The extensive monitoring scheme of pesticides taken on board by APHA is mandatory (commissioned by DAFM) and there were possibly different views in the need for such a scheme.
- The research and specifically the private well sampling was welcomed by the group. They were keen to find out the quality of their water supply and if their pesticide usage is having a discernible impact.
- Research was prioritised within the budgetary constraints.
- There is still some confusion on the governance structure and who does what. Some issues remain highly political which inhibits collaboration and progress.

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- From our experience, the groups had some similarities in the perception on water governance. For example, all saw the farmers and the Department of Agriculture as the most important actors. But there were also some differences as they all perceived themselves as the next very important actor.
- The scale of the two catchments was appropriate for this work. It was useful to learn from two paired catchments with contrasting physical settings and to collaborate with Wexford County Council who works with the whole region (County).
- The multi-actor approach is important and provides a good feedback to both water governance structure and the water quality indicators.

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4.4 Achievements by the WaterProtect process

4.4.1 Ambition 'network formation'

		NETWORK FORMATION				
		7	4			3
ACTORS INVOLVED	Action lab leader(s)	7	4			3
	Chemical producers	4	2			1
	Famers		3			1
	Farmer unions and advisories	2	4			2
	Food processors and distributers	2	2			
	Water producers and suppliers of drinking water	3	2			1
	Regional – national gov.	5	1			1
	Local government	5	1			1
	Research	3	2			3
	Inhabitants - consumers		1			

Achievements

⇨ **Stimulate involvement and cooperation with and between various actors**

- There was a synergy between the experimental teams to avoid overlap and provide mutual benefits.
- More communication between stakeholders led to a better understanding and appreciation for each other's role.
- Actors from all aspects of the Source-Pathway-Receptor elements of the pesticide contamination issue were present which provided a holistic approach.
- There was contact with APHA and the DAFM pesticide group. The network is extended and there will be on-going dialog and possibly data exchange in the future.
- There has been more transparency and open discussion between stakeholders which has improved the trust them between (Teagasc, Wexford County Council, EPA, Irish Water etc.).

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- Since the problem with MCPA is now emerging, the situation relies on new scientific output from WaterProtect and the ACP. Action lab leaders will stimulate leadership of e.g. the specialist advisors (ASSAP) by informing on research findings and recommendations.
- Farm advisors are informing and receiving information from research projects and monitoring campaigns.
- More stakeholders have a better feeling of being involved in the governance structure with benefits on the drinking water quality.
- Stakeholders also have been more keen to know more about the views and opinions of others.

4.4.2 Ambition 'exchange and continuation'

		EXCHANGE AND CONTINUATION				
		4	2	1		3
ACTORS INVOLVED	Action lab leader(s)	4	2	1		3
	Chemical producers	2	2	1		1
	Famers		1			1
	Farmer unions and advisories	2	2			2
	Food processors and distributers		2			
	Water producers and suppliers of drinking water	1	2			1
	Regional – national gov.	2	1			1
	Local government	3	1			1
	Research	1	2	1		3
	Inhabitants - consumers		1			

Achievements

⇨ **Stimulate exchange of experiences and findings**

- Providing new data and knowledge has generated more collaboration between stakeholders and opened possibilities for future research collaboration.

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- Further funding for a research project has been secured building on research needs highlighted by the Irish action lab.
- The WaterProtect project has created a platform to continue the work with engaging for action in the field.
- There were many common interests between the two projects (WaterProtect and Fairway). Project partners believed that they will achieve more and better results through the collaboration.
- It was good to get feedback from international young researchers. They are interested in the approach of the action lab.
- The action lab leaders actively participated in the national stakeholder debate on MCPA.

4.4.3 Ambition 'knowledge building'

		KNOWLEDGE BUILDING				
		9	3	1	1	1
ACTORS INVOLVED	Action lab leader(s)	9	3	1	1	1
	Chemical producers	7	1	1		1
	Famers		2		1	
	Farmer unions and advisories	4	3		1	1
	Food processors and distributers	1	1			
	Water producers and suppliers of drinking water	3	1			1
	Regional – national gov.	4	1		1	1
	Local government	6	1		1	1
	Research	4	1	1	1	1
	Inhabitants - consumers					

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Achievements

⇨ **Provide information for targeted measures for MCPA in critical times, places and pathways**

- The occurrence of herbicides (MCPA and metabolites) is monitored in a once-off extensive survey of private drinking water wells, continuously by passive samplers in the outlet of the two river catchments and by auto sampling during events on a focused study site on an agricultural field.
  - Provided more knowledge about the underlying processes of loss of MCPA to water.
  - A new data set has been generated for concentrations of nutrients, herbicides and metabolites (and the presence/absence of >2000 compounds) for 98 drinking water wells.
  - Temporal data set of two-week, time-weighted mean herbicide concentrations in two rivers.
- Action lab leaders mapped the stakeholder perception of the water governance structure and indicators for drinking water. The aim is to identify the best method for improvement, test scenarios and identify where changes are most needed, efficient and adaptable.

4.4.4 Ambition 'actor awareness'

		ACTOR AWARENESS				
		7	4		1	1
ACTORS INVOLVED	Action lab leader(s)	7	4		1	1
	Chemical producers	5	2			1
	Famers		3		1	
	Farmer unions and advisories	3	4		1	1
	Food processors and distributers	2	2			
	Water producers and suppliers of drinking water	4	2			1
	Regional – national gov.	5	1		1	1
	Local government	6	1		1	1
	Research	3	2		1	1
	Inhabitants - consumers		1			

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Achievements

⇨ **Use of the WaterProtect tool**

- The data will be available to stakeholders via the WaterProtect tool. Private well owners, many who are farmers, will have the results from their well sent to them.
- There is a project webpage which is regularly updated.

⇨ **More awareness of the problem among farmers, rural dwellers, agricultural advisors, the Agricultural Sustainability Support Advisory Programme (ASSAP) and governmental organisations**

- There is more awareness among farmers about:
  - the fact that their farming activity may affect the quality of their or their neighbour's water;
  - the problems with PPP's;
  - how they can influence and improve practices to reduce loss of nutrients and PPP's to water;
  - that loss of nutrients means loss of money.
- All involved stakeholders agreed on the importance of understanding the underlying science for targeted and effective measures.
- Project partners contributed to national training events to advisors and other stakeholders across Ireland.

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4.4.5 Ambition 'farmer practices'

		FARMER PRACTICES				
		2	2			1
ACTORS INVOLVED	Action lab leader(s)	2	2			1
	Chemical producers	2				1
	Famers		2			
	Farmer unions and advisories	1	2			1
	Food processors and distributers					
	Water producers and suppliers of drinking water	1				1
	Regional – national gov.					1
	Local government	2				1
	Research	1				1
	Inhabitants - consumers					

Achievements

- **Avoid spreading at sensitive times**
  - Farmers said that they will be more observant on the spreading conditions regarding weather, soil drainage and proximity to water.

- **Sowing winter cover crops**
  - A number of farmers who were informed about mitigation options were interested particularly in sowing winter cover crops.
  - While some farmers have started using cover crops and being more careful with the handling of MCPA, most of the achievements related to this ambition are likely to be after the project.

- **Measures associated to handling of MCPA (safe storage and transport, safe stands, safe disposal, etc.)**
  - Above baseline BMP implementation lies beyond the project time.

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- The engagement with LAWPRO and the ASSAP advisors will generate action in the field on a national level. Advisors will identify problem areas and discuss solutions with the farmers.
- Farmers in the catchments are both aware and willing to take action. But may need help from an advisor.

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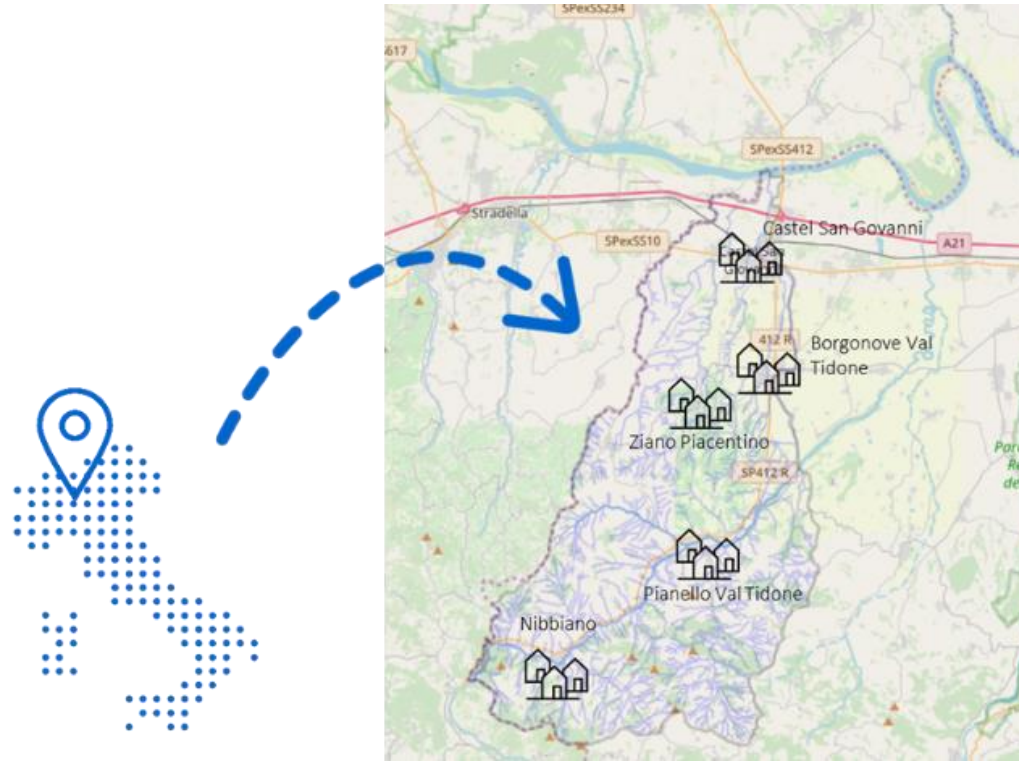
5 Italian action lab – Val Tidone

5.1 General characteristics and description of the problem



- North-west of Italy in Emilia Romagna region
- 207 km²
- A hilly zone characterized by an elevation level between 100 and 350 meters above sea level.
- Mix of urban, peri-urban and rural areas
- Two types of farm structures:
    - Vineyard with cellar. In this case, the grape transformation to wine and the wine retail is self-made. This is the case of 25% of the total vineyards present in the investigated area.
    - Vineyard without cellar. In this case, the farmers deliver the grape to social wineries. This is the case of 75% of the total vineyards present in the investigated area.
- Grape and wine production in the Tidone Valley is of a high quality, with several DOC (Denominazione di Origine Protetta – Protected designation of origin), DOP (Denominazione di Origine Controllate – Controlled designation of origin) and IGP

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(Indicazione di Origine Protetta – Indication of protected origin) certifications for the products and with a positive economic remuneration for all population categories.

- Surface and ground water used for drinking water production, agricultural, zootechnical and industrial sectors.
- Ground water is under study in the action lab.

Pollution in focus

- Pesticides and nitrates used in vineyards
- Pesticides in other agricultural fields, if present in water, will also be investigated.

Agricultural sources

- Until now, the impact of grape cultivation on pesticides and nitrates groundwater contamination was never investigated.
- As observed from the ground water monitoring results obtained in the WaterProtect project and confirmed by technical experts that acts on the territory, the contamination is due to both diffuse and point sources.
- The point source contamination is mostly accidental, but quite common, especially for those vineyards that do not have a proper area for machinery cleaning and mixture preparation.
- Part of the nitrate measured in the water is originating from the fertilisation of agricultural lands.

Reinforcing factors on pollution

- Concerning pesticides:
  - No natural processes are involved in the level of pollution with pesticides as in general, they are synthetized chemicals, not present in nature.
  - The use of pesticides outside the agricultural sector is considered to have an insignificant effect on ground water pollution.
- Concerning the nitrates
  - Part of the nitrates present in the water is naturally occurring.
  - Human activities, other than the agricultural sector, are considered to have a negligible impact on groundwater pollution by nitrates.
- Climate change: the rise of global temperature and the changes in the precipitation typology, with high volumes in short periods, results in a decrease of leaching water from soil surface to ground water. As a result,

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	the ground water volume decreases while the concentration of pollutants in the water increases.
Other pollutions and pollution sources	• /

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5.2 Start situation

5.2.1 The actors and their roles

Production and distribution of plant protection products

Actor type	Actor in action lab	Role
Chemical producers	/	/
Distributers of plant protection products	/	/
Actor responsible for the collection of the packaging	/	/
Representative of chemical producers	/	/
Representative of chemical distributers	/	/

Agricultural production

Actor type	Actor in action lab	Role
Farmers	455 farmers in the Val Tidone catchment	Production of grape for wine. Use of groundwater for their activity.
Seasonal farmer	/	/
Contract sprayer	/	/
Farmers advisory and farmer's unions	National private organization for the request of European agriculture funds: CAA- Centro assistenza Agricola (CAA)	The CAA represents farmers in applying for European funds for agricultural production.

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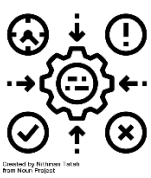
	Consorzio Fitosanitario Provinciale	Provide technical advice to farmers for a sustainable use of pesticides + involved in authorising the sale of pesticides and chemicals.
	Consorzio Agrario Terrepadane	Provide technical advice and products to farmers for water irrigation, pesticides, fertilizers, equipment, etc.
	Confagircoltura Coldireti Agricoltori Italiani (CIA)	Provide technical advice to farmers for a sustainable use of groundwater + make governmental and environmental public institutions aware of farmer's needs.
Union of contract sprayers	/	/

Processing and selling food products

Actor type	Actor in action lab	Role
Food processor and trader	Cantina Sociale Vicobarone Cantina Sociale Valtidone	Use groundwater for their activity + provide technical advice to farmers for a sustainable use of ground water.
Corporate buyers	Coop Italia Famila Italia Galassia Italia Auchan Italia Sma Italia	Distribute wine produced by Cantina Vicobarone.
Local businesses	Consorzio tutela Vini DOC Colli Piacentini	Promote a sustainable water use to improve the quality of DOC wine.

Drinking water production

Actor type	Actor in action lab	Role
Water producers and supplier of drinking water	IRETI (Gruppo IREN)	Responsible for the management of water collection, treatment and distribution.



Context factors and societal preferences over the entire system and all subsystems

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Actor type	Actor in action lab	Role
Supranational government	European Parliament European Commission Council of the European Union	Legislating, planning and financing the water governance at European level.
National government	National government: Parliament, Lower House, Senate and the Ministries of Environment, Health, Public works, Industry and Economy and Finance	Legislating, planning and financing the water governance at national level.
	National authority for electricity, gas and water (Autorità di Regolazione per Energia Reti e Ambiente (ARERA))	Protect the interests of users and consumers + promote competition + ensure efficient, cost-effective and profitable nationwide services with satisfactory quality levels in the electricity and gas sectors.
	National paying agency for agriculture: Agenzia per le erogazioni in agricoltura (AGEA)	Responsible for budget determination, paying and controlling the European funds for agricultural production.
	National system for environmental protection: SNPA	Responsible for combining the direct knowledge of the territory with the national policies for environmental protection + represents an institutional and technical-scientific reference point for the Italian territory.
	Environment/ river basin agency: ARPAE-ER	Responsible for controlling the water quality + supporting the sustainability of human activities + authorise the use and sale of pesticides and chemicals.
Regional	Regione Emilia-Romagna	Legislating and planning the water governance at regional level: strategic decisions and funds allocation, trough ATERSIR + authorise the use of pesticides and chemicals.
	Regional state consultation: Conferenza Stato Regioni	Planning, consulting and junction between the national and regional governments.
	Regional paying agency for agriculture: Agenzia regionale per le erogazioni in	Responsible for paying the European funds for agricultural production.

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	agricoltura della Regione Emilia Romagna (AGREA)	
	Integrated urban water management: Agenzia territoriale dell'Emilia Romagna per i servizi Idrici e Rifiuti (ATERSIR)	Water governance planning at regional level: strategic decisions and funds allocation + establishment of the multi-utility company in charge of water collection, treatment and distribution.
	Po River Hydrographic District Basin Authority (ADBPO)	Responsible for defining the river basin district management plan: establishment of objectives and identification of the required measures to reach the objectives. Furthermore, ADBPO is responsible for monitoring the enforcement of the management plan.
Local government	Provincial government: Provincia di Piacenza	Responsible for the spatial planning of the territory by establishing and coordinating rules for water protection intended for urban transformations and the mining industry.
	The local health authority: AUSL	Control the drinking water quality + authorise the use and sale of pesticides and chemicals.
	Reclamation authority: Consorzio di Bonifica di Piacenza (CBPC)	Responsible to coordinate both public and private works devoted to drainage, irrigation, flood control, soil defence, protecting waters and environment.
	Five municipalities are involved: Castel san Giovanni, Borgonovo Val Tidone, Pianello Val Tidone, Ziano Piacentino, Alta Val Tidone	Responsible to take the final decisions for a complete or final ban of drinking water. Local water supply plans are drawn up periodically by the municipalities in consultation with the regional authorities and IRETI.
Research	Università Cattolica del Sacro Cuore	Responsible for conducting and disseminating research on sustainable water use.
Inhabitants	All the inhabitants of Val Tidone	Use and conserve the water resources.
Civil society organizations	Associazione La Valtidone SPS Alta Val Tidone SPS Pesca e Natura in Val Tidone	Responsible for preserving the natural environment and aquatic ecosystems.
Consumers	All the inhabitants and the population consuming products from Val Tidone (China)	Sustainable use of water resources.
Consumer organisations	APCS	Responsible to promote a sustainable agri-food sector and environmental protection.

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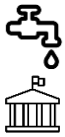
Federconsumatori	Responsible to protect consumer's rights concerning drinking water availability, safety and price.

5.2.2 Functioning of the water governance system

KNOWLEDGE		
Monitoring		• ARPAE-ER (river basin agency) is responsible for the water quality monitoring (based on water framework directive (WFD) requirements) and publish their data on their website. • Regione Emilia Romagna collects and publishes data on pesticide and fertilizer use in the Emilia Romagna Region in cooperation with ISTAT (National Institute of Statistics).
		• Drinking water quality monitoring for the parameters requested by DL 31/2001 is done by IRETI (water producer) and AUSL (local health agency).

MOTIVATION		
Economics		• A good water quality could determinate a decrease of human and economic resources needed (of farmers originations) to support the farmers for a sustainable use of pesticides on the territory.
		• A good water quality could increase the farmer's, food trader's, local businesses and corporate buyer's income due to higher wine quality and lower contaminants concentration. Moreover, it could determinate their inclusion in a quality assurance system (sustainable wines).
		• A good water quality could decrease the costs of water treatment, therefore decreasing the water tariff.
		• A good water quality could determinate a decrease of needed human and economic resources for water monitoring and drinking water management.

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		• The wine industry can be motivated by the fact that the reduction of water consumption, linked to a good technological renewal strategy, can not only reduce the company's impact on the environment but also reduce production costs. • The inclusion in a quality assurance system due to an improvement of the water quality could help the processors, local businesses and retailers to increase the adhesion of farmers.
Attractive and healthy environment		• A good water quality could increase the quality of aquatic ecosystems and of the fish species present in the water bodies of Val Tidone. • A good water quality could improve the quality of life of inhabitants.
Trust and continuation of activities		• Increased trust of the inhabitants in local, regional and national government policies. This could ensure their permanency as policy makers. • Increased trust of the European member states in the Italian government policies and the correct application of European funds for agricultural production. • Increased trust of the European member states on the European policies. This could ensure their permanency as policy makers. • Decreased water tariff due to a reduction in the cost of water treatment. This could increase the trust of citizens on the services of ARERA.
		• Increased acknowledgement as a consumer association for health safety. • Increased acknowledgement of civil society organizations as associations for environmental conservation.
		• Increased public confidence in research institutions. • Improved collaboration with local organisations and farmers.

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INFLUENCE		
Implementation of BMP's		• Farmers are responsible for the implementation of BMP's and mitigation measures. • Farmers advisory and farmer's unions might influence the farmer's water, fertilizer and pesticide use.
		• Food traders, processors, retailers and local businesses could have an influence on farmer's water use. • Corporate buyers could have an influence on the food traders (Cantina Sociale Vicobarone) to produce a sustainable wine.
		• Civil society organizations, inhabitants and consumers have an influence on farmers for a sustainable water use.
Information and education programs		• The farmer unions Coldiretti and Confagricoltura periodically organise information meetings on topics of particular interest to the farmers (e.g.: fertilization plans or documentation for economic incentives). • CAA (farmers representative) help farmers to request European community funds for agriculture and offer fiscal/tax assistance. • Farmers must attend a training course organised by the Consorzio Fitosanitario Provinciale (farmers advisory) in order to get a renewal of their licence for the use and purchase of pesticides. During those trainings, technical advice is given about sustainable use of pesticides and implementation of the water policy.
		• The consumer organisation APCS organises one or twice a year a CaffExpo event to share knowledge about consumer' involvement and consumer rights concerning water availability.
		• The river basin agency ARPAE-ER organises an annual conference "Academia Nazionale dei LINCEI – Water World Day" on hydrogeological forecasting of water resources. In addition, together with the geologists association they organise an international exhibition on technologies and equipment for prospecting, extracting and conveying underground fluids. • The reclamation authority CBPC, organises information meetings on topics related to water irrigation. Additionally,

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		they are responsible for the dissemination of the activities of the consortium in schools (from elementary to high school with about 2,000 children reached each year) and they organise guided tours to the main facilities (dam Molato, dam Mignano, water plant of Finarda). CBPC also made an on-line simulator that simulates the functions of hydraulic defence and irrigation.
		• The research organisation UCSC hosts a pesticide symposium in order to share knowledge about water management, pollution, sustainability and agricultural impact.
		• Farmers receive technical assistance for irrigation systems from the Consorzio Terrepadane (farmers advisory) and from the regional government Regione Emilia Romagna.
		• Farmers get organisational assistance from the social cellar Cantina Vicobarone, which facilitates the transformation process of grapes and the sale of wine on the market. • Consorzio Vini Colli Piacentini helps farmers with safeguarding the wine's quality and origin.
Control		• Basin management plans have to be consistent with national policies and local conditions. Therefore, the plans must have a strategic environmental assessment (internal control). • For the European funds the cross-compliance mechanism is used. Farmers have to respect environmental, food safety, phyto-sanitary and animal welfare standards in order to get financial support.
Economics		• European Common Agricultural policy (CAP), at regional level trough (1) cross-compliance program and (2) program for rural development in Emilia Romagna (PSR Program) • The measures taken to comply with WFD requirements are financed by national funds.
Policy		• European level: ▪ Common Agricultural policy (CAP): implements a system of agricultural subsidies and other programs. ▪ Directive 2009/128/CE "Sustainable Use of Pesticides": establishes a framework for Community action to achieve the sustainable use of pesticides

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- Directive 2006/118/EC "Protection of groundwater against pollution and deterioration": establishes specific measures in order to prevent and control groundwater pollution.
- Water Framework Directive (WFD) 2000/60/CE: establishes a framework for the protection of inland surface waters, transitional waters, coastal waters and ground water.
- Drinking Water Directive 98/83/EC: establishes the quality of water intended for human consumption.

- National/regional level:
  - DLGS 150/2012 – receipt of Directive 2009/128/EC: establishes a framework for community action to achieve the sustainable use of Pesticides.
  - DLGS 30/2009 – receipt of Directive 2006/118/CE: establishes specific measures in order to prevent and control groundwater pollution.
  - DLGS 152/2006 "Norme in materia ambientale" and successive modifications and integrations: establishes qualitative standards for some parameters and threshold values for the evaluation of good chemical ground water status.
  - DLGS 31/2001 "Attuazione della direttiva 98/83/CE relativa alla qualità delle acque destinate al consumo umano": establishes technical rules for protection of inland surface waters, transitional waters, coastal waters and ground water.
  - L. 36/1994 (Legge Galli) "Diposizioni in materia di risorse idriche": establishes the quality of water intended for human consumption.
  - R. D. 1775/1933 "Testo unico delle disposizioni di legge sulle acque e impianti elettrici": establishes that all waters are public + establish the priority of the drinking water with respect to the other possible uses + establish a sustainable use of water maintaining the water balance between the inputs and outputs + regulate the water uses

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		▪ Legislation on the collection and treatment of washing water originating from mixing and filling of the sprayers. ▪ DGR 350/2010 “Adozione dei piani di gestione dei Distretti Idrografici Padano, Appenino settentrionale e Appenino Centrale”: development of the River Basin management plan for the implementation of Directive 2000/60/EC. ▪ DCR 40/2005 “Approvazione del piano di tutela delle acque” and DPCM 27 October 2016 “Approvazione del secondo Piano di gestione delle acque del distretto idrografico Padano (PDG Po)”: establishes the technical rules for the state of the art identification of water bodies quality, identification of the objective to achieve a good water quality and development of measure for them achievement.
Initiatives		• The V.I.V.A sustainable wine project: collaboration between the Italian ministry for the environment, the catholic university (Università Cattolica del Sacro Cuore) and Cantina Sociale Vicobarone. ▪ To develop a methodology for calculating and assessing the sustainability of the wineries and their products, from field to consumer, including the measuring of the environmental quality in vineyard and wine production. ▪ To define technical specifications, based on the developed methodology, for the analysis and the certification of the four indicators (Air, Water, Territory and Vineyard), periodically updated according to European and international legislation in the sector. ▪ To improve sustainability performance in vineyards and in wine production, also through the collaboration with the Italian Wine Union UIV. ▪ To train Vicobarone technicians and consultants on the application of VIVA indicators in order to help the assessment and improvement of their sustainability performance over time.

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	▪ To provide easy-to-use tools for the analysis of water, territory and vineyard related indicators.

FUNCTIONING IN SYSTEM

General system context	• The impact of the grape cultivation on pesticides and nitrates groundwater contamination was never investigated in Tidone Valley. • Even with existing European, national and regional legislation and measures to improve the groundwater quality, the nitrate concentration in the groundwater does not decrease. • There exist a conflict of interest between different actor types concerning the water use priorities and the actor's objectives. It was decided by legislation and recognised by ONU from 2010 that the use of water intended as drinking water is first priority. Second priority is environmental safety, also decided by legislation. Finally, economical uses of water, such as agriculture, industry and territory conservation come into play. Especially in case of water scarcity, as in 2017, those priority rules can create conflicts. • The action lab territory is in property of a large number of farmers with different agricultural practices and different approaches.
Transparency and trust	• The water monitoring data produced by ARPAE-ER and IRETI are open data, published on their websites. The data produced by AUSL is shared on request. The ARPAE-ER open data is also available on the website of Regione Emilia Romagna. ▪ Even if the existing data are available, form a preliminary survey in the action lab, 83% of 175 farmers declared that they are not aware about the existence of the data. • In general, there is a moderate trust between the different actors. • In some steps of the decision making process, transparency is missing. An increase in trust of farmers on public authorities is needed. • ARPAE promote the access to all the documents needed for authorization and concession of use of water resources and public property. • The transparency of the public institutions started with the L. 241/1990 and evolved to the "open government" approach with the d. lgs 97/2016. The web access strongly increased the access and availability of public institutions data and activities to the citizens, developing the "right to

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	know" concept in Italy. An important step was the c.d "Riforma Brunetta" (d.lgs 150/2009) that implements the "total disclosure" concept, which makes a bridge between the transparency and the economic evolution of the public institution's staff.
Coherence	• Agricultural and environmental policies are not integrated in a satisfactory way. • In the water sector, the decisional power is fractioned between governmental institutions (Regione ER, ARPAE, AUSL, Municipality, Basin District Authority) that ensure water availability and different associations (Consorzio di Bonifica di Piacenza, IRETI, trade unions, environmental associations) that protect private interests. Therefore due to absence of a decisional final leader each decision is somehow conflictual. However, most of the stakeholders considers Emilia-Romagna Region as the leader for water management (feedback from stakeholder consultations organised in WaterProtect Project). • Agricultural production and drinking water production by law must be compatible. • All the decisions must respect the legislation starting from the European level and following with the national, regional and local levels.
Leadership	• As required by law (water framework directive), the river basin agency takes the lead. The river basin agency recognises its difficulty to act as a leader for small local realities, as is the case of Tidone Valley. • Leadership roles like sponsors, facilitators/mediators, science translators and public advocates are not present within the action lab actors. • Some stakeholders consider that the local leadership role is occupied by the Regione Emilia-Romagna. In the past, this role was reserved for the Province of Piacenze. • There are situations on which the power imbalance is known and in those cases, the public institutions must act to balance it.
Inclusive participation	• Several economic categories have a high influence on the decision-making processes. • Multi-actor: several stakeholder categories are engaged: farmers, farmer's unions, environmental authority, health authority, social cellar, drinking water supplier, farmer's consultancy consortia, reclamation authority, local business, research organization and consumer's association.

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	• Multi-level: all the decisions must respect the legislation starting from the European level and following the national, River Basin, regional and local levels. ▪ European institutions (Parliament, Commission and Council) – Italian national institutions (Parliament and Ministries): transposition of community legislation in National legislation. ▪ National institutions – Regione Emilia Romagna: transposition of national legislation in regional legislation (could be more restrictive). ▪ Municipalities – AUSL (health authority): the municipality may restrict the use of drinking water based on the potability of drinking water decided by AUSL. • Multi-sector: two principal sectors are involved in the water management: civil and agricultural. The actors of the civil sector (municipalities, AUSL, IRETI (gruppo IREN)) have the role of providing a good drinking water quality, which is then used in the activities of the actors of the agricultural sector (farmers, Cantine Sociali Vicoborone e Valtidone, Consorzio Vini DOC Colli Piacentini, etc.)
Roles and responsibilities	• The roles for water management are well defined with all organisations involved from national to local level. • The legislation, at all levels, covers all needs for water governance. However, legislation is applied only partially.

AWARENESS AND ACTIONS

Awareness	• The farmers are not aware of the problem. There is no direct link between the monitoring results and the communication to them.
Actions	• /

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5.3 Process

5.3.1 Representation of the process

METHODS OF CONTACT

Exchange – bilateral conversation

Exchange – multi-actor conversation

Exchange – questionnaire/survey

Exchange – demonstration/field visit

Exchange – interactive workshop

INVOLVED ACTORS

Action lab leader(s)	UPSC (university) ARPAE-ER (river basin agency) APCS (consumer organization)
Research	Università Cattolica del Sacro Cuore
Farmers	Farmers of the Val Tidone catchment
Farmer advisory and unions	Confagricoltura (farmer representative) Coldiretti (farmer representative) CIA (farmer representative) Consorzio Fitosanitario (farmers advisory) Axe Environment (farmers advisory)
Water producers and suppliers of drinking water	IRETI (drinking water production, supply and treatment)
River basin/ environmental protection agency	Po River Hydrographic District Basin Authority (river basin agency) ARPAE (environmental protection agency)
Regional/national government	Piacenza (government provincial level) Regione Emilia Romagna (government regional level)
Local government	Borgonovo (municipality) Ziano (municipality) Castel San Giovanni (municipality) Pianello (municipality) Alta Val Tidone (municipality)

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	Local health agency AUSL Provincial reclamation authority, Consorzio di Bonifica Piacenza
Food trader – Industry winery	Vicobarone winery - cellar (Cantina Vicobarone) (food processor and trader) Val Tidone winery - cellar (Cantina Val Tidone) (food processor and trader) Consorzio vini DOC Colli Piacentini (local business)
Inhabitants - consumers	Consumer associations

AMBITIONS

Network formation	• Increase farmer's participation • Increase trust between farmers and between farmers and other involved actors • Create an autonomous local territorial water governance in which there is mutual trust between farmers and regulatory authorities without a command-control approach
Exchange and continuation	• Finding the most appropriate leader who can continue the project and take over the facilitating role of the catholic university. • Search for possibilities to collaborate and to continue some activities/ideas of WaterProtect after the ending of the project
Knowledge building	• Developing a sampling network • Increase the knowledge on groundwater direction and flow by the use of the CRIERIA model
Actor awareness	• Use media channels to highlight the importance of environment preservation • Sensitize civil society to the efforts and farmer's role in preserving water quality • Better sharing of data between project partners
Farmer practices	• Installing and demonstrating a (mobile) impermeable platform for washing machinery with collection of waste water

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- More effective training systems with demonstrations in the field

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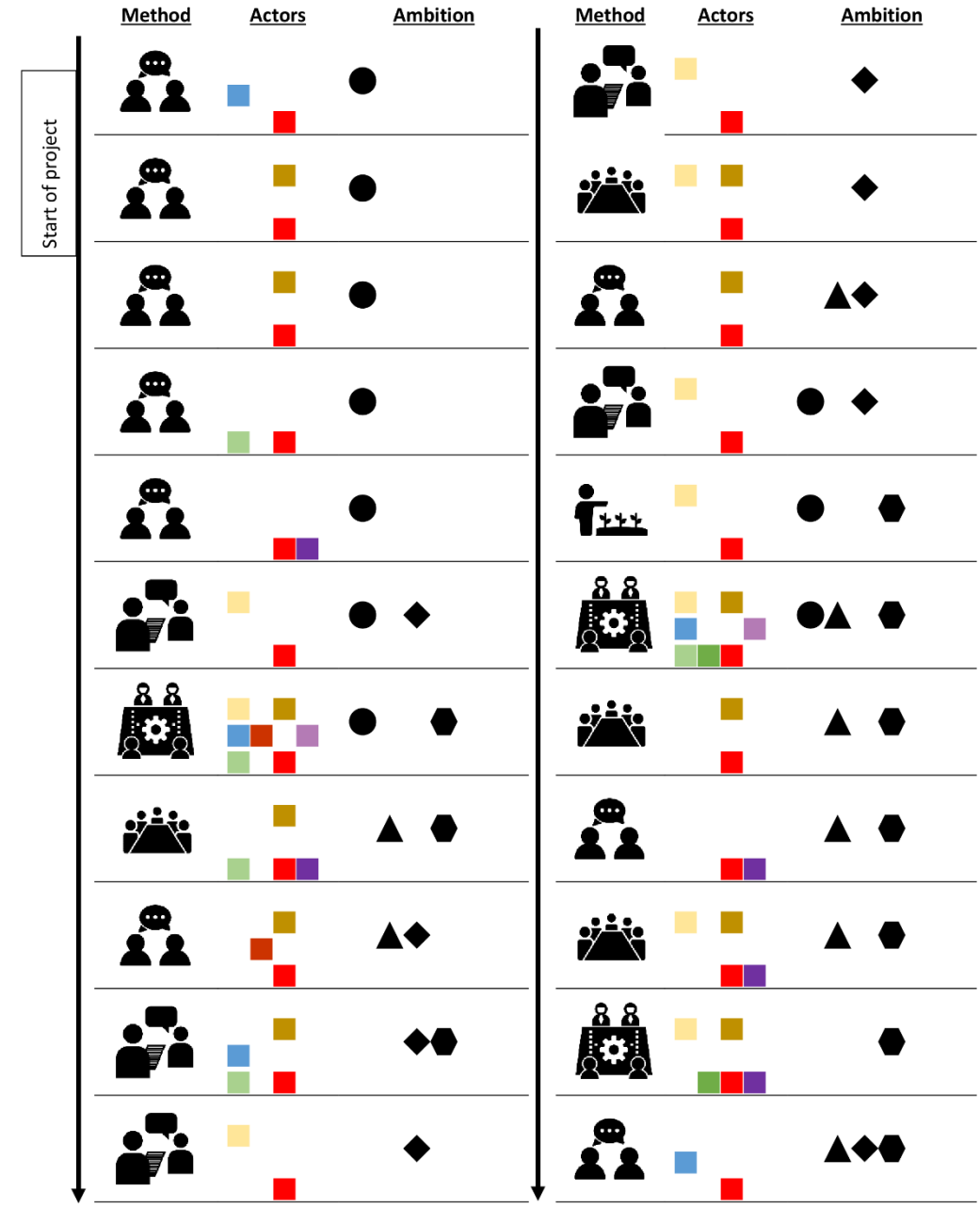
COMBINED VISUAL REPRESENTATION



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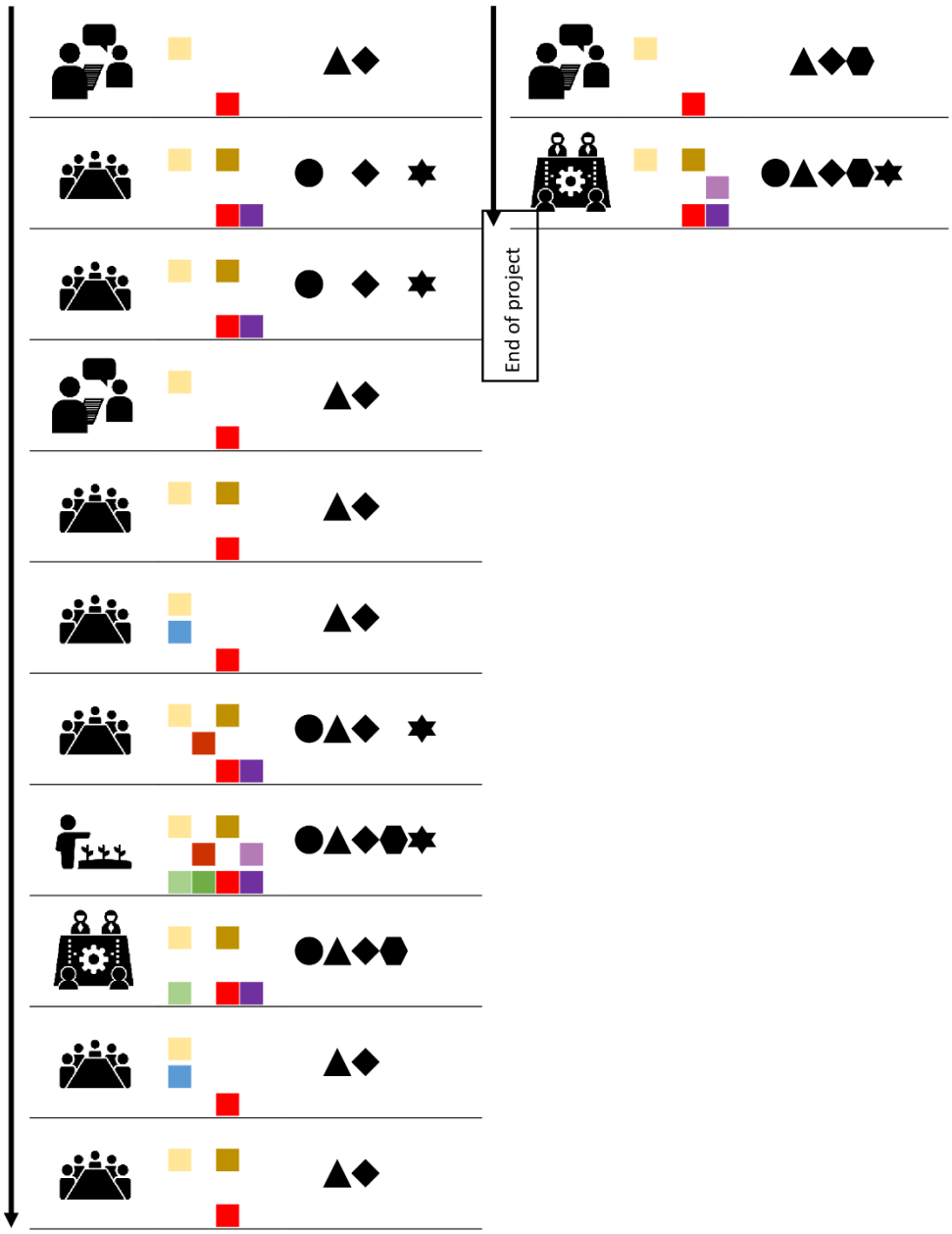

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PROCESS SUMMARIZED IN FIGURES

		METHODS				
						
		9	5	8	2	11
ACTORS INVOLVED	Action lab leader(s)	9	5	8	2	11
	Research	1	1		1	1
	Farmers		5	7	2	9
	Farmer advisory and unions	4	5	1	1	9
	Water producers and suppliers of drinking water	2	2	1		2
	Regional/national government	1	3	1	1	1
	Local government		2		1	
	Food processors and distributer – industry winery	2	3		1	5
	Inhabitants – consumers		3		1	
AMBITIONS	Network formation	5	4	2	2	3
	Exchange and continuation	4	3	3	1	8
	Knowledge building	3	2	8	1	8
	Actor awareness	2	5	2	2	3
	Farmer practices		1		1	3

5.3.2 Evaluation and lessons learned of the process

METHODS

				
9	5	8	2	11

- The bilateral conversations were fundamental for the involvement of all different stakeholders.
- The bilateral conversation and multi-actor conversation, with the involvement of famers, farmer's associations (Coldiretti, Confagricoltura and CIA), farmer's consultancy (Consorzio Fitosanitario Provinciale) and food traders (Social Cellar Vicobarone) were useful to increase the interaction and give innovative ideas for the presentation of monitoring data to farmers, have feedback from farmers

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	concerning the source of pollution and implementation of best management practices. • The face to face meetings in presence of farmer associations increased farmer's confidence and their wish to collaborate.
	• The bilateral conversation and multi-actor conversation, with the involvement of famers, farmer's associations (Coldiretti, Confagricoltura and CIA), farmer's consultancy (Consorzio Fitosanitario Provinciale) and food traders (Social Cellar Vicobarone) were useful to increase the interaction and give innovative ideas for the presentation of monitoring data to farmers, have feedback from farmers concerning the source of pollution and implementation of best management practices. • Interactive sessions increases the knowledge of local partners on the action lab territory and their awareness of the farmers in the action lab.
	• The questionnaire was the starting point for the involvement of farmers.
	• The demonstration-field visits with the international partners were of high importance to make the farmers and other stakeholders feeling part of the project and increase their trust. • Demonstrations allowed for an interactive debate on the goals of the project and were essential for a better understanding of the territorial reality.
	• Multi-actor meetings increased the knowledge of local partners on the action lab territory and their awareness of the farmers in the action lab. • Multi-actor meetings allowed for an interactive debate on the goals of the project and were essential for a better understanding of the territorial reality.

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INVOLVEMENT OF ACTORS

						
ACTORS INVOLVED	Action lab leader(s)	9	5	8	2	11
	Research	1	1		1	1
	Farmers		5	7	2	9
	Farmer advisory and unions	4	5	1	1	9
	Water producers and suppliers of drinking water	2	2	1		2
	Regional/national government	1	3	1	1	1
	Local government		2		1	
	Food processors and distributer – industry winery	2	3		1	5
	Inhabitants – consumers		3		1	

Farmers

- The low level of farmers' trust, partly due to their typical closed character, was the highest barrier at the beginning of the project.
- The involvement of key persons, such as the representative of Consorzio Fitosanitario (farmers consultancy), farmers organizations (Confagricoltura, Coldiretti) and farmers associations (Cantina Vicobarone), was essential to gain farmers' trust and further involve them in the water governance.
- Since the work in the vineyards takes a lot of time, the right moment to appeal to farmers was when they donated their grape harvest to the associations.
- Local farmer markets are the ideal moments for farmers to meet and discuss their problems concerning the water quality.
- The interactive workshops with the international partners were of high importance to make the farmers and other stakeholders feeling part of the project and increase their trust.
- Farmer representatives were involved in order to improve the communication of results to farmers and use less technical language.
- In order to increase farmers' participation, the meetings were organised between January and March (period of the year when farmers are less involved in agricultural activities) and using the meeting rooms of farmers associations, of Cantina Vicobarone and of municipality of Ziano Piacentino.
- By organising demonstrative events on a demo-farm of the project, the will of the farmers to participate increased. Moreover, the aperitif afterwards

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	was a good opportunity to meet the actors in a more friendly environment and to establish a direct approach with them. • By allowing a meeting to take place on the site of a research institution, stakeholders' trust increased and with it their involvement and collaboration. • The face to face meeting and presence of a consultant/association exponent increased the confidence and the wish to collaborate of the farmers.
Regional government	• An important actor that the action lab leader (UCSC) involved in the project, was the leader for water governance, the Emilia - Romagna Region. The most important lever to involve the region was the use of monitoring results that highlighted that, beside the diffuse contamination, the point source contamination, due to incorrect farmer's behaviour during pesticides handling, is responsible for groundwater contamination in the action lab. These monitoring results increased the awareness and sensibility of the region to find together with the farmers and partners of the project the most suitable solution.
National government	• The actual national context concerning the sustainable use of pesticides, with the ongoing revision of the NAP, determinate a more concrete and operative position of the Italian ministries towards the regulation of wastewaters resulted after machinery washing.
All	• Direct contact was very important.

5.3.3 Progress of the process, considerations and points of attention

- All the meeting activities (bilateral and multi-actor conversations, field visits, interactive workshops, demonstration activities, etc.) were essential for the continuous involvement of all actors and for the achievement of the project objectives. Actor involvement in the action lab is essential to overcome the problems and to propose appropriate solutions.
- Project partners received very positive feedbacks from farmers associations and political community, regarding the scope of the project.
- Linking the project results with the activities of the actors in the field was essential to evaluate the results.
- The increase of the communication between the different stakeholder categories and the definition of a common approach was very important to achieve the scope of the project.
- The use of key persons helped to increase trust of the farmers.
- The organization of continuous multi-actor meetings increased the transparency of the decisional process.

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- The WaterProtect partners represented a facilitator for the collaboration of local actors, but we did not increased their collaboration without our presence.
- The pioneering farm, Mossi 1558 Aziende Vitivinicole, that is the demo-farm, is not recognized as a local leader by the other farms and this could prevent a real continuity of the project activities implemented in the field.
- The other important social cellar, Cantina Valtidone did not participate in the project. No concrete actions were taken during the project to facilitate cooperation between the two social cellars.
- A project time of three years is too short to show effects of the implementation of BMP's on water quality and to increase the number of BMP's implemented.
- Action lab leaders stated that the actions taken are not enough. For example, just one demo-farm was launched and one washing area installed, while there are more than 455 farms in the action lab. Therefore they are looking for additional funding, as this seems an important barrier for BMP implementation.

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5.4 Achievements by the WaterProtect process

5.4.1 Ambition 'network formation'

NETWORK FORMATION						
		5	4	2	2	3
ACTORS INVOLVED	Action lab leader(s)	5	4	2	2	3
	Research		1		1	1
	Farmers		4	2	2	3
	Farmer advisory and unions	2	4		1	3
	Water producers and suppliers of drinking water	1	2			
	Regional/national government	1	3		1	
	Local government		1		1	
	Food processors and distributer – industry winery	1	2		1	3
	Inhabitants – consumers		3		1	

Achievements

⇨ **Increase farmer's participation**

- The newsletter together with other leaflets were distributed in person or by mail to farmers and other actors to increase the direct contact and trust.
- Involvement of farmers and farmer's associations in the monitoring process.
- By organising an event in a demo-farm of the project, the will of the farmers to participate increased. Moreover, the aperitif afterwards was a good opportunity to meet the actors in a more friendly environment and to establish a direct approach with them.
- The level of farmer awareness concerning water pollution in the action lab increased but we cannot say that most of them are aware of the problem. However, an important number of farmers, the ones who frequently followed the project activities and participated to all the communication meetings, are now showing a high interest and are willing to take action in order to avoid pollution.

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⇨ **Increase trust between farmers and between farmers and other involved actors**

- The involvement of key persons, such as the representative of Consorzio Fitosanitario (farmers consultancy), farmers organizations (Confagricoltura, Coldiretti) or farmers associations (Cantina Vicobarone), was essential to gain farmers' trust and further involve them in the water governance.
- The organisation of multiple multi-actor meetings increased transparency and trust.
- Farmers' trust in the project partners increased, especially the trust in the environmental agency, which is an important aspect for future collaboration.
- Farmers were given the opportunity to learn more about the international context of the WaterProtect project.
- Work was being done to overcome the mistrust and scepticism of farmers towards the supervisory authorities, as for example ARPAE and AUSL.

⇨ **Create an autonomous local territorial water governance in which there is mutual trust between farmers and regulatory authorities without a command-control approach**

- A successful output of the action lab was the creation of a network with all the actors involved in the water use and governance: UCSC (research organisation), ARPAE (environmental protection regional agency), APCS (consumer association), farmers, Consorzio Fitosanitario Provinciale (farmers consultancy), municipalities (Ziano Piacentino, Borgonovo Valtidone, Catel San Giovanni, Pianello VT, Alta Val Tidone), AUSL (local health authority), Consorzio di Bonifica (regulation authority), Coldiretti, CIA, Confagricoltura (farmers associations), Cantina Vicobarone (farmers organisation), Consorzio Vini DOC Colli Piacentini (farmer's organization), IRETI (drinking water supplier), Regione Emilia-Romagna (regional leader for water management), Autorità di Bacino Distrettuale del Fiume Po (basin river authority), Italian Ministry of Health and the Italian Ministry of Environment.
- Collaboration with Emilia-Romagna Region to overcome the legislative gap for the use of systems to treat the wastewater in the field.
- The bilateral conversations, the multi-actor conversations as well as the interactive workshops have positive effects not just for the goals of the project or for the local stakeholders, but also for the effective local partners of the project. These methods increased project partners' knowledge towards the territory and farmers' awareness concerning them research and environmental protection activities.

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5.4.2 Ambition 'exchange and continuation'

EXCHANGE AND CONTINUATION						
						
		4	3	3	1	8
ACTORS INVOLVED	Action lab leader(s)	4	4	3	1	8
	Research	1			1	1
	Farmers		4	3	1	6
	Farmer advisory and unions	2	4		1	6
	Water producers and suppliers of drinking water	1	2			2
	Regional/national government		3		1	1
	Local government		2		1	
	Food processors and distributer – industry winery	1	2		1	3
	Inhabitants – consumers		3		1	

Achievements

- **Finding the most appropriate leader who can continue the project and take over the facilitating role of the catholic university**
  - As highlighted by several stakeholders types, the leader is the Emilia-Romagna Region. In the second part of the project, the region took up this leading role and was directly involved in finding solutions.
- **Search for possibilities to collaborate and to continue some activities/ideas of WaterProtect after the ending of the project**
  - Submission of a regional project in collaboration with three farms of the action lab for the purpose of the implementation of additional BMP's for water protection.
  - Contribution to the valorisation of the territory of Val Tidone trough the foundation of the local Observatory of Val Tidone Landscape.
  - The Consorzio Fitosanitario decided to include a summary of the results of the WaterProtect project in official training courses for the farmers. In the other official meetings in 2020 they will also present the WaterProtect tool. The first one, scheduled in March 2020 was cancelled due to COVID-19 health emergency.

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- There are other regions with vineyards to which the action lab approach could be exported, as for example the area of production of Lambrusco wine, in Emilia – Romagna Region, area of production of Barolo wine, in Piedmont Region, area of production of Prosecco wine, in Veneto and Lombardy Regions, area of production of Franciacorta wine, in Brescia Region, etc.
- Action lab leaders stated that they cannot speak of a changed system, but that they are on the good way towards behavioural change and overcoming actors' preconceptions.

5.4.3 Ambition 'knowledge building'

KNOWLEDGE BUILDING						
		3	2	8	1	8
ACTORS INVOLVED	Action lab leader(s)	3	2	8	1	8
	Research	1			1	1
	Farmers		2	7	1	8
	Farmer advisory and unions	2	2	1	1	6
	Water producers and suppliers of drinking water	1		1		2
	Regional/national government		1	1	1	
	Local government				1	
	Food processors and distributer – industry winery		2		1	4
	Inhabitants – consumers		1		1	

Achievements

⇨ **Developing a sampling network**

- At the beginning of the project, ARPAE with the support of UCSC and APCS developed a network of 26 sampling wells in the area of the action lab to evaluate the occurrence of pesticides and nitrates in the groundwater. In order to do, 175 farmers were conducted with the farmers involved in the WaterProtect project, who are also the owners of the wells.

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- For the selection of pesticides to be analysed several meetings were organised with territorial experts (consultants that work with famers for appropriate use of pesticides).
- Involvement of farmers and farmer's associations in the monitoring process.

⇨ **Increase the knowledge on groundwater direction and flow by the use of the CRIERIA model**

- The sampling results highlighted a negative impact of grape cultivation on phreatic groundwater quality, but was not possible to identify the polluters. However, the point contamination represents an important contamination source.
- Creation of drainage maps and pollutants transport.
- The multi-actor conversations and demonstration-field visits allowed an interactive debate towards the goals of the project and were essential to better understand the territorial reality. This territorial reality includes farmers' and other stakeholders' behaviour and awareness, the use of water sources for drinking water, the agricultural techniques used, the farmers organizations, the management of the water in the three catchments under study, the production chain and the pollution level of the groundwater.

5.4.4 Ambition 'actor awareness'

		ACTOR AWARENESS				
		2	5	2	2	3
ACTORS INVOLVED	Action lab leader(s)	2	5	2	2	3
	Research		1		1	
	Farmers		5	1	2	1
	Farmer advisory and unions		5	1	1	3
	Water producers and suppliers of drinking water	1	2	1		
	Regional/national government		3	1	1	1
	Local government		2		1	
	Food processors and distributer – industry winery	1	3		1	2
	Inhabitants – consumers		3		1	

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Achievements

- ⇨ **Use media channels to highlight the importance of environment preservation**
  - Increased awareness and sensibility of famers and other actors towards environmental and agricultural sustainability and innovation for grape cultivation and management through innovative tools and methods.
  - The newsletter, which was created after 18 months of the project and sent by hard mail to 100 farmers in the catchment, has reached a high pool of persons, also on the local website of the project (995 by date 30 march 2020). It was a successful tool to share results and activities. By data (30 march 2020), 29 news and 9 informative documents, including newsletters and BMP sheets, were published in the website, having 2005 views.
- ⇨ **Sensitize civil society to the efforts and farmer's role in preserving water quality**
  - The monitoring results were evaluated by the consortium members and the environmental local experts and one national and one local workshop were organized in order to communicate the results to all actors involved in water management.
  - The local newsletter, the WaterProtect newsletter, the local website of the project, scientific posters and presentations to international conferences and national scientific journals were used to communicate sampling and project results.
  - All the other meeting activities (bilateral and multi-actor conversations, field visits, interactive workshops, demonstration activities, etc.) were essential for the continuous involvement of the actors and the achievement of the project objectives.
  - Farmers indicated inappropriate behaviour during pesticide handling and use.
  - The level of awareness concerning water pollution in the action lab of farmers increased but we cannot say that most of them are aware of the problem. However, an important number of farmers, the ones that frequently follow the activities of the project and participated to all the communication meetings, are now showing a high interest and are willing to take actions in order to avoid pollution.
  - Increased awareness of WaterProtect Project partners towards the Val Tidone reality and increased interaction and collaboration with inhabitants.
  - Increased awareness and sensibility of famers and other actors towards environmental and agricultural sustainability and innovation for grape cultivation and management through innovative tools and methods.
  - In the last year (2019) during the presentation of the guidelines for integrated pest management, managed by Emilia-Romagna Region, ARPAE was asked to present the results of the surface water and groundwater monitoring campaigns in order to increase the awareness of the farmers. In this year (2020), during the same event, Emilia-Romagna Region asked ARPAE and UCSC to present the results of WaterProtect project. However, the event was cancelled due to COVID-19 health emergency.

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⇨ **Better sharing of data between project partners**
- Development of the GIS platform for sharing monitoring data.
- Farmers ask assistance for using the web platform.
- Inclusion of monitoring results of the project and best management practices in the official training courses (licenses for pesticides handling) of the Emilia - Romagna Region.

5.4.5 Ambition 'farmer practices'

FARMER PRACTICES						
			1		1	3
ACTORS INVOLVED	Action lab leader(s)		1		1	3
	Research				1	1
	Farmers		1		1	3
	Farmer advisory and unions		1		1	3
	Water producers and suppliers of drinking water					
	Regional/national government				1	
	Local government				1	
	Food processors and distributer – industry winery		1		1	3
	Inhabitants – consumers		1		1	

Achievements

⇨ **Installing and demonstrating a (mobile) impermeable platform for washing machinery with collection of waste water**
- The most extended farm, Mossi 1558 Aziende Vitivinicole (Ziano Piacentino, Italy), became a demo-farm where an impermeable platform and hard containers were installed and used for machinery washing and collection of wastewater.
- Implementation of the first common mobile impermeable platform for machinery washing.
  - The Val Tidone Cellar was not interested to be involved.

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- The Vicobarone cellar didn't have the appropriate space to implement it.
- Several farms: they preferred to implement private platforms for singular use.
- The big farm Costola was intent to install a platform when economic support is available.

- Collaboration with the Emilia-Romagna Region to overcome the legislative gap for the use of systems to treat the wastewater in field.

⇨ **Shift from a formal trainings (without demonstration activities, supposing lack of knowledge by the farmers) to more perception-oriented and context-specific trainings**

- The Consorzio Fitosanitario decided to include a summary of the results of the WaterProtect project in official training courses for the farmers. In the other official meetings in 2020 they will also present the WaterProtect tool. The first one, scheduled in March 2020 was cancelled due to COVID-19 health emergency.
- Organization of demonstrative meetings for BMP implementation: storage of pesticides in appropriate places, mixture preparation and machinery washing, management in the farm of wastewater resulted from the washing of sprayers, vegetated filter strips, vegetated ditches, buffer strips of 5-15 m, nutrient soil analysis.

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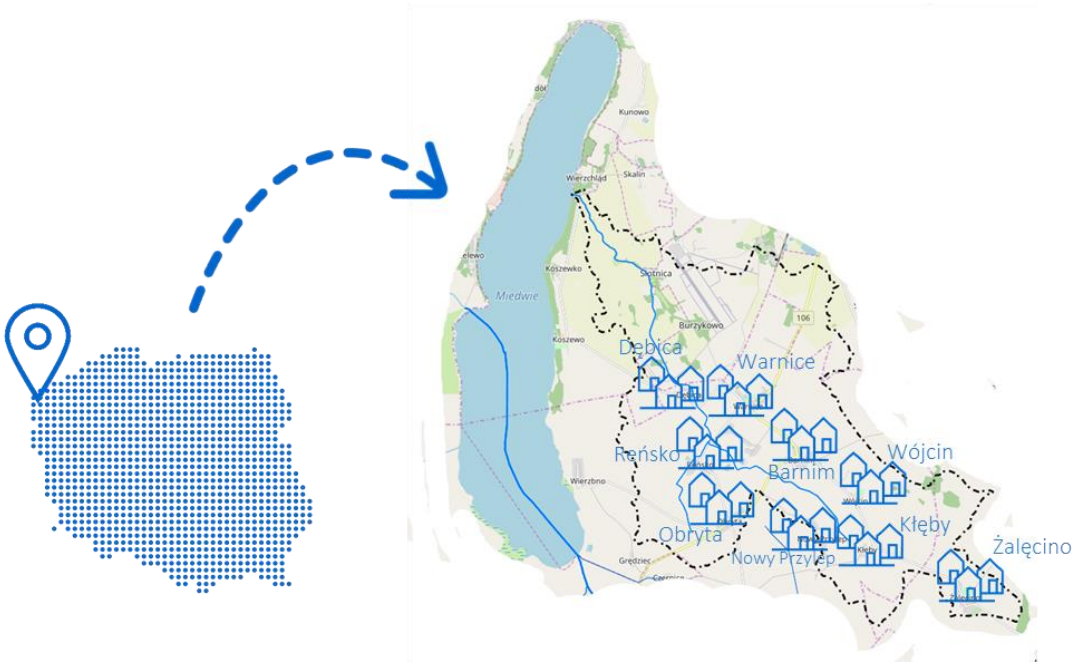
6 Polish action lab – Gowienica river

6.1 General characteristics and description of the problem



- North-West of Poland
- Rural region
- 69,23 km^2
- Very good agricultural soils:
    - over 90% is arable land (73% cereals (wheat, barley), 25% industrial plants (rapeseed, maize, sugar beetroots); small areas of grassland, vegetables and legumes
    - in total only 7 pig herds and 1028 cattle were registered (data of 2017)
- Surface and groundwater catchment area: 4 commune drinking water intakes for drinking water provision for the population (municipal groundwater intakes) and for irrigation
    - Gowienica Miedwiańska River flows into the Lake Miedwie which is also a reservoir of drinking water for the city of Szczecin (approximately 340 000 inhabitants).
    - Individual intakes (drilled or dug wells) are also used by farms (in the catchment area one groundwater well is used for irrigation)
- Catchment of the Miedwie Lake, from 2004-2016 in subsequent editions, was qualified as a part of an area particularly exposed to nitrate pollution from agricultural sources (Nitrate Vulnerable Zone (NVZ)).

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Pollution in focus	• Nitrate
Agricultural sources	• Agriculture has a significant impact on the quality of surface water and groundwater due to the large cultivation area in the catchment area. • Fertilizer management (organic fertilizers): leaky tanks for manure or manure plates. • Crop production includes mostly plants requiring the use of high doses of mineral fertilizers and plant protection products, which when used incorrectly (bypassing the principles of good agricultural practices) or in excessive quantities, significantly affects the deterioration of the catchment's water quality.
Reinforcing factors on pollution	• Water erosion of dusty formations of which the soil is mainly built. • Surface runoff and leaching of organic matter along with fertilizer components to surface waters. • There is a correlation between the depth of aquifers and their contamination. • Climate change: the increasing number of hot days and related evaporation may cause an increase in the concentration of pollutants in surface waters and reduce environmental flows. On the other hand, the more frequent occurrence of sudden precipitation will increase surface outflow and soil erosion, which may lead to a reduced supply of groundwater.

Other pollutions and pollution sources	• Historical pollution of the groundwater by oil-related substances originating from a contamination of the ground of a former Soviet Union army base.
	• Sewage infrastructure:
	  ○ No sewage system in two villages: unstructured deposition of domestic sewage in the catchment area and the watercourse.
	  ○ Some households remain unconnected to the sewage system.
	  ○ According to the data of the Warnice commune, from 50 to 100% of the existing sewage network is leaky.
	  ○ Outdated and inefficient sewage treatment plant.

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6.2 Start situation

6.2.1 The actors and their roles

Production and distribution of plant protection products

Actor type	Actor in action lab	Role
Chemical producers	/	/
Distributers of plant protection products	/	/
Actor responsible for the collection of the packaging	/	/
Representative of chemical producers	/	/
Representative of chemical distributers	/	/

Agricultural production

Actor type	Actor in action lab	Role
Farmers	Farmers from the villages of the Warnice commune: Dębica, Warnice, Barnim, Kłęby, Wójcin, Nowy Przylep, Obryta	Production of food and water consumers.
Agricultural companies	Agricultural companies	Large agricultural companies that produce crops.
Seasonal farmer	/	/
Contract sprayer	/	/
Farmers advisory and farmers unions	West Pomeranian Agricultural Advisory Board in Barzkowice	A state organizational unit with legal personality, conducting agricultural consulting including activities in the field of agriculture, rural development, agricultural markets and rural households. Their goal is to improve

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		the level of agricultural income, to increase the market competitiveness of farms, to support sustainable development of rural areas and to raise professional qualifications of farmers and other inhabitants of rural areas.
	West Pomeranian Chamber of Agriculture in Szczecin	Provincial organizational units of agricultural self-government. The members of the Chamber pay agricultural tax or income tax from special departments of agricultural production and members of agricultural cooperative societies possessing land contributions in these cooperatives.
Union of contract sprayers	/	/

Processing and selling food products

Actor type	Actor in action lab	Role
Processors and retailers	Associations of Wheat and Beetroot Producers	Producer organisations.
Local businesses	Pension Florentyna (Obryta)	Hotel services

Drinking water production

Actor type	Actor in action lab	Role
Drinking water producers	West Pomeranian Water Services	Water supplier for communal intakes. Ensuring water supply from communal intakes (5) for approximately 3500 inhabitants, of which approximately 2430 inhabitants of the Gowienica river catchment.
	Water treatment station „Miedwie" Szczecin Water Services	Drinking water production from Miedwie Lake surface water intake, which supplies drinking water to the city of Szczecin (about 340 000 residents).
Sewage treatment plants	West Pomeranian Water Services	Responsible for the operation of rural wastewater treatment plants. Ensuring and maintaining an appropriate composition of sewage sludge (according to water and legal permits).

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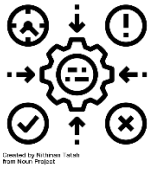

Context factors and societal preferences over the entire system and all subsystems

Actor type	Actor in action lab	Role
Supranational government	European Commission	Draw up directives applicable in EU countries (e.g. water framework directive and the nitrates directive).
National government	Ministry of Environment	Shape state policy in the field of water resources management.
	Ministry of Water Management and Inland Navigation	The competent authority regarding water management.
	State Water Farm Polish waters	Responsible for developing, among others, the management plans of river catchments, implementing measures for sustainable water management and achieving environmental objectives.
	The National Board of Water Management (Warsaw) (within Polish Waters)	Coordinate the implementation of investments in water regions + monitor water management + undertake activities aimed at quantitative and qualitative balancing of surface and ground waters + take measures to ensure the needs of population, industry and agriculture concerning water quantity and quality + prepare strategic documents (water management plans for river basin areas, flood risk, drought prevention strategies) + monitor the implementation of the directives (WFD).
	The State Sanitary Inspection Department	Monitor the quality of water intended for consumption.
	Agency for Restructuring and Modernization of Agriculture (ARMA)	ARMA implements the agricultural support program under the CAP mechanism and controls the BMP compliance.
	The Voivodeship Inspector of Environmental Protection (VIEP)	Responsible for surface water quality monitoring + monitor POM implementation by farmers + identify causes of pollution (perpetrators) + responsible for issuing administrative decisions regarding the removal of irregularities + impose financial penalties.

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	Regional Directorate for Environmental Protection (RDOŚ)	Administration dealing with legal forms of environmental protection (reserves, Natura 2000 areas) and providing opinions on investments in these areas.
Regional government	Poviat Starosty Stargard, Pyrzyce	Responsible for legal permits for groundwater intake (until 2018).
	Regional water management board in Szczecin	Competent in the field of water management in the water region. Among other things, it develops conditions for the use of water in the water region (Lower Odra river and coastal rivers).
	Management of the catchment (Stargard)	Responsible for issuing water-law permits + determine fees for water services + carry out activities aimed at sustainable water management + carry out tasks related to water maintenance.
	Water supervision (Stargard, Pyrzyce)	Among other things, contribute to the implementation of actions for sustainable water management.
Local government	Warnice Community Office	Owner of groundwater intakes (Warnice, Wójcin, Reńsko) + ensure water supply for the commune's inhabitants and sewage collection.
	Stargard Community Office	Only the lower part of the Gowienica Miedwianska river and the north-western part of the catchment lies within Stargard Community.
	Dolice Community Office	The eastern part of the catchment lies within the Dolice Community. The Gowienica Miedwiańska river flows outside this Community area. They own the Żalęcino groundwater intake.
Research	Polish Geological Institute – National Research Institute (PGI-NRI)	From the tasks concerning hydrogeology PGI-NRI provides effective quantitative and qualitative assessment of groundwater within RBD, performs observations, studies, analyses and forecasts concerning groundwater.
	Institute of Technology and Life Sciences (ITP) (former Institute for Land Reclamation and Grassland Farming)	Conduct scientific research and development works in the field of natural and technical sciences, landscaping and infrastructure of rural areas, water resources, agroecosystems, grasslands, technologies in plant and animal production, machinery and equipment.
	West Pomeranian University of Technology (ZUT)	Educate and conduct scientific research in the field of technical, agricultural, economic, biological, chemical and mathematical sciences.
Civil society organisations	/	/

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Inhabitants	Inhabitants of the Warnice commune (approximately 2430 inhabitants)	Consumers of the drinking water.
Consumer organisations	/	/

6.2.2 Functioning of the water governance system

KNOWLEDGE		
Monitoring		• The level of data collection in the Gowienica catchment is high. Monitoring is carried out by two state authorities obliged to do so: The voivodeship Inspector of Environmental Protection (VIEP) and the Polish Geological Institute – National Research Institute (PGI-NRI). • Szczecin Water Services, the drinking water producer of the city of Szczecin, also collect data on water quality. • The water quality of groundwater intakes is investigated by the State Sanitary Inspection Department. • For years, regional scientific units (Institute of Technology and Life Sciences and the West Pomeranian University of Technology Szczecin) have studied the quality of surface water, groundwater, sediments and the impact of agriculture. • There is no nitrate monitoring program based on the provisions of the new act (Water Law Act of 20 July 2017).

MOTIVATION		
Trust and continuation of activities		• A good water quality would satisfy inhabitants of the municipality, and will have a positive impact on the perception of farmers about the municipality, the governmental institutions and the water producing company.
		• The farmers are aware that good water quality increases the safety and quality of the final product (crops, animals).

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Economics		• The cleaner the water, the lower the cost of treatment for sewage treatment plants and municipal water intakes.
Use of the water		• A better groundwater quality ensures a better quality of the irrigation water.
Image		• Achieving environmental goals, a good status of water quality, is important for regional administrations.

INFLUENCE

Information and education programs		• Cyclic publications (Agricultural News, West Pomeranian echo of the village), local articles about agricultural issues and water protection. • Thematic e-subscriptions related to agriculture and the use of BMP's and protection of the aquatic environment. • Annual Agricultural Fair (Barzkowice). • Trainings are organized by the Agricultural Advisory Centre and agricultural advisors in the scope of opportunities offered by the Rural Development Program for 2014-2020, implementation of packages: sustainable agriculture, organic farming, soil and water protection, rules for the protection of waters against pollution from agricultural sources, Nitrates Directive and the Water Framework Directive. • Agricultural consulting conducted by employees of the West Pomeranian Agricultural Advisory Centre. Trainings are organised every autumn and winter in the municipal offices. These are trainings on agro-technical practices promoting a sustainable management system of fertilization and plant protection products.
		• Trainings for agricultural producers organised by the Agricultural Advisory Centre and ARMA.
		• Training for agricultural advisors, farmers and local government administration conducted by the Land Reclamation and Grassland Farming (currently Institute of Technology and Life Science).
Control		• There are clear consequences for not fulfilling the regulations concerning the outflow of nitrates from agricultural sources into

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		waters. The bodies that control compliance with the action program (ARMA, VIEP) and the scope of the audit were also indicated. • Previous sporadic controls on the implementation of the Programmes of Measures (POMs) have not been effective. Existing regulations are sufficient, but they are inadequately enforced.
Economics		• The post-audit report of the internal controlling body (Supreme Audit Office) indicates insufficient financing of bodies monitoring the water quality (VIEP), also insufficient human and technical resources to carry out monitoring tasks in the territory of the country resulting in periodic (every few years) water quality testing and the use of methodology principles of inheritance when making assessments of the status of water bodies. VIEP financing was smaller than the requested National Fund for Environmental Protection and Water Management and Voivodeship Fund for Environmental Protection and Water Management, which resulted in a restriction of frequency monitoring and did not constitute a guarantee of meeting the requirements of national law and EU obligations of Poland. • Guaranteed co-financing within the framework of the implementation of the common agricultural policy, the rural development program and payments are provided by ARMA, which, assisting agriculture in the catchment area, obliges farmers to use BMP's under the threat of lowering the financing to enforcement proceedings. • The National Centre for Research and Development and the National Fund for Environmental Protection and Water Management supports projects from the private sector conducting scientific research and development works concerning innovative pro-ecological technologies. • The financing of water management, its protection and treatment are provided by funds from the state budget or by mechanisms of support by institutions supporting public and private sector support programs (National Fund for Environmental Protection and Water Management, Voivodeship Fund for Environmental Protection and Water Management). Financing the activities of entities dealing in water treatment and purification is the task of local self-government units determined by law.

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		• Direct payments and Rural Development Program for 2014-2020: farmers support program based on direct payments inclusive: single payments scheme on the surface, payments for greening (practices beneficial to the climate and the environment), payment for young farmers, additional payments (redistributive), payment for area selected crops and animal husbandry, payment as part of transitional national support system for small farms. • From Rural Development Program agri-environmental payments for sustainable agriculture, ecological agriculture, extensive permanent grasslands, protection of endangered species of birds and habitats, protection of endangered genetic resources of plants and animals, protection of soils and waters, buffer zones.
Consultation and cooperation		• Public consultations on the implementation of action programs (nitrate vulnerable zone). In the period between 2004 and 2012 this was conducted by the Regional Water Management Authority in Szczecin.
		• Until 2012, there was the Union of Communes of the Miedwie Lake catchment. The aim of the commune was to modernize and construct sewage infrastructure and sewage treatment plants.
Policy		• European level: ▪ Directive 92/271/EWG of May 21, 1991 concerning the treatment of municipal wastewater. ▪ Directive 91/676/EWG of December 12, 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources. • National/regional level: ▪ Water Law of July 17, 2017 – The amendment Water Law, which applies from January 1,2018 adjusted the water management in the country to the EU requirements set in the FWD or the Nitrates Directive. A new body responsible for the national water management was established together with a new structure and extended competences in the field of administration, collection of fees, control and administration. At the time of this analysis (2018/2019), this body did not function efficiently yet. Time was needed to start the proper procedures as some structures have changed their authority from local administration bodies to

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government administration bodies. The change was introduced very rapidly and this caused chaos in the functioning and implementation of competences by this body, lack of a national water management statute (lack of regulations, executive acts to the new act) and no program of actions on the NVZ already established in the previous year.

- The Odra River Basin Management Plan updated in 2016: Implementation of WFD (2000/60/CE). Assessment of water and environment status and indicates of the risk of failure to achieve environmental goals , indicates actions aimed at achieving good environmental status for water bodies.
- Act on collective water supply and sewage disposal 7/6/2001: Implementation of Urban Waste Water Directive 91/271/EEC, Drinking Water Directive 98/83/CE and WFD 2000/60/CE. Principles of water supply to recipients and sewage disposal.
- Ordinance of the Minister of Health 7/12/2017 on the quality of water intended for human consumption: Implementation of Drinking Water Directive 98/83/CE. Determines drinking water quality standards.
- Ordinance of Minister of Environment Protection 21/12/2015: Implementation of Groundwater Directive 2006/118/EC. Criteria and methods for assessing groundwater status.
- Programme for Municipal Waste Water Treatment last update 12/2017: Implementation of Urban Waste Water Treatment Directive (91/271/EC). Increase waste water treatment system.
- Ordinance of Environment Minister 06/2/2015: Implementation of Sewage Sludge Directive (86/278/EEC). Regulations of sewage sludge using in agriculture.
- Action Program 5/6/2018: Implementation of Nitrates Directive (91/676/EC). Establishes good agricultural practices and obligations for farmers to prevent nitrate losses from agricultural sources

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	▪ Act of plant protection products 8/3/2013: Implementation of Sustainable use of pesticides (2009/128/EC). Principles of plant protection products using and placing on the market. ▪ National action plan to reduce the risk associated with the use of plant protection products for years 2018-2022, 11/7/2018: Implementation of sustainable use of pesticides (2009/128/EC). Dissemination of general integrated principles plant protection and prevention of risks associated with the use of plant protection products. ▪ Regulation of the Minister of Maritime Economy and Inland Navigation of 11 October 2019 on the classification of ecological status, ecological potential and chemical status and the method of classifying the status of surface water bodies as well as environmental quality standards for priority substances. ▪ Regulation of the Minister of Maritime Economy and Inland Navigation of 9 October 2019 on the forms and method of monitoring surface water bodies and groundwater bodies.

FUNCTIONING IN SYSTEM

General system context	• Limiting the use of fertilizers (especially nitrogen fertilizers) raises concerns about reduced yield, decreased competitiveness of farms against producers from other EU countries and decrease in profit. • In 2018 there was a change of the main regulatory document: the amended Water Law Act, which introduced a big change into the organization of the water management at the national and regional levels. New institutions replaced previous ones. At the state level the State Water Farm Polish Waters was established, which took over the responsibilities of the National Water Management Board and Regional Water Management Boards. The introduction of new structure required reorganization of all administration related to water management. This was introduced quickly and caused chaos in the first year of functioning of this body. • The difficulty in convincing agricultural producers and inhabitants of the catchment of the essence of water protection.

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	• The area within the Miedwie catchment (outside action lab) was lately transformed from meadows into crops with intensive plant production and together with poor wastewater treatment process (ineffective treatment plants, uncontrolled discharges). This could be regarded as a growing threat towards water quality. Although there is an intake protection zone, the control of its provisions within the zone is limited. In addition, the Miedwie intake water treatment is modern and highly effective, thus there is no immediate need to take actions towards protection of the catchment. Nonetheless, on the long term problems are likely to arise and then actions will have to be taken. It should be therefore in favour of the drinking water producer to control pressures at source.
Transparency and trust	• The surface water monitoring results for the previous year are made available in the form of an annual report available to the public on the website of the Voivodeship Inspector of Environmental Protection. Detailed data on surface water monitoring for institutions and citizens is available on request. • Data on groundwater quality are revealed to the public within two months after the lapse of the quarter they refer to in the form of Quarterly Bulletin of Groundwaters Polish Hydrogeological Survey and once a year in the form of Hydrogeological Annual Report Polish Hydrogeological Survey. Publications are available on the PGI-NIR website. Detailed data is provided to citizens and institutions on request. • Data obtained by the research institutions are presented in the form of scientific publications. • There is a lack of a common platform containing water quality data of the catchment area.
Coherence	• Policy coherence is stimulated at the level of legislation on national legal acts. The government legislation centre is responsible for the coordination of legislative activities. Previous experience of inter-ministerial and public consultations on the example of the new Water Law Act (operating since 01.01.2018) proves the effectiveness of this procedure, because it is a well-refined document that regulates issues related to management and protection of waters that until now were non-transparent (financing services water, regulations related to

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	monitoring and protection of waters, the responsibility of administrative bodies). • Monitoring is undertaken by different institutions with no coordination. The same points are surveyed by different actors.
Leadership	• There is no clear identification of which institution shall lead activities towards better water quality and environment. • A potential leader can be the Warnice commune that carries out basic tasks related to ensuring adequate quality of drinking water for residents and organization of sewage management in the catchment. It is also the organ closest to the inhabitants, having the widest information on the situation in the action lab. • The Regional Water Management Board in Szczecin (currently as part of Polish Waters) place the role of mediator, who takes into account the interests of stakeholders in the process of creating a local law associated with water management. • The role of the leader could be attributed to scientific institutions (Polish Geological Institute – National Research Institute, Institute of Technology and Life Sciences ITP, West Pomeranian University of Technology – ZUT)), which have been conducting research in this area for years, involving agricultural producers in monitoring and promoting BMP's. This would however require some formal agreements and funding. • No private (e.g. farmers and companies) leader striving for water quality in the catchment.
Inclusive participation	• There is moderate involvement among agricultural producers. The cooperation of research centres with individual farmers in the field of groundwater monitoring has been taking place for years (access to research, exchange of information) with an agricultural cooperative in the monitoring of environmental parameters (meteorological conditions, water levels, information exchange). Of the abovementioned actors, everyone actively cooperates on the WaterProtect project (access to the site, sharing of data, exchange of information). • Citizens have the opportunity to take part in the decision-making process (municipal council meetings, personally, as part of consultations, through representatives), but in general they show little interest. Inhabitants and farmers showed little interest for consultation

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	of the water management plans. Consultations regarding the establishment of NVZ within the catchment area and the subsequent action program revealed more active participation. • Citizens are under-represented actors in the decision-making process. The public authorities encouraged the public through information campaigns. Public authorities and associations are over-represented. • The public authorities encourage participation of society through different communication channels (internet, adverts, mail, e-mail, television, radio, training and workshops). The results of the consultations carried out in the region indicate that the best results are brought by direct meetings with actors (especially citizens and farmers) (data from Regional Water Management Board). • The citizens have the possibility to create civil initiatives, but there is a low public interest in actions improving the quality of water in the catchment.
Roles and responsibilities	• From 01/1/2018, the roles and competencies of authorities related to water management are clearly stipulated in the Water Law Act (20/07/2017).

AWARENESS AND ACTIONS

Awareness	• The Gowienica Miedwaińska River Basin has been operating as a nitrate vulnerable zone for 12 years until now and still some farmers have very little knowledge on this subject. • Lack of interest (or little interest) of inhabitants in the water quality state in the catchment. • During the project it became clear that farmers and inhabitants weren't aware of the surface water and groundwater quality problem and that their understanding of the cause was limited. They didn't match water pollution to the proximity of agriculture. However, they indicated the wastewater management (e.g. poor efficiency of the treatment plant) as the major polluter of the river. When the monitoring results were presented, understanding of the poor water quality and the causes of pollution increased. • Farmers are generally aware of obligations resulting from Program of Measures (PoMs) and other provisions. Voluntary measures are also

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	known. However, even though studies in this area were conducted for years, knowledge of water conditions and quality in the catchment is limited. • There is a discrepancy between knowledge and taking action. Farmers have little sense of responsibility for the environment and focus on maximizing profits. The main reason to undertake pro-ecological activities is to obtain additional funds from agricultural subsidies rather than the resulting benefits for the environment. • Some farmers did not know that the Gowienica Miedwianska is a river. They thought it was a drainage ditch. As a result, they didn't know that they should have applied the Programme of Measures. • The problem of water quality is known by farmers and by institutions related to water management and agriculture (NVZ area). • Non-agricultural and non-water management companies and inhabitants are not aware of the existing problem. • Non-agricultural local companies are not aware of the problem of water quality in the Gowienica river catchment. They assess surface and groundwater as of good quality. The tap water supplied to the recipients mentioned above is also assessed by them as of good quality. • There is also no information about activities aimed at improving water quality in the catchment. • The exception is Florentyna Pension, which as an agritourism farm receives information on agricultural activities related to the improvement of water quality from The West Pomeranian Agricultural Advisory Center in Barzkowice. Also based on own experience, this actor considers the quality of water in the catchment (and its direct vicinity) as bad and indicate mineral and organic fertilization as reason for poor water. • Farmers and inhabitants should have been aware (but are not) of the problem with water quality (associated with farming) as trainings were provided by West Pomeranian Agricultural Advisory Board in Barzkowice. Series of trainings were conducted in the catchment area related to agriculture and management in the NVZ areas in years 2004-2016 and currently also more trainings regarding the new PoMs were organised (since2018).
Actions	• Based on the observations and informal discussions with farmers and inhabitants, obligatory measures are not fully implemented. There are

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	many reasons for that matter, we can indicate among others: irrelevant with weather conditions terms of fertilise use, lack of environmental awareness and focusing only on maximisation of plant production.

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6.3 Process

6.3.1 Representation of the process

METHODS OF CONTACT


Informing – newsletter


Informing - leaflet


Exchange – bilateral conversation


Exchange – multi-actor conversation


Exchange – questionnaire/survey


Exchange – demonstration/field visit


Exchange – interactive workshop

INVOLVED ACTORS

Action lab leader(s)	Polish Geological Institute - National Research Institute (PGI-NRI) Institute of Technology and Life Sciences (ITP) West Pomeranian University of Technology (ZUT)
Farmers	Farmers of the Gowienica river catchment
Farmer advisory and unions	West Pomeranian Farmer's Advisory Centre (ZODR)
Water producers and suppliers of drinking water	Szczecin Water Services West Pomeranian Water Services
Regional/national government	Department of Agriculture and Fisheries, Wespomeranian Marshall Office (not interested in the project) Department of Environmental Protection, Westpomeranian Marshall Office (not interested in the project)

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	Department of Environmental Protection, Szczecin City Hall Regional Water Management Authority, National State Water Farm Polish Waters (RWMA) Voivodship Inspectorate for Environmental Protection (VIEP) Regional Directorate for Environmental Protection (RDOŚ) West Pomeranian Board of Land Reclamation and Water Facilities in Szczecin (operated until 31.12.2017) Voivodship Fund for Environmental Protection and Water Management Agency for the Restructuring and Modernization of Agriculture (ARMA) Faculty of Infrastructure, Agriculture and Regional Development Westpomeranian Voivodeship Office
Local government	Warnice Borough Stargard Borough
Food processors and distributers	Polish Sugar Inc.
Inhabitants - consumers	Inhabitants

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AMBITIONS

Network formation	• Involvement of water producers in maintaining good water quality in the catchment • Build proper relationships and trust between stakeholders, i.e. relevant institutions and between institutions and farmers. Development and improvement of communication channels between stakeholders • Involve local leaders in the villages to introduce innovative solutions or BMP's • Involve the West Pomeranian Agricultural Advisory Board and local agricultural advisors in the scope of sharping awareness and transferring knowledge
Exchange and continuation	• Identify local leaders (farmers) within the action lab area in order to increase possibilities to promote advantageous solutions or best management practices (BMP's)
Knowledge building	• Analysing the environmental and economic conditions of the agricultural system
Actor awareness	• Raising awareness by the farmers of the environmental risks associated with their activities • Raising awareness by the farmers of the functioning of the Programme of Measures (PoMs) • Raising knowledge about the benefits of BMP's • Raising a broad awareness by inhabitants, farmers, agricultural producers, local administration about specific problems in the catchment: problems with water quality and their impact on the potential deterioration or improvement of water quality. • Use of the WaterProtect collaborative tool as a platform for providing and sharing information about the environmental conditions in the catchment
Farmer practices	• Implementing BMP's

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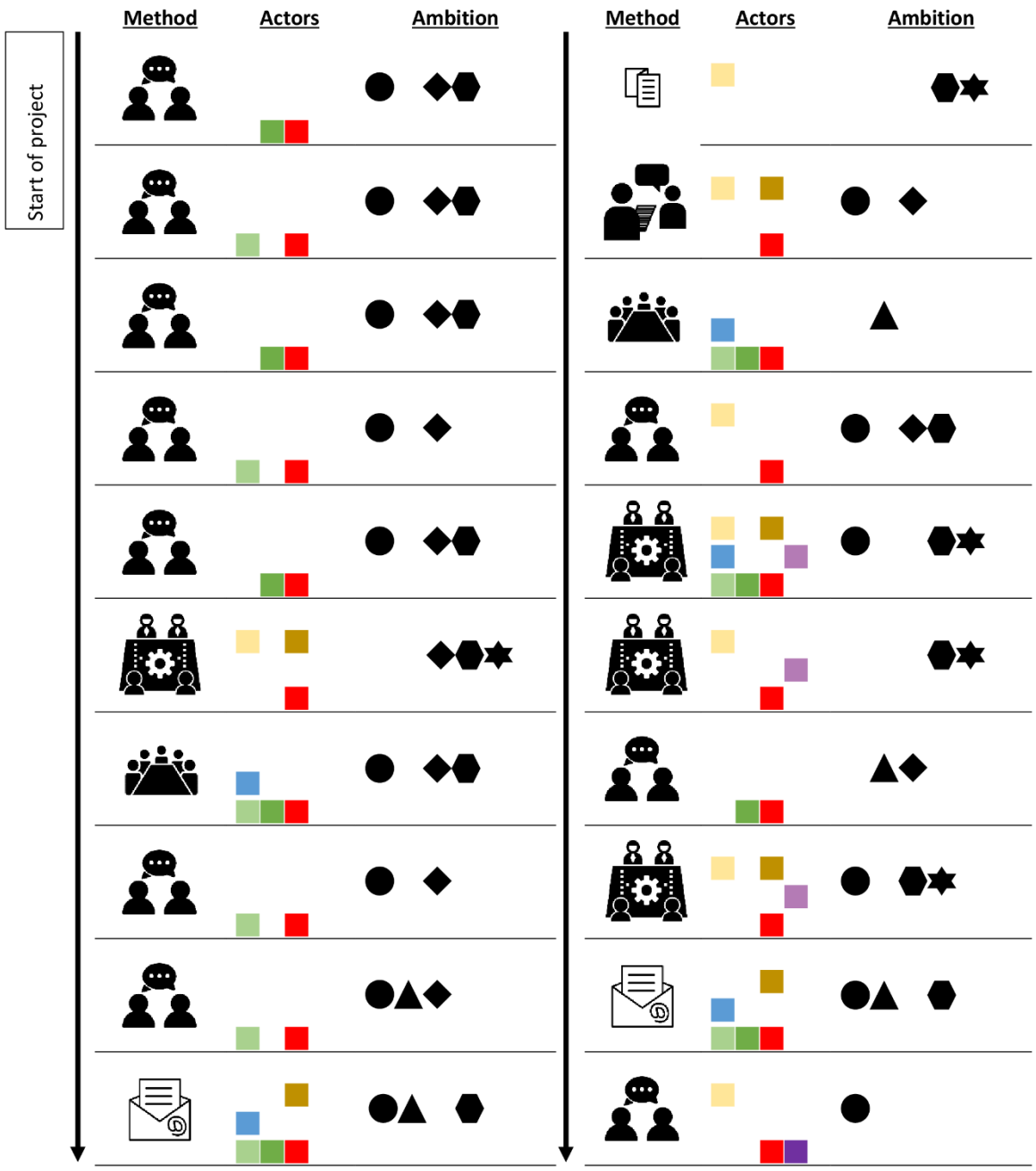
COMBINED VISUAL REPRESENTATION



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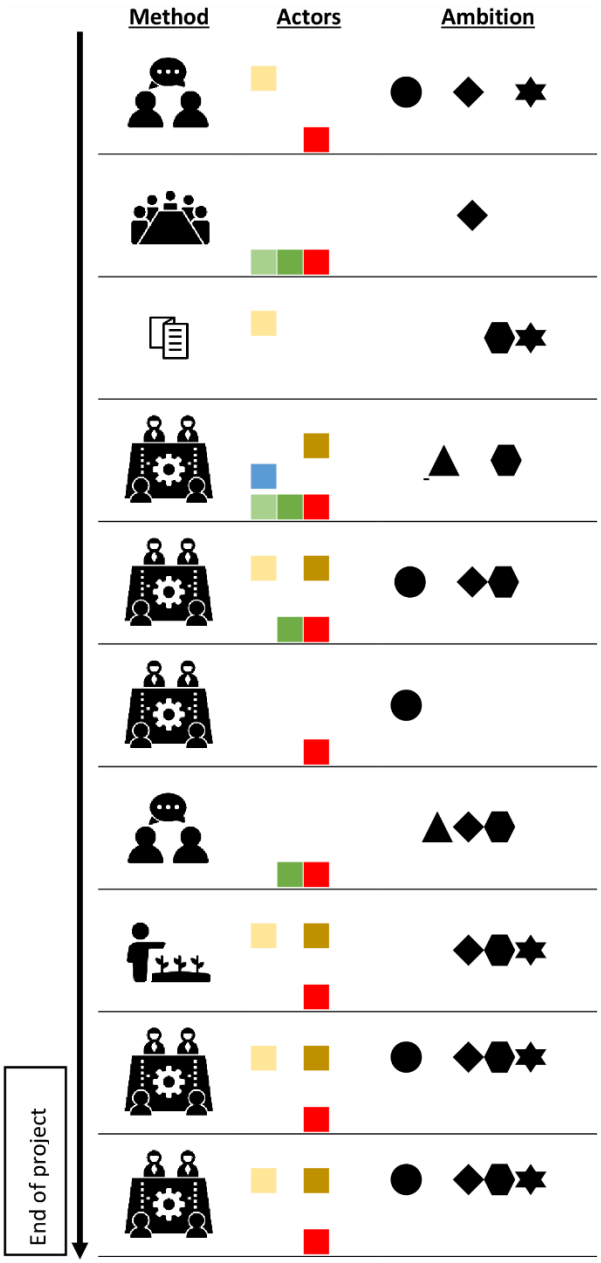

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PROCESS SUMMARIZED IN FIGURES

		METHODS						
								
		12	9	1	1	2	3	2
ACTORS INVOLVED	Action lab leader(s)	12	9	1	1	2	3	
	Farmers	3	7	1	1			2
	Farmer advisory and unions		7	1	1	2		
	Water producers and supplier of drinking water		2			2	2	
	Regional/nation government	4	2			2	3	
	Local government	5	3			2	3	
	Food processors and distributers	1						
	Inhabitants - consumers		3					
AMBITIONS	Network formation	10	6	1		2	1	
	Exchange and continuation	3	1			2	1	
	Knowledge building	11	4	1	2		2	
	Actor awareness	6	8		2	2	2	2
	Farmer practices	1	6		1		1	2

6.3.2 Evaluation and lessons learned of the process

METHODS

						
12	9	1	1	2	3	2

- Direct meetings with farmers are establishing relationships that bring benefits to the project partners by increasing their awareness of the importance of the problem of water quality.
- Bilateral conversations with institutions were useful to get a deeper insight into the topic, to discuss specific issues and future cooperation.

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	• Bilateral discussions with farmers were a great opportunity to discuss obligatory and voluntary BMP applications, environmental issues and the condition of agriculture in the region. • Bilateral conversations were held at stakeholders office or farm, rather informal, which gave the opportunity to talk freely on sensitive topics. Moreover, those meetings were more convenient and made it possible to tailor the meeting to the availability of the farmer. • Limited applicability if the aim is problem sharing and solving between stakeholders.
	• Workshops were very effective. All stakeholders were very active and there was a good interaction between stakeholders. However, facilitation is needed to start and steer discussions. • Performing workshops for stakeholders and giving them the opportunity to express their needs is a good start to establish long-term relationships between them. • Workshops/meetings with stakeholders from different institutions with different interests and competencies gave quicker insight into the topic and made a quick exchange of information possible. • Required encouragement for participation.
	• Very effective method both for farmers and institutions, because problems can be seen in-situ and this changes the perspective of stakeholders. • A visit to a demonstration farm organised for farmers was very effective and inspiring for those farmers. • Problem visualisation was very helpful to catch people's attention and allowed to start the discussion about the practices used by farmers. • An effective method to get more stakeholders involved.
	• The newsletter was sent once a year to all stakeholders to report on the action lab achievements and findings. • Action lab leaders believe that this method kept stakeholders involved and motivated stakeholders to keep coming to the meetings and workshops.
	• Multi-actor conversations were a great opportunity for actors to meet, interact and establish new relationships. • Give actors the opportunity to discuss the subject to a greater scale, exchange information and share experiences. • Give stakeholders the opportunity to find solutions for improvement together.

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- Workshops/meetings with stakeholders from different institutions with different interests and competencies gave quicker insight into the topic and made a quick exchange of information possible.
- It gives the opportunity to listen to the voices of different parties.
- It allows inhabitants to interact with representatives of the administration in a more independent manner.
- Allowed for deeper insight on weaknesses of current legislative and organisational setups inhibiting implementation of mitigation measures and BMP's.
- Required encouragement for participation.

- Leaflets were used to inform farmers about the project within the catchment: BMP's, nitrates in the groundwater, where they can find information if they need any, the competences of institutions responsible for water management, etc. In this way the action lab leaders corresponded to the needs they were told about by the farmers.
- It can be studied by farmers in their private time.

INVOLVEMENT OF ACTORS

								
ACTORS INVOLVED	Action lab leader(s)	12	9	1	1	2	3	
	Farmers	3	7	1	1			2
	Farmer advisory and unions		7	1	1	2		
	Water producers and supplier of drinking water		2			2	2	
	Regional/nation government	4	2			2	3	
	Local government	5	3			2	3	
	Food processors and distributers	1						
	Inhabitants - consumers		3					

Farmers

- Workshops for farmers were run together with farmer advisors to boost the importance of the meetings.

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	• Little interest of farmers in consultation, policymaking process, workshops, training courses. It takes a lot of effort and different means of communication (e-mail, telephone, direct invitations from persons with a good reputation), sometimes repetitive, to encourage farmers to participate in meeting to cooperate. • Farmers are not used to participating in research projects. Therefore, more effort was needed to encourage them to cooperate and to show them the benefits of environmental protection. • Action lab leaders experienced that meetings with smaller groups of farmers created comfortable conditions to share knowledge.
Szczecin's inhabitants	• Szczecin's inhabitants as consumers of the drinking water could be partners in the project. However, the city council's representatives pointed out that the involvement of inhabitants could cause unnecessary conflict as the role of agriculture in the water quality problem will be exaggerated by some and wrongly understood. Therefore, the inhabitants were not involved. • Inhabitants showed little interest in participating in meetings.

6.3.3 Progress of the process, considerations and points of attention

- Project meetings among stakeholders were held once a year with representatives of institutions who formally supported the project. During the meetings the findings of the project were reported within the framework of work packages. Action lab leaders felt it was necessary for these institutions to be treated partly as part of the project team. This allowed for discussion between institutions and an exchange of views and also for starting personal contacts between institutions. According to the action lab leaders, it is a very effective tool for building relationships between institutions.
- In Poland it is rather unusual for stakeholders to cooperate using a multi-actor approach, especially locally. Therefore it was continued in the following years of the project to sustain and develop this new pattern.
- During the project, the water quality was again verified and proved to remain polluted and what's worse, the amount of nitrate in surface water and groundwater increases, especially in the upper part of the catchment. Taking the above into account, there is a need for further determining actions towards water protection. This also means that institutions need to take actions that they are entitled to do, e.g., more effective training programs (there has been a lot of training programs, but their effectiveness seems low), better information flow between farmers and institutions (ot only about water quality but the basis of the problem, some farmers have not known that the Gowienica Miedwiańska was a river, they thought it was a drainage

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ditch and therefore they did not know they should have applied the programme of measures) and more controls.

- It is rather uncommon that Polish institutions on a local scale to work together on solving problems. By multi-actor approach it was possible to establish relationships between actors, give them the opportunity to express their needs and present obstacles that they are facing.
- There was little interest of the stakeholders in the process or misunderstanding of the goal of the project.
- The multi-actor approach allowed stakeholders to be involved in the process. However, not every institution from the Polish action lab desired to cooperate in the project. Then the on-going process needed a lot of effort from the WaterProtect team.
- Some unexpected and unwanted actions occurred during the project. For example, project partners presented the water quality results in the action lab to the control institution and requested information regarding the number of controls undertaken within the action lab in the past years. This resulted in immediate controls of farmers within the action lab. Despite presenting the aim of the project many times during meetings, institutions did not understand the long-term cooperative water governance goal and rather performed immediate actions to fulfil the overlooked responsibilities. This could be the result of little interest in the project. In response to the increased controls, farmers were dissatisfied and reluctant for further cooperation in the WaterProtect project. The lack of sufficient control mechanisms was pointed out by farmers themselves in many meetings within the project and also reported by the National Audit Office in 2018.
- Taking into account that the project involved continuity of previous research (monitoring) in which exceeded quality standards were proven, in the future the water monitoring should be done to a lesser extent to focus more on interpreting the data, informing stakeholders and discuss possibilities for measures to be installed in place (e.g. intelligent buffer zones and improved drainage systems).

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6.4 Achievements by the WaterProtect process

6.4.1 Ambition 'network formation'

		NETWORK FORMATION						
		9	5	1		2	1	
ACTORS INVOLVED	Action lab leader(s)	9	5	1		2	1	
	Farmers	3	4	1				
	Farmer advisory and unions		4	1		2		
	Water producers and supplier of drinking water		1			2	1	
	Regional/nation government	4	1			2	1	
	Local government	3	1			2	1	
	Food processors and distributers	1						
	Inhabitants - consumers		2					

Achievements

- ⇨ **Involvement of water producers involved in maintaining good water quality in the catchment**
  - It may be concluded that the water service that produces drinking water from Miedwie Lake is likely not aware of the fact that there has been growing anthropogenic pressure on Miedwie waters.

- ⇨ **Build proper relationships and trust between stakeholders, i.e. relevant institutions and between institutions and farmers. Development and improvement of communication channels between stakeholders.**

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- Several workshops for farmers were organised to discuss BMP's, but this also allowed to establish a relationship between research institutions and farmers and improve the trust of farmers in research organisations.
- As a result of multi-actor meetings, trust between institutional actors slightly rose during the WaterProtect project. This may be the result of participation in workshops where knowledge and experience were transferred between stakeholders, and that they were given the opportunity to speak up and therefore be a part of the policy process. Although it cannot be described as cooperation itself, positive examples of working together and solving problems were discussed and the atmosphere for future relationship was prepared. However, based on the experience and observations, it requires more effort from stakeholders to maintain that positive pattern.
- As a result of participatory monitoring, the trust of farmers in research results increased, as it was demonstrated how the samples are taken as well as the rules and restrictions for providing good quality data were discussed.
- During the whole process, project partners focused on cooperation with persons directly engaged in the relevant topic, rather than exchanging official letters with inquires. This resulted in establishing good, slightly informal relations in which the stakeholders and the work package team were more open to cooperation.

⇨ **Involve local leaders in the villages to introduce innovative solutions or BMP's**

- Warnice Community (municipality) was contacted for the modernization of the sewage network with a new sewage treatment plant. However, this process may take more time. It requires a capital investment of the community and, as far as the project partners know, the community has to deal with low income from taxes and therefore little budget.

⇨ **Involve the West Pomeranian Agricultural Advisory Board and local agricultural advisors in the scope of sharping awareness and transferring knowledge**

- Active involvement of the West Pomeranian Agricultural Advisory Board in Barzkowice.

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6.4.2 Ambition 'exchange and continuation'

		EXCHANGE AND CONTINUATION						
								
		3	1			2	1	
ACTORS INVOLVED	Action lab leader(s)	3	1			2	1	
	Farmers							
	Farmer advisory and unions		1			2		
	Water producers and supplier of drinking water		1			2	1	
	Regional/nation government	1	1			2	1	
	Local government	2	1			2	1	
	Food processors and distributers							
	Inhabitants - consumers							

Achievements

⇨ **Identify local leaders (farmers) within the action lab area in order to increase possibilities to promote advantageous solutions or best management practices (BMP's)**

- No pioneering farmer identified. One exemption may be a food producer (sugar company) that established cooperation with farmers producing sugar beetroot.
- Since the beginning of the project the future leader was sought among institutions and farmers. Firstly it was nearly obvious for the work package team that the local water management authority should take up the role. However, the whole water governance in Poland had been changed (new institutions, different departments and competences) and therefore cooperation with this stakeholder encountered difficulties. Further works

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showed that the farmers' advisory boards could be more actively involved in actions towards the protection of water resources from agricultural pollution. As an actor for which farmers show much respect and have faith in, farmer's advisors have the possibility to lead the change towards more sustainable farming aiming at the better protection of the surrounding environment.

- Farmers are reluctant to share practical knowledge with each other as this may affect their competitiveness.
- The action lab leaders were not able to identify anybody that can continue the efforts made during the project and take the lead.

6.4.3 Ambition 'knowledge building'

KNOWLEDGE BUILDING							
		11	4	1	1		2	
ACTORS INVOLVED	Action lab leader(s)	11	4	1	1		2	
	Farmers	2	4	1	1			
	Farmer advisory and unions		4	1	1			
	Water producers and supplier of drinking water						1	
	Regional/nation government	4					2	
	Local government	5	1				2	
	Food processors and distributers							
	Inhabitants - consumers							

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Achievements

⇨ **Analysing the environmental and economic conditions of the agricultural system**

- A good understanding of the environmental, sociological and organisational conditions of the catchment was achieved.
- Project partners gained knowledge on the planned investments in the commune, as well as an overview of the problems faced by officials in the field of municipal management for water protection: lack of sufficient funds for investments, complicated procedures in obtaining co-financing and low awareness of inhabitants and farmers of environmental protection.
- Farmers pointed out several problems that they are facing, mainly economic (restrictions in fertilization) and environmental (droughts and flooding).
- Actors indicated that sometimes it's difficult to cooperate with institutions responsible for environmental protection because of unclear competences.
- Due to previous investigations and infra-red imaging carried out within the WaterProtect project it is possible to assess the impact on surface water quality of the outlets of pipelines and the outlets from sewage treatment plants. The authorities of the Warnice commune are conducting intensive activities to reduce the negative phenomena associated with pressure on the aquatic environment. Registration and control of all farms without connection to the sewage system positively affect the activities of residents (limited uncontrolled sewage overflows).

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6.4.4 Ambition 'actor awareness'

		ACTOR AWARENESS						
		6	8		1	2	1	2
ACTORS INVOLVED	Action lab leader(s)	6	8		1	2	1	
	Farmers	1	7		1			2
	Farmer advisory and unions		7		1	2		
	Water producers and supplier of drinking water		2			2	1	
	Regional/nation government	1	2			2	1	
	Local government	4	3			2	1	
	Food processors and distributers							
	Inhabitants - consumers		3					

Achievements

⇨ **Raising awareness by the farmers of the environmental risks associated with their activities**

- Demonstrations in the field raised farmer's understanding of the problem.
- Involvement of the farmers in the participatory monitoring of surface and groundwater. Farmers were very interested in the water quality of brought samples from their own well.
- Farmers are more engaged in analysing the condition of the drainage system in the catchment.
- Familiarizing farmers with the basics of water circulation, the level of water pollutions and ways to prevent contamination, increase environmental awareness and encourages action.

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- **Raising awareness about farmers' obligations with respect to the Water Law Act and the Program of Measures and the functioning of the programme**
  - The farmer's advisors already organise multiple training courses for farmers concerning the requirements of the Nitrates Directive and subsequent Programmes of Measures. However, it was observed that there should be a reflection on the effectiveness of the trainings in the environment, especially when taking into account the number of provided trainings and the number of trained farmers.

- **Raising knowledge about the benefits of BMP's**
  - Demonstrations in the field raised understanding of the benefits of BMP's.
  - Several workshops for farmers were performed during the project to promote BMP's, discuss their efficiency and costs of implementation.

- **Raising a broad awareness by inhabitants, farmers, agricultural producers, local administration about specific problems in the catchment: problems with water quality and their impact on the potential deterioration or improvement of water quality**
  - Direct meetings with farmers are establishing relationships that bring benefits to the project partners by increasing their awareness of the importance of the problem of water quality.
  - Project partners performed awareness campaigns about the nitrate transfer to groundwater during multiple open events (agri-fairs, school visits, thanksgiving events, field visits).
  - During AgroPomerania Fairs (years 2017, 2018, 2019) water quality tests were performed using photometer to raise inhabitant knowledge on the matter of water pollution. Water was delivered from private wells of farmers and inhabitants. With this simple method the amount of nitrate in the water was directly visible (change of colour).
  - During the third AgroPomerania Fair (in 2019) preliminary results were shown to the stakeholders together with further discussion on barriers preventing effective water protection and measures for improvement.
  - Education of school youth and inhabitants regarding threats and the need to protect the waters.

- **Usage of the WaterProtect collaborative tool as a platform for providing and sharing information about the environmental conditions in the catchment**
  - The web tool is used by ITP, ZUT, PGI-NRI and easily accessible through the web page for farmers and inhabitants.
  - Actors and the WaterProtect team declared further cooperation on the analysis of the functionality of the tool, as well as the inclusion of specific GIS layers.

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6.4.5 Ambition 'farmer practices'

		FARMER PRACTICES						
		1	6		1			2
ACTORS INVOLVED	Action lab leader(s)	1	6		1			
	Farmers	1	6		1			2
	Farmer advisory and unions		5		1			
	Water producers and supplier of drinking water		1					
	Regional/nation government		1					
	Local government		1					
	Food processors and distributers							
	Inhabitants - consumers		3					

Achievements

⇨ **Implementing BMP's**

- No new farmer practices were implemented during the project. The main reason is that extra funding and other incentives are needed in order to encourage the farmers to implement them. There were no funds for new practices within the project. BMP's which implementation is cost-free are already implemented.
- According to questionnaires, farmers are willing to implement additional BMP's. However, there may be a big gap between the declaration of implementing new practices ad their actual implementation.

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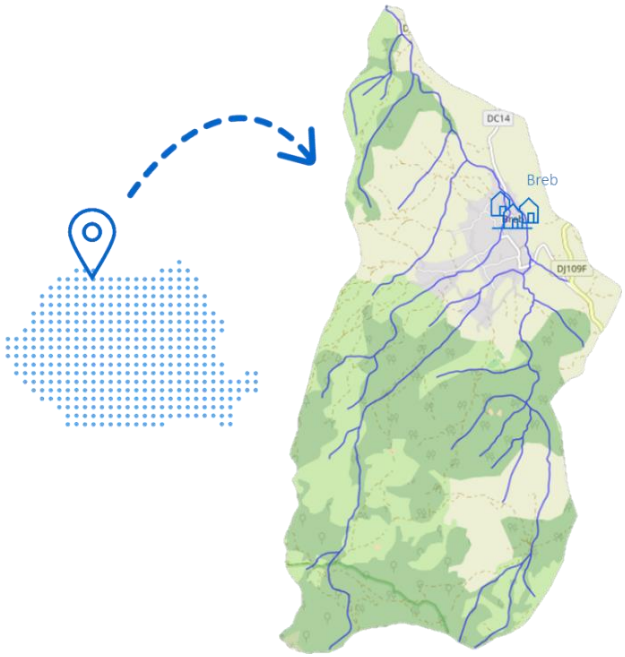
7 Romanian action lab – Mara river

7.1 General characteristics and description of the problem



- 20 km²
- Rural region, typical cultural landscape shaped by traditional practices
- Protected area of local interest due to the presence of important protected species: trout and grayling who's survival depends on the water quality
- Breb village is crossed by a hydrographical network of watercourses that spring from the Gutâi mountains and flow into the Mara river.
- Surface water capturing area for drinking water.
- Groundwater wells: only very few are used for drinking water.
- Small scale/ subsistence farming systems: cattle and sheep breeding are the main agricultural production systems.
- Internal as well as external tourism in the region is increasing, which offers economic opportunities to the local people (e.g. guest houses, restaurants, leisure activities, etc.); area is part of ecotourism destination Mara-Cosău-Creasta Cocoşului
- Cattle and sheep farming

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Pollution in focus	• Nitrates
Agricultural sources	• The main cause is “small point source” pollution arising from the multiple, small-scale discharges to the river that occur from the many agricultural holdings that are dispersed throughout the Mara catchment (small-scale discharges from the manure heaps/stores of individual households). • Cattle and sheep breading in the catchment area affects the drinking water quality but also the surface water quality since manure is used as a large scale fertilizer and leaks from the barns of most of the households. • Sheepfolds are not respecting all the time the good practices related to fertilization (movement of sheep is done later than it should be and may result in degradation of pastures)
Reinforcing factors on pollution	• Rainy seasons can evoke leakages from manure storage platforms to rivers/ surface water • Climate change: will probably have some impact, but there are no specific data on this aspect in relationship with the case study area.
Other pollutions and pollution sources	• There is no centralized sewage system • Diffuse pollution from the forestry sector • No functional wastewater treatment facilities • Seasonal excess nutrient inputs in aquatic systems

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7.2 Start situation

7.2.1 The actors and their roles

Production and distribution of plant protection products

Actor type	Actor in action lab	Role
Chemical producers	/	/
Distributers of plant protection products	/	/
Actor responsible for the collection of the packaging	/	/
Representative of chemical producers	/	/
Representative of chemical distributers	/	/

Agricultural production

Actor type	Actor in action lab	Role
Farmers	378 households totalizing 1096 inhabitants in Breb village	Small scale/ subsistence farming systems: producing food on a small scale or for personal consumption. Water consumers + potential polluters.
Seasonal farmer	/	/
Contract sprayer	/	/
Farmers unions	3 associations	Associated in order to get subsidies: not offering any consultancy to farmers
Farmer advisory	/	/
Union of contract sprayers	/	/

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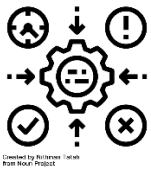
Processing and selling food products

Actor type	Actor in action lab	Role
Processing industry	/	/
Retailers	/	/

Drinking water production

Actor type	Actor in action lab	Role
Water producers and supplier of drinking water	See governmental organizations below	/



Context factors and societal preferences over the entire system and all subsystems

Actor type	Actor in action lab	Role
Supranational government	European Environment Agency	Helps the community and member and cooperating countries to make informed decisions about improving the environment + integrating environmental considerations into economic policies and moving towards sustainability + coordinate the European environment information and observation network
Regional or national government	Maramures County Council	Makes proposals for environmental protection projects including water and population safety
	Ministry of Waters and Forests	Elaborates of the national strategy on environmental protection and water resources + collect data on water quality
	Ministry of Environment, Waters and Forest (previously the Ministry of Environment and Climate Change)	The Ministry of Environment, Waters and Forests, implements national policy in the fields of environment, water management and forest management, fulfilling the role of state authority, synthesis, coordination and control in these areas, directly or through specialized technical bodies, public authorities or institutions under the subordination, coordination or under the authority of the ministry.

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	National Agency for Environmental Protection	Is responsible for strategic environmental planning + monitors environmental factors + authorizes of activities with environmental impact + implements environmental legislation and policies at national and local level + reports to the European Environment Agency on the following areas: air quality, climate change, protected areas, soil contamination, water.
	County Public Health Directorate	Monitors the quality of water distributed to the population from centralized system.
	National Authority Romanian Waters (ANAR APELE ROMANE)	Monitors the water quality in case of pollution.
	Agency for payments and intervention in agriculture	Monitors the use of pesticides
	Directorate for Agriculture Maramures	Does consultancy to help achieve EU funding for farmers; organizes trainings for farmers in agricultural activities; does monitoring, controls agricultural related regulations e.g. fertilizers, ecological agriculture; authorizes plantations
	Maramures water management branch (SGA Maramures)	Monitors water quality in certain monitoring stations.
Local government	Ocna Sugatag Mayor House	Imposes rational water resource management rules through local council decisions + makes sure the provision of drinking water to the households + ensures the quality standard for drinking water
	Budesti Mayor House	As part of Ecotourism destination and located in the proximity of Ocna Sugatag (proximity of RO action lab), the Budesti Mayor Houses imposes safety in relation to use of water and water management, also with respect to drinking water that partially comes from Gutai Mountains. There is no imposition of water metering in Budesti neither, water is sometimes at risk of being wasted by locals. In seasons of high consumption correlated with droughts, both communes encounter lack of sufficient water.
River basin agency	Maramures water management branch (SGA Maramures)	Applies the national strategy in the area of surface and ground water management + manages water resources + proposes and performs improvement works on hydrographic basins + monitors the water quality
	Environmental Protection Agency Maramures (EPA MM)	Monitors economic activities from the perspective of environmental impact, including the impact on water + monitors environmental factors, including water factors + authorizes activities with an impact on the environment, including water + implements national

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		legislation with environmental profile + reports to the European Environmental Agency about the quality of water
	National Environmental Guard, Maramures County Inspectorate	Controls activities with environmental impact + exercises control over activities at risk of environmental accidents + participates in interventions to eliminate / mitigate the effects of pollutants on the environment, including on water + checks for violations of environmental, including water legislation + provides information on the status of the environment (water)
Research	Technical University Cluj Napoca	Elaborates specialized studies
	Baia Mare University Center	Conducts educational and environmental awareness actions
Civil society organisations	EcoLogic	Empowers citizens and farmers + collaborates with environmental institutions + initiates environmental projects and awareness campaigns
	Center for ecology and tourism Maramures CET	Empowers citizens and farmers + collaborates with environmental institutions + initiates environmental projects and awareness campaigns
	Local Action Group GAL Mara Gutai	Empowers citizens and farmers + collaborates with environmental institutions + runs local development programs, including water infrastructure + initiates environmental projects and awareness campaigns
Inhabitants	The church	The church is a place of meeting in rural areas; the priest is also informing people on new developments; it is an important place to share relevant info related to everyday life
Consumers	/	/
Consumer organisations	/	/
Local businesses	Tourism business	Are water consumers, as well as potential polluters.

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7.2.2 Functioning of the water governance system

KNOWLEDGE		
Monitoring		• Maramures water management branch (SGA): ▪ Biological elements ▪ Hydro-morphological elements ▪ Physico-chemical elements ▪ Microbiological elements • National Authority Romanian Waters (ANAR APELE ROMANE): performs monitoring in case of accidental pollution • National Environmental Guard, Maramures County Inspectorate: Proposes sanctions • Agency for Payments and Intervention in Agriculture (APIA): monitors the use of fertilizers as part of subsidies regulations

MOTIVATION		
Use of the water		• Citizen's safety/ health: distribution of good quality water to the inhabitants.
		• Maintaining the health of their animals. • Compliance with sanitary hygiene rules.
		• Tourism business: maintaining the health of tourists + compliance with sanitary hygiene rules
Attractive and healthy environment		• Environmental protection
		• Increasing the quality of biodiversity due to clean water.

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INFLUENCE		
Implementation of BMP's		• Farmers are responsible for the effective implementation of best management practices on farm level.
		• The local communities are responsible for a nature friendly treatment of waste water.
Information and education programs		• Awareness campaign by local authorities for use of metering water • Educational projects: training young people on the rational use of water resources • Specific trainings are organised for national water authority representatives to learn skills needed in the design and implementation of water policy and arrangements. • The Maramures county council is responsible for the coordination and management of environmental protection projects. In this way it has an influence on the related research organisations working on those projects.
		• Civil society organisations can have influence on the society trough awareness campaigns. • The church is a meeting place in rural areas in Romania. The priest informs people on new developments and it is a good place to share relevant info related to everyday life.
Control		• The national environmental guard and the Maramures county inspectorate control activities with an environmental impact. • The county public health directorate controls drinking water distributers and if necessary applies sanctions. • The ministry of waters and forests monitors the application of the existing legislation concerning environmental protection and water resources. • The National authority Romanian Waters , the environmental guard and APIA (Agency for payments and intervention in agriculture) monitor the implementation of best management practices. • The environmental protection agency Maramures can have an influence on local business because they are responsible for

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		the authorization of economic activities with an environmental impact.
Economics		• The direct payment schemes as support mechanisms for agricultural producers, which apply in agriculture between 2015 and 2020 ▪ Single payment scheme dependent on the surface area ▪ Redistributive payment ▪ Payment for agricultural practices beneficial to the climate and the environment: ▪ Payment for young farmers ▪ Coupled support scheme ▪ Simplified scheme for small farmers • The national rural development plan applicable to agricultural land (2014-2020) ▪ Measure 10: agro-environment and climate ▪ Measure 11: organic farming ▪ Measure 13: payments for areas experiencing natural constraints or other specific constraints ▪ Measure 214: agri-environmental payments • Animal subsidies (in order to maintain local traditional breeds) • Transitional nation aids (for maintaining traditional landscape in rural areas, extensive grazing) • Financial resources for water governance are ensured at state level. In order to implement an action plan from river management plans in Romania from 2016 to 2021, funding is distributed in the following way: 45% EU funds; 24% state/governmental funds; 3% economic agents funds; 0,89% sources from National Authority Romanian Waters; 27% other sources not yet identified
Consultation and cooperation		• Maramures Natura 2000 platform: cooperative platform for development of natural and cultural patrimony in a sustainable manner. The effect of the platform was that different action plans of different sectoral institutions were integrated.
Policy		• European level:

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- Directive 79/869/EEC analysis of surface water destined for consumption, transposed into national legislation via governmental decision 100/2002
- Directive 91/ 676/EEC for protection of waters against nitrate pollution coming from agricultural sources, transposed into national legislation via governmental decision 964/2000
- Directive 2007/60 / EC on Flood Risk Assessment and Management: reducing the risks and the negative consequences of the floods.

- National level:
  - Somes Tisa management plan 2016 – 2022: the main goal is to achieve a good environmental status for all water bodies.
- Local level:
  - The local government can have great power by imposing a set of rules concerning water governance

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FUNCTIONING IN SYSTEM

General system context

- Although water quality is an important issue, people in the village are more concerned about water quantity. As a preventive measure water supply is often shut down during dry periods, which constrains the development of economic activities among which tourism. Water quality problems are thus often deemed less important than water quantity problems.
- Water quality has been a major issue for many years in the area. A second centralized water system was built in Breb, which according to locals does not always provide good water quality. People are blaming the Major House for not taking sufficient measures to ensure good water quality.
- There are some different opinions regarding the water quality. Local authorities state that the water quality is good (according to the official measurements), but locals say that the water coming out of the tap is occasionally muddy.
- There is very little experience in having a democratic process of decision making at local level. This is linked to the local culture where communities are waiting for their leaders to make the change and farmers feel like nobody is taking them into account.
- There is a lack of coordinating bodies that provide sufficient information on innovative production methods, moreover, focus is more on marketing strategies. Farmers are locally rooted and they know to work the land, however their income is low and this creates disadvantages and low profit compared to other regions. Lately there are some guidance groups that offer specialized information to farmers but it is not always in a constant manner and not centred on farmers' needs.
- A major challenge is to improve the water quality in the region, meanwhile keeping the small agriculture alive, which gives Maramures its unique mosaic landscape.
- Officially the village of Breb is using a central water system developed by Ocna Sugatag Mayor House, however in practice people are also using wells for household needs, including drinking water, even if testing of well water is not obligatory nor performed by inhabitants.
- Farmers use the local markets in Ocna Sugatag commune, or surrounding cities: Sighetu Marmatiei, Baia Mare. Some of them take the products to capital Bucharest farmer markets. There is difficulty in accessing the

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	corporate market as the quantity of products is very low and there are no associations that place products together for selling (even if there are some initiatives, they are rather in initial stage: supermarkets start to purchase some products at county level and sell them as traditional products: meat, apples, honey) • Too centralized system where only some authorities (central and mainly local) rule the community; there are some informal leaders in rural areas (e.g. local priest in Breb) but he acts mainly at the level of education for children and less on adult representatives of community.
Transparency and trust	• Because of the small community, the bonds between the different people are very strong, which makes regulation less effective. Violations against the law are rarely reported, as families know a lot from each other and don't want to be caught on something themselves. Also local authorities and policy makers do not dare to confront people, as they need the support of the people during election times. • The river basin agency Romanian waters is responsible for making monitored data available to the public. • The data is displayed on the websites of the institutions or is provided through official requests. • There is no common database of institutions that collect information, perform analyses and participate in water quality decisions.
Coherence	• Policies do not contradict each other, but they do not complement each other either. There exist a gap in legislation.
Leadership	• At this moment leadership for improving water management process is taken by Ecologic who works collaboratively with stakeholder institutions in the region.
Inclusive participation	• Not all actors are engaged in the decision making process. Communities are informed by public consultations, however the information given is not always relevant or understandable. Communities therefore need relevant and sufficient information in order to participate in the decision making process. • Different policy areas are integrated within the action lab especially because the area is an ecotourism destination. Ecologic is monitoring the integration between multidisciplinary aspects like agriculture and environment. • The national water authority is conductive to stakeholder engagement. They, for example, organize consultations on action plans related to water basins.

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	• The voice of the farmers is low as they do not want to associate (this aspect is also due to communistic era when collectivization was imposed to farmers and lands were taken from them; even if in Maramures collectivization was done on a very limited scale, people are reluctant to associate).
Roles and responsibilities	• Responsibilities are clear at institutional level. However, more interaction between different sectoral institutions is needed. Legislation should be more integrative. Riparian forests, for example, are now managed by no one, nor by Romanian waters, nor by forestry funds. Therefore a lot of logging is taking place, causing risk of flooding.

AWARENESS AND ACTIONS	
Awareness	• Most farmers are not aware that there are some problems related to bad agricultural practices. And if they acknowledge this, they still consider it as a small problem and certainly not their individual problem.
Actions	• /

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7.3 Process

7.3.1 Representation of the process

METHODS OF CONTACT

Informing – newsletter

Exchange – bilateral conversation

Exchange – multi-actor conversation

Exchange – questionnaire/survey

Exchange – demonstration/field visit

Exchange – interactive workshop

INVOLVED ACTORS

	Action lab leader(s)	Universitatea Tehnica CLUJ-NAPOCA (UTC) Ecologic (civil society organization)
	Research	Universities Experts Students
	Farmers	Farmers of the Mara river catchment
	Farmer unions	Farmer association
	Regional/national government	EPA Maramures Directorate of Agriculture Maramures Water Directorate Maramures
	Local government	Ocna Sugatag Municipality County Council Maramures Budesti Commune
	Industry - Tourism	Tour operators Ecotourism destination Ocna Sugatag Tourism Promotion Center
	Inhabitants - consumers	Inhabitants of the villages Children Priest

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AMBITIONS

Network formation	• Support project partnerships concerning environmental improvements • Building a good network of communication between decision-makers and the local community
Exchange and continuation	• Stimulate continuation within regular operation of actors or in new project
Knowledge building	• Monitor the quality of water • Monitor the environmental impact of economic activities
Actor awareness	• Encourage the sharing of information and the integration of data • Reach farmers, county public health directorate, local/central authorities, tourism business, economical agents, retailers and consumers for increasing their awareness on the problem + change mentalities with regard to use of water resources. • Make clear the environmental and economic potential of good water quality to the industry, among which businesses working in ecotourism
Farmer practices	• Installing and demonstrating manure depositing platforms
Water provision infrastructure	• Set-up an efficient centralized sewage system • Repair non-functional wastewater treatment facilities

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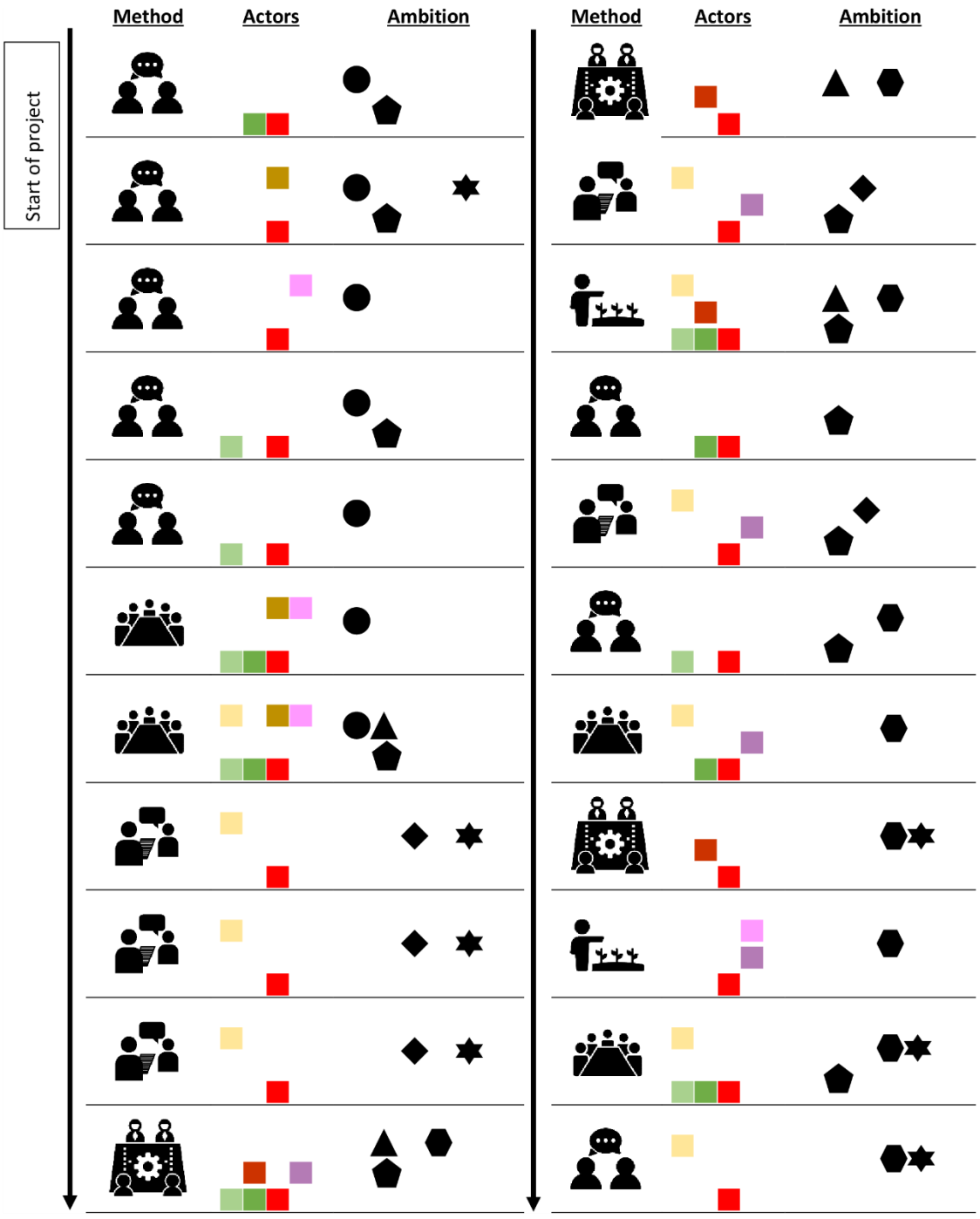
COMBINED VISUAL REPRESENTATION



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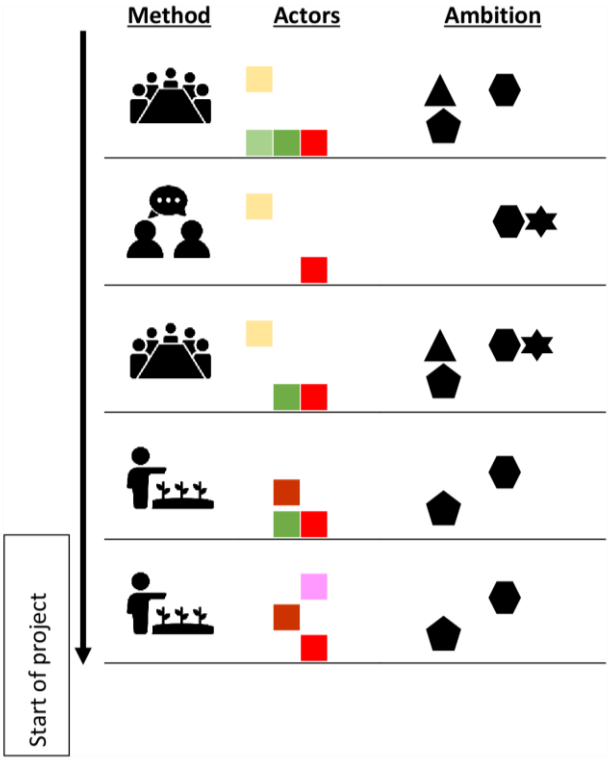

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PROCESS SUMMARIZED IN FIGURES

		METHODS				
						
		9	3	5	4	6
ACTORS INVOLVED	Action lab leader(s)	9	3	5	4	6
	Research		3		3	
	Farmers	2		5	1	5
	Farmer advisory and unions	1				2
	Regional/national government	3	1		1	4
	Local government	2	1		2	6
	Industry - tourism	1			2	2
	Inhabitants - consumers		1	2	1	1
AMBITIONS	Network formation	5				2
	Network formation	5				2
	Knowledge building			5		
	Actor awareness	3	3	1	4	4
	Farmer practices	3	1	3		2
	Water provision infrastructure	5	1	1	3	4

7.3.2 Evaluation and lessons learned of the process

METHODS

				
9	3	5	4	6

- The bilateral conversations and the multi-actor conversations were the most effective methods.
- The bilateral conversation was very important to discuss with farmers and decision makers.
- Open discussions with different actors (bilaterally or in group) resulted in insight in current situation and challenges and permitted to explore solutions for an improvement in water management in the action lab.

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	• Interactive workshops were relevant for having a good overview on what different stakeholders consider as priority top needs and challenges • Interactive workshops permitted in depth analysis of current situation and discussions on the common action plan for water quality and water management improvement at action lab level. • Interactive workshops take much time to alienate the different priorities of the different actors.
	• The surveys were interesting and brought up relevant information. • Good opportunity to see people's reaction on the monitoring results. • Good to get an overview of the existing situation in relation to water provision in Breb.
	• Demonstration field visits bring a very good insight on the current water management in the action lab, while giving the opportunity for exploring possibilities to improve the water management. • Good mechanism to share information and knowledge. • Farmers are interested in practical results. • Demonstration field visits were more costly than other methods.
	• The bilateral conversations and the multi-actor conversations were the most effective methods. • Open discussions with different actors (bilaterally or in group) resulted in gaining insight in current situation and challenges and permitted to explore solutions for an improvement in water management in the action lab. • Some actors are very busy and difficult to reach. Therefore more effort and time was needed to stimulate those individuals to attend the group meetings. • All stakeholders have different priorities and it is therefore difficult to get them in a common meeting.

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INVOLVEMENT OF ACTORS

						
ACTORS INVOLVED	Action lab leader(s)	9	3	5	4	6
	Research		3		3	
	Farmers	2		5	1	5
	Farmer advisory and unions	1				2
	Regional/national government	3	1		1	4
	Local government	2	1		2	6
	Industry - tourism	1			2	2
	Inhabitants - consumers		1	2	1	1

Farmers	• Lack of interest from farmers to participate in decision making as they lost trust in the elected leaders. • Farmers are mostly focused on their farm. However, there is interest in participating into meetings and discussing the action plan for improvement of different aspects at village level: water quality, development of ecotourism/ agro-tourism potential. • It is important to meet individually with farmers, discuss their situation and provide information on relevant issues (from administration level, to financing schemes available, etc.) in order to keep them connected to existing information from other domains and for them to find new opportunities.
All stakeholders	• Difficult to keep stakeholder along the whole process involved (maybe they participate in 1 meeting, and then they do not find the time to come to the 2nd meeting). • It is important to meet individually with important stakeholders in order to get their full support. • Stakeholders need constant information on status of process.
Consumers	• Consumers of agricultural products were not reached. However, the farmers in the action lab are not gaining that much money from selling agricultural products.
Tourists	• Tourists were already involved as they come to the area because of the traditional landscape and practices.

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7.3.3 Progress of the process, considerations and points of attention

- The actions are clear but there is still no clear role for each institution when it comes to actions.
- The scale is manageable. But being very little, it was difficult to access official data for water quality for example, as these official data are available only on larger scales.
- Having a participatory approach and involving different actors in discussions was very useful and started a fruitful cooperation. This needs to be continued. The action lab leaders considered it as the only mechanism that may result in long term solutions that bring benefits for nature and communities.
- Constant communication is needed. Adaptation and re-analysing are priority steps. Actors seem to have different views on the situation. Therefore, presenting a complete picture could bring integrated long term solutions.
- More budget is needed to implement some practical systems so that the results of those systems can be demonstrated to the farmers.
- Overcoming barriers and organizing a system that is coherent and well-coordinated requires time.
- Discussions with farmers are never easy but it is important to take the pulse of each place, to understand the situation and to listen to all parties.
- It is highly important to develop strategies and action plans based on people's needs. Therefore bottom-up approaches have to become the main instrument in community development.
- It is important to always find techniques to involve locals, to provide sufficient information and to be open to assist further.
- People were first questioned about the actions of collecting water from wells and wanted to know what action lab leaders would do with it and if the results would be accessible. However, they all gave their permission to test the samples.
- People are waiting for easy overnight solutions. However it takes time and a combination of factors to get results.

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7.4 Achievements by the WaterProtect process

7.4.1 Ambition 'network formation'

		NETWORK FORMATION				
		5				2
ACTORS INVOLVED	Action lab leader(s)	5				2
	Research					
	Farmers					1
	Farmer advisory and unions	1				2
	Regional/national government	2				2
	Local government	1				2
	Industry - tourism	1				2
	Inhabitants - consumers					

Achievements

⇨ **Support project partnerships concerning environmental improvements**

- During the project a network was established of students willing to support the research and to participate in monitoring visits in the target area.
- Trust and transparency has improved to a certain degree, and this needs to be fostered in the future as well.
- The project triggered some change in water governance because actors are aware of each other, they have better results on water monitoring, they have good view of challenges related to water management in action lab as well as some solutions for water management improvement but this process needs to be guided for the future.

⇨ **Building a good network of communication between decision-makers and the local community**

- There is a network of stakeholders participating in developing a set of recommendations for improvement of water management in the Romanian action lab. They were involved in analysing the current situation, identifying challenges and solutions and giving

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recommendations. All of these will be further on discussed in the context of the action lab as ecotourism destination, whereas some of them could be integrated especially in local action plans.

7.4.2 Ambition 'exchange and continuation'

EXCHANGE AND CONTINUATION						
			1		1	3
1ACTORS INVOLVED	Action lab leader(s)		1		1	3
	Research		1		1	
	Farmers				1	3
	Farmer advisory and unions					1
	Regional/national government		1		1	2
	Local government		1		1	3
	Industry - tourism					1
	Inhabitants - consumers		1			

Achievements

⇨ **Stimulate continuation within regular operation of actors or in new projects**

- Further investment in the project after its end will be done within the context of ecotourism destination Mara-Cosau-Creasta Cocosului. Ecologic will act as an umbrella organization for the development of ecotourism (including securing natural resources).
- The Mayor House in Ocna Sugatag wants to put in place a special department (as part of the Mayor House activity) to deal with water management systems. This (if well budgeted) could bring an improvement in the area. The department should also include several human resources that may maintain the link to other relevant parties interested in /impacted by the water quality.
- Two students are interested to continue research on water quality in the Breb area.
- Sharing of information is crucial as there may be some opportunities to take the activities further in the future.

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7.4.3 Ambition 'knowledge building'

		KNOWLEDGE BUILDING				
			1	5	1	
1ACTORS INVOLVED	Action lab leader(s)		1	5	1	
	Research		1		1	
	Farmers			5	1	
	Farmer advisory and unions					
	Regional/national government				1	
	Local government				1	
	Industry - tourism					
	Inhabitants - consumers			2		

Achievements

⇨ **Monitor the quality of water**

- In Breb village there is a potential risk of nitrate pollution for surface water and groundwater from agricultural sources (animal waste, manure) and from social sources (improperly managed waste, undersized sewerage networks, etc.). In order to determine the extent and intensity of nitrate contamination, a plan for monitoring the watercourses in the Breb Valley watershed (Breboaia) was designed. The monitoring tools were: riparian vegetation, physical chemical parameters provided in the quality standards in force in Romanian legislation (pH, oxygen regime: O2, BOD5 and nutrients: $N\text{-}NO2^{-}$, $N\text{-}NO3^{-}$) and the macroinvertebrates present in the valley. As part of the water quality monitoring in the action lab 19 sampling locations were analysed: 14 groundwater (once in 2018) and 5 surface water (3 seasonal in period 2017-2018) samples. Assessment of groundwater quality was conducted also involving school children from Breb village (local club Coconii din Breb) using specific kits for analysis of physical-chemical parameters. This participatory action helped to raise awareness on protection of drinking water resources. Groundwater quality did not exceed accepted limits in terms of nitrates contamination; surface water as well is in compliance with the environmental quality standards for nutrients, but there were some points where nitrate concentrations were higher due to existence of several

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factors: low seasonal precipitations, multiple households with animals and no manure depositing systems, etc.

⇨ **Monitor the environmental impact of economic activities**

- The influence of local economic activities was also studied in the water quality analysis, especially the impact of the tourism sector (guesthouses). There is an impact of this sector on surface water quality at this moment due to lack of a centralized sewage system; nevertheless all tourism operators do have septic tanks operated according to legislation. However if tourism activity extends in the area in the future and no measures are taken for sewage systems, water quality problems could arise.

7.4.4 Ambition 'actor awareness'

		ACTOR AWARENESS				
		6	3		3	5
1ACTORS INVOLVED	Action lab leader(s)	6	3		3	5
	Research		3		2	
	Farmers	2				5
	Farmer advisory and unions	1				1
	Regional/national government	3	1			3
	Local government		1		1	5
	Industry - tourism				2	1
	Inhabitants - consumers		1		1	1

Achievements

⇨ **Encourage the sharing of information and integration of data**

- During the project, information was shared. Stakeholders got to know each other's personal view on "how things should be done". Different types of stakeholders or sectors have different goals and perspectives.

⇨ **Reach farmers, county public health directorate, local/central authorities, tourism business, economical agents, retailers and consumers for increasing their awareness on the problem + change mentalities with regard to use of water resources**

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- Actos are aware of each other, have access to water monitoring results, have an idea of the challenges related to water management in the action labs as well as some solutions.
- 50 out of 84 farmers were already reached. These farmers start to see the problem, especially taking into account that the area is developing as an ecotourism destination.
- Participants are interested in the current state of the water quality and the possible solutions to improve the water quality in the Breb village.
- Visited stakeholders are interested in sustainable development of the area and acknowledge that there are problems related to water use.
- Municipalities want to design a special department for the water system.
- The newsletter was not very effective. The newsletter is not read by farmers, although other stakeholders (authorities) consulted it.
- Printed materials were disseminated. These materials included information on results from water monitoring and other BMP related information at local level.

⇨ **Make clear the environmental and economic potential of good water quality to the industry, especially tourism industry**

- During discussions the need for improved water management became clear, especially for the development of a continuously flourishing tourism activity in the area. Especially operators understand this, as they are dependent on water provided in a centralized manner. Low quantity and/or low quality of water will negatively impact local economy. Ocna Sugatag municipality extended centralized water system for the use of local community, because during the high tourism season (summer months june-august especially) the water consumption increases and there are insufficient water resources.

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7.4.5 Ambition 'farmer practices'

		FARMER PRACTICES				
		3	1	3		2
1ACTORS INVOLVED	Action lab leader(s)	3	1	3		2
	Research		1			
	Farmers	2		3		2
	Farmer advisory and unions	1				
	Regional/national government					1
	Local government					2
	Industry - tourism					
	Inhabitants - consumers					

Achievements

⇨ **Installing and demonstrating manure depositing platforms**

- Farmers acknowledge the need to implement manure platforms. Because of the available funding via the National Rural Development Programme (NRDP), more farmers are considering the installation of a manure platform. The associated financial costs are considered as a barrier for implementation and farmers need a guidance on how to apply for NRDP funding.
- Although less important than the economic barrier, there is also a barrier linked to low farmers' level of awareness, i.e. farmers are often not aware of the negative impact of the absence of manure storage systems in their households.
- Four farmers are willing to build manure storage platforms but discussions are ongoing.
- By the end of the project there will be an easy to use design model tool so that farmers can make a price estimation for the manure storage systems at conceptual level. By the end of the project, we target to have a model ready for a conventional platform and another easy to use platform using local materials and with lower costs, affordable for individual farmers.
- Farmers are interested in applying good practices. They know very well that water is important for securing their farm future. They started to think of small environmental

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actions that prevent water pollution: some do understand that negative impacts of manure (including bad odour) affects tourists and are willing to build with their funds some manure storage platforms; local club led by local priest organizes information campaigns on environmentally related aspects, children are very good promoters for environmental friendly behaviour; collective waste is more and more used in accommodation facilities, households. However, other people are hard to convince and they require provision of good practice examples on a longer timeframe. There is need for continuous information and awareness raising campaigns, field trips, etc. to understand the importance of good agricultural practices.

- Farmers start to speak to each other about inappropriate actions concerning water quality.
- Farmers actively approach project members to ask how they can improve management and if there are funds available.

7.4.6 Ambition 'Water provision infrastructure'

WATER PROVISION INFRASTRUCTURE

		2	1	2	3	3
1ACTORS INVOLVED	Action lab leader(s)	2	1	2	3	3
	Research		1		3	
	Farmers			2	1	3
	Farmer advisory and unions					
	Regional/national government	2	1		1	2
	Local government		1		2	3
	Industry - tourism				1	
	Inhabitants - consumers		1	2		

Achievements

⇨ **Set-up an efficient centralized sewage system, i.e. repair the non-functional wastewater treatment facility**

- There is a sewage system in Breb village, but this is not operational. Discussions with local municipality have taken place to assess what needs to be done to put the sewage system

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back into operation. They consider it as a priority to start operate the existing sewage system; however they claim there are very high costs associated to it and still there is a need to include all households to the system.

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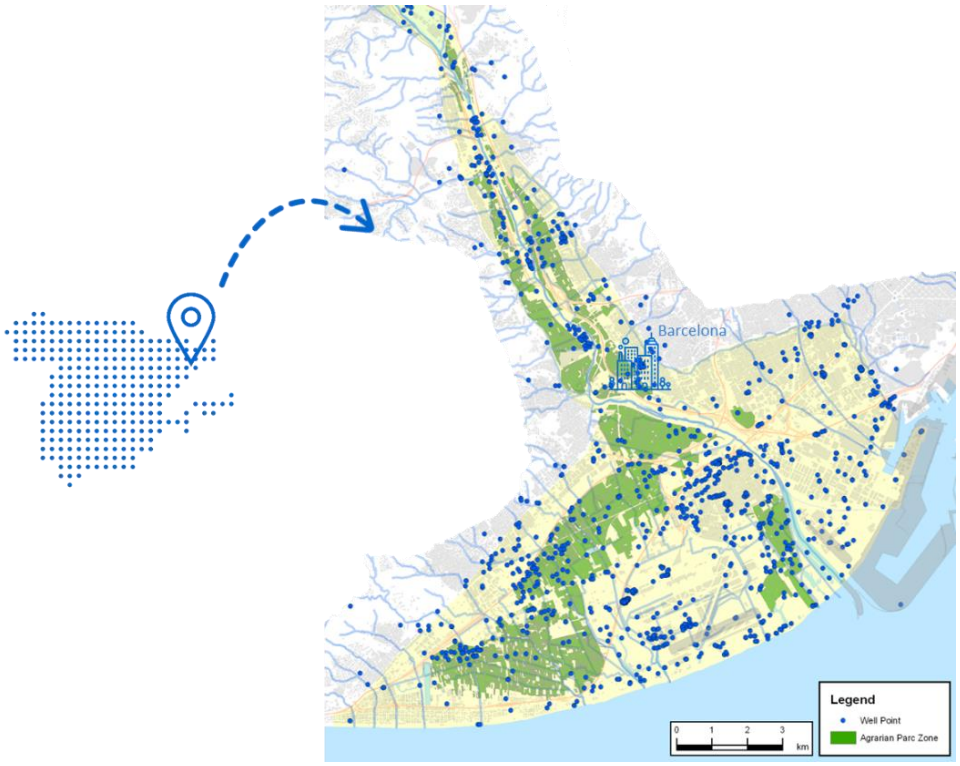
8 Spanish action lab – Lower Llobregat river

8.1 General characteristics and description of the problem



- 486 km² (Lower Llobregat River Basin)
- Urban area: metropolitan area of the city of Barcelona (29 municipalities)
- The water resources of this area are used to provide drinking water to 2,8 million people in Barcelona and its metropolitan area.
    - Surface water: Llobregat River water and Ter River water are used for drinking water production. Llobregat River water is also used for agricultural and industrial activities.
    - Groundwater from two aquifers (the Llobregat lower basin and the Llobregat basin) is used for drinking water production, agricultural and industrial activities.
    - Desalinated seawater is used for drinking water production.
    - Reclaimed water is used for cleaning purposes, agricultural and industrial activities, and to stop seawater intrusion.
- The availability of water resources fluctuates due to the Mediterranean climate (drought periods and flow peak events).
- Most of the agricultural activity is carried out in the Agrarian Park (34 km², 14 municipalities)
    - Irrigation farming
        - Irrigation channels - use of gravity-fed irrigation systems.
        - Greenhouses – pressure-based irrigation systems.

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- Irrigation close to the sea – capillarity.

- 60% orchards (artichoke, tomato, Brassica species, different lettuce plants, pumpkin, cucumber and squash, beans, onions, celery, etc.) and 40% fruit trees (peach tree, cherry tree, plum tree, apple tree and pear tree) and cereals (mainly alfalfa and corn).
- Livestock farming is limited to few chicken (with geographical indication) and sheep farms (extensive grazing).
- Types of operation:
  - Most of the activity in the Agrarian Park is carried out in family-run agricultural farms. They include 200 and 250 professional farmers that own farmland between 3 and 10 Ha.
  - There are only 5 big agricultural companies that develop their activity in areas between 30 and 50 Ha.
  - About 300 farms with an extension between 0.5-1 Ha are run by retired people and part-time farmers.
  - There are also 1000 small (80-100 m²) vegetable gardens for recreational purposes.

Pollution in focus

- Pesticides and nitrates
- Wastewater-derived organic pollutants
- Industry-derived pollutants: volatile organic compounds
- Chloride

Agricultural sources

- Agricultural drainage water ends up in the delta area and eventually in the sea.
- The impact of pollution coming from agriculture in the area of the Agrarian Parc of the Llobregat lower basin is not relevant.
- In fact, agrarian activity in the Agrarian Parc can be: a) a filter or decontaminant factor of surface water and catchment for later uses; b) a resource that helps to recharge natural groundwater in an area with very high urban pressure.

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 **Reinforcing factors on pollution**	• Climate change: potential increase of seawater level and consequential flooding of part of the Agrarian Park and effects on water quality and quantity due to more severe drought periods. • Mediterranean climate results in river flow fluctuations and drought periods. During low river flow conditions, wastewater treatment effluent discharged into the Llobregat River is not diluted, which results in increasing concentrations of pollutants in surface waters.
 **Other pollutions and pollution sources**	• All water resources are under high pollution pressure from urban and industrial activities since the area is highly urbanized and densely populated (e.g., the Llobregat River receives the effluent discharges of 63 wastewater treatment plants). • Mining activity upstream the Llobregat River is related to an increasing surface water salinity. • Overexploitation of the aquifer for different uses has led to seawater intrusion. This problem is currently managed with a hydraulic barrier created by injecting reclaimed water into the aquifer using injection wells.

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8.2 Start situation

8.2.1 The actors and their roles

Production and distribution of plant protection products

Actor type	Actor in action lab	Role
Chemical producers	/	/
Distributers of plant protection products	/	/
Actor responsible for the collection of the packaging	/	/
Representative of chemical producers	/	/
Representative of chemical distributers	/	/

Agricultural production

Actor type	Actor in action lab	Role
Family-run agricultural farms	250 farmers	Production of food in the area on farmland between 3 and 10 Ha.
Big agricultural companies	5 companies	Production of food in the area on farmland between 30 and 50 Ha.
Retired people and part-time farmers	300 farms	Production of food in the area on farmland between 0.5 and 1 Ha.
Recreational farmers	1000 small vegetable gardens	Production of food in the area in small (80-100 m2) vegetable gardens.
Farmers advisory and farmers unions	Unió de Pagesos	Protection of water resources + users of water for agriculture.

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	ADV Horta del Baix Llobregat	Farmers advisory
	ADV fruita del Baix Llobregat	Farmers advisory
Union of contract sprayers	/	/

Processing and selling food products

Actor type	Actor in action lab	Role
Processing industry	/	/
Retailers	/	/
Food trader	Mercados de abastecimiento de Barcelona, S.A (Mercabarna)	Mercabarna is a kind of food city or food hub that guarantees the food supply to the public by concentrating more than 700 companies specialised in distribution, preparation, import and export of fresh and frozen products (Mercabarna, n.d.).
	Agropecuaria GAVÀ	Agropecuaria GAVÀ is a cooperative of farmers. They provide all kind of services that farmers may need: phytosanitary products, infrastructure cleaning services, etc.

Drinking water production

Actor type	Actor in action lab	Role
Water producers and supplier of drinking water	ATLL Concessionària de la Generalitat SA	Drinking water production and supply to local drinking water management companies (e.g. Aigües de Barcelona in the area) + research.
	Aigües de Barcelona	Drinking water production and supply to Barcelona and the surrounding area + wastewater treatment + research + protection of water bodies.
	Aigües del Prat (Prat de Llobregat municipality)	Drinking water production and supply + administration.
	Aqualia (Molins de Rei municipality)	Drinking water supply

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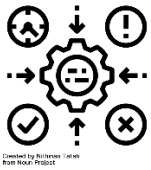
	Aigües de Sant Vicenc (Sant Vicenc municipality)	Drinking water supply
Local businesses	Trenchsalvic SL	Cleaning and repairing drinking water supply networks and irrigation networks.
Water user association	Comunitat d'Usuaris d'Aigües del Delta del Llobregat (CUADLL)	Protection of water resources + administration.
	Communitats de Regants (Canal de la Dreta and Canal de la Infanta)	Water users for agricultural activity.



Context factors and societal preferences over the entire system and all subsystems

Actor type	Actor in action lab	Role
Supranational government	/	
Regional or national government	Agencia de Salut Pública de Catalunya (ASPCAT)	Regional administration + protection of health.
	Catalan Water Agency (ACA)	ACA is a regional administration of water. Responsible to protect the water resources according to EU WFD + ensure water availability for drinking water production and other users.
	Area Metropolitana de Barcelona (AMB)	Water related infrastructures + waste water treatment + protection of water resources.
	Agriculture Department of the Catalan Government	Responsible for the revitalization of the agricultural sector.
	Public Health Secretary (PHS) (Ministry of Health of Catalonia)	Establish the guidelines and priorities in public health in accordance with the directions of the Health Plan of Catalonia.
Local government	Consell Comarcal Baix Llobregat (CC)	Administration + protection of water resources + water use for agriculture.
	Consorci Protecciò I Gestiò Espais Naturals Delta del Llobregat (CPGENDLL)	Management and protection of wetlands.

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	Consorci del Parc Agrari del Baix Llobregat (CPABLL)	Protection of water resources + administration + water use for agriculture.
	Ajuntament de Molins de Rei	Administration
	Ajuntament de Gavá (Department of Environment)	Protection of water resources + administration.
	Ajuntament del Prat de Llobregat	Drinking water production and supply + protection of water resources + administration.
	Ajuntament de Pallejà	Administration
	Ajuntament de Sant Joan Despi	Administration
Research	Escuela Superior de Agricultura de Barcelona – Universidad Politécnica de Cataluña (ESAB-UPC)	Superior Agricultural School of Barcelona - Polytechnic University of Catalonia (ESAB- UPC)
	Instituto de Diagnóstico Ambiental y Estudios del Agua – Consejo Superior de Investigaciones Científicas (IDAEA-CSIC)	The Institute of Environmental Assessment and Water Research (IDAEA) is devoted to environmental sciences and, particularly, to the study of natural and anthropogenic changes in ecosystems using chemical and geochemical techniques.
	Agricultural Machinery Unity (UMA) of the Polytechnic University of Catalonia (UMA-UPC)	Transfer and research group whose core topic is agricultural machinery, with extensive experience especially in the field of plant protection product application technology.
	University of Barcelona (UB)	Promote the consolidation of multidisciplinary teams to work in specific environmental issues and especially those related to water.
	IRTA	Research institute owned by the Government of Catalonia ascribed to the Department of Agriculture.
Civil society organisations	Associació catalana d'amics de l'Aigua	Protection of water resources
Inhabitants	/	/
Consumers	/	/

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8.2.2 Functioning of the water governance system

KNOWLEDGE	

Monitoring 	• The drinking water treatment plants (DWTPs): biological and chemical quality is monitored at the entrance and outlet of the DWTP.
	  ▪ Aigües de Barcelona (AB)
	  ▪ Aigües del Prat (APSA)
	• Port of Barcelona
	• Airport of Barcelona (AENA)
	• The Catalan Water Agency (ACA) measures the chemical quality. Data is made available through their webpage and shared with water users.
	• Agrarian Park management: Consorci del Parc Agrari del Baix Llobregat (CPABLL) measures the chemical quality of water used for irrigation.
	• Delta natural area management: Consorci per a la Protecció I la Gestió dels Espais Naturals del Delta del Llobregat (CPGENDLL) measures the chemical quality of the delta Lagoons.
	• Water users associations: Comunitat d'usuaris d'aigües de la vall baixa i del delta del riu Llobregat (CUADLL) measures the chemical quality of groundwater. They also yearly report on groundwater status.
	• Stakeholders that sporadically monitor water quality:
	  ▪ Research institutes and universities (specific pollutants and contamination events)
	  ▪ Other entities operating in the area : RENFE, Amazon, etc.
	➔ Today, as in the last decades, a high amount of data is routinely collected. There exist data regarding microbiology, physical-chemical parameters and quantity-related parameters.

MOTIVATION	
Use of the water 	• Farmers will benefit from a better quality of irrigation water because water is necessary for crop production. The better the

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		irrigation water, the better the quality and the safety of the final product. • The availability of (proper) water has an influence on the development of agriculture and the competitiveness of agricultural enterprises. It will also affect maintaining of the wetlands and the water use of urban vegetable gardens.
		• A good water quality will facilitate the water management in terms of water supply for all different users. It will increase the reuse of water and therefore contribute to the preservation of groundwater resources.
		• Safe drinking water will have a positive impact on the public health.
		• Research organisations could use other water resources instead of rainwater to irrigate experimental fields.
		• Water availability would ensure water supply for all uses all year long.
Economics		• A better quality of irrigation water will contribute to development of agricultural activity in the area.
		• The cleaner the water, the lower the treatment cost will be for the drinking water producer. Moreover, the attractiveness and acceptance of tap water will increase among consumers.
		• A good water quality ensures the safety and the quality of the final product. This is important for the economic activity of the food industry and the farmers.
Attractive and healthy environment		• When the quality of tap water increases, the acquisition of bottled water will decrease and as a consequence less solid waste will be produced. • A better water quality would improve the ecological status of the Delta lagoon and the wetlands in the area. This is important for local actors like the local government and the river basin agency.

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Political		• A good quality of water resources would facilitate the implementation of the European directive of drinking water.

INFLUENCE

Implementation of BMP's		• Farmers are responsible for the effective implementation of best management practices on farm level.
		• At regional level, ACA is in charge of taking measures to improve the water quality.
Control		• ACA is the governmental body in charge of the control and protection of water resources. • ACA is subjected to the usual controls that regulate the functioning of the public administration. In this way an efficient and transparent allocation of water-related public funds is ensured.

Economics		• Investment plans and programs:
		  ▪ to carry out research and development research projects to improve water quality and water availability and implement good agriculture practices;
		  ▪ to monitor water pollution.
		• Water dumping fee (of an authorized effluent volume): to prevent water pollution from domestic and industrial sources.
		• Water use fee: to promote an efficient use of water.
		• Water regulation fee: to pay back surface and groundwater regulating waterworks in the internal basins.
		• Subsidies on products and practices: to reduce drinking water production price and adoption of specific practices.
		• European and regional (ACA) funds. Specifically, there is a tax collected by the ACA for the use and pollution of water that must be exclusively used for the implementation of water policies.

Consultation and cooperation		• ADV Horta and ADV Fruita are in direct contact with farmers and therefore have an influence on the farmers.

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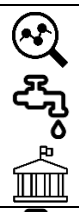
		• Inter-municipal collaborations (Aigües de Barcelona, Aigües del Prat, Amics de l'aigua): to improve the water quality and water availability. • Inter-municipal collaborations (CPGENDLL, CPABLL): to protect the wetlands.
		• Pilot studies, research and new contracts/agreements between institutions (ADVs, and ESAB-UPC, Unió Pagesos, CPABLL, ASPCAT): to reduce phytosanitary products application and apply good agricultural practices.
		• Pilot studies, research and new contracts/agreements between institutions (Aigües de Barcelona, Aigües del Prat, ACA, CUADLL, CSIC): to stop seawater intrusion by aquifer recharge.
		• Pilot studies, research and new contracts/agreements between institutions (CSIC, Aigües de Barcelona, Aigües del Prat, ATLL, ACA, CPGENDLL, ASPCAT, Mercabarna: to determine pollutants in different source waters, wastewater and drinking water and to evaluate treatments to reduce their presence.
Policy		• European level: ▪ Water supply companies analyse water intended for human consumption according to RD 140/2003 (European Directive 98/83/CE). • National and regional level: ▪ Spanish water act (adopting the Water Framework Directive): Water resource planning and sustainable management at national and regional level. ▪ Hydrological plan of the Catalonia Internal basins (river basin management plan): water resource planning and sustainable management at national and regional level. ▪ Management plan for the river basin district of Catalonia for the period 2016-2021: water resource planning at the regional level. ▪ Decree concerning the protection of aquifers in Catalonia: to control groundwater use and reduce aquifer overexploitation.

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	▪ Royal Decree 817/2015 of 11 September: criteria to monitor surface water and environmental quality standards, i.e. determination of maximum concentrations for preferential substances, other than EU priority pollutants, relevant in the Spanish territory: terbutylazine, toluene, ethylbenzene, metolachlor, etc ▪ Royal Decree 1620/2007 of 7 December: to regulate the use of treated water and to establish quality standards according to the designated use. ▪ Royal Decree 261/1996 of 16 February: to control nitrate pollution derived from agricultural sources. ▪ Royal Decree 1514/2009 of 2 October: to protect groundwater against pollution and deterioration. ▪ Royal Decree 140/2003 of 7 February: to set quality criteria for water intended for human consumption. ▪ Royal Decree 11/1995 of 28 December: to treat municipal wastewater. ▪ Royal Decree 2163/1994 of 4 November: procedure to commercialise and use phytosanitary products.

FUNCTIONING IN SYSTEM

General system context	• Agriculture has been always a relevant activity in the region. However, the surface devoted to this use has been reduced due to urban pressures. • It is important to highlight the intense subdivision of the farming land, which makes that different units of the same farm are separated long distances. • If nothing changes, the agricultural activity will be ceased in Gava-Viladecans because the products currently are not competitive on the market. The availability and quality of irrigation water will improve production in terms of quantity and quality, which in turn will increase the engagement of young people in agriculture in this area. • It is more difficult to establish quality criteria for reclaimed water than for drinking water, since reclaimed water could have different uses and thus different qualities are required.

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	• The area is composed of farms of different types and with different needs and part of the area is also environmentally protected.
	• Water scarcity is the main constraint in the Barcelona's metropolitan area, which can only be exacerbated by the foreseen impact of climate change.
	  ▪ In addition, the Catalan government has committed itself to a water transfer from the Ter river. This river contributes a relevant part of the water resources (for drinking water) that the action lab has been using for the last decades.
	  ▪ The reversal of this water transfer will lead to a more intensive use of the resources of the Llobregat Basin and will force local actors to recycle regenerated water coming from wastewater treatment plants with advanced treatments. As a result, there will be even more pressure on the optimization of water resource management.
	• There are also people who think that upper river areas also have an impact on the action lab. In that sense, treatments and water management should have an integrated view among the different territories and actors.

Transparency and trust	• There currently exist a gap in data sharing concerning research projects and non-regulated parameters. Although legislated parameters are shared among different institutions, the inclusion of research project results in a common database and open access of non-regulated parameters is still not implemented. Research data are only available through scientific publications or project reports. • Yearly, CUADLL writes a report about the status and evolution of several chemical parameters in groundwater. Users, water suppliers, farmers and Water Catalan Agency provide data for the document. • Monitoring data available to the public is data of which one is obliged to collect by the government and that is made available by ACA. • The water users association (CUADLL) organizes five meetings throughout the year to present quality and quantity data to water supply companies and farmers. Moreover, there is an annual meeting with a monographic content. • Data generated by any stakeholder are considered valid and valuable by other stakeholders.

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Coherence	• Very little overlap in interests: a potential gap is the focus that different institutions may have regarding water quality. For instance, Aigües de Barcelona is monitoring parameters that may impact drinking water quality that may be not relevant for environmental purposes or agricultural activities (i.e. compounds responsible for taste and odour problems, regulated compounds of concern for humans but unregulated according to environmental legislation, etc.). • Basin management is decentralized, ACA is fully responsible for it and ensures that it meet all EU requirements (and if any, also additional Spanish ones). • Current rules only set values for a reduced number of specific chemical substances considered dangerous for the environment and the human health, and oversee the presence of other chemicals (some of them are used to replace priority substances) and neglect the potential effect of chemical mixtures.
Leadership	• The highest leadership is taken by the Government Catalonia (ACA as river basin authority and the Health Ministry). In addition, there are specific leadership roles in the different domains: scientific, academic, NGO, water operators, municipal authorities and water user associations. Each stakeholder recognizes the leadership of the others in their specific domain of action.
Inclusive participation	• All actors related to water management (drinking water production companies, water users associations, different administrations) are engaged in the decision-making process. • There is a high level of commitment among all stakeholders. • Some actors at the regional level (ACA) or local level (research institutions) participate in the decision process of new legislation at EU level. • ACA promotes public participation for most of their activities. • The final user, the consumer of drinking water, is represented through the participating institutions, but not directly. It is almost impossible to engage them in the process, but all stakeholders take this issue into account and try to do their best also for them. • The involved stakeholders are different in nature, so it is very unlikely that any of them can force all others to a unilateral point of view.

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	• Environmental regulators hardly communicate with health authorities and both of them hardly communicate with municipalities, users or other stakeholders. • ACA will gain knowledge about the needs in order to take them into account for further planning. All the involved parties will have the opportunity of discussing and sharing goals and points of view, so learning from each other will be achieved.
Roles and responsibilities	• The responsibilities of the different actors are mostly defined by law, but there are also internal agreements (i.e. exchange of information between institutions). • The roles and responsibilities of the actors are clear, no problems detected. • In principle, there are no conflicts of interests, as all stakeholders hold different responsibilities and have complementary fields of action.

AWARENESS AND ACTIONS	
Awareness	• /
Actions	• /

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8.3 Process

8.3.1 Representation of the process

METHODS OF CONTACT

Exchange – bilateral conversation

Exchange – multi-actor conversation

Exchange – demonstration/field visit

Exchange – interactive workshop

Informing and exchange - conference

INVOLVED ACTORS

Action lab leader(s)	IDAEA-CSIC (research organization, action lab leader) AB (local drinking water company) CUADLL (local water administration) CPABLL (local government)
Research	Agricultural Machinery Unity (UMA) of the Polytechnic University of Catalonia (UMA-UPC) Higher School of Agriculture of Barcelona attached to Polytechnic University of Catalonia (ESAB-UPC) University of Barcelona (UB) IRTA - research institute of the Government of Catalonia adscribed to the Department of Agriculture) Ilersap (analytical company) Students
Farmers	Famers of the Llobregat delta catchment
Farmer advisory and unions	Unió de Pagesos (major agriculture trade union) ADV Horta (farmers advisory) ADV Fruita (farmers advisory)

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Water producers and suppliers of drinking water	ATLL Aigües d'El Prat FCC Aqualia SA
Regional/national government	Catalan Water Agency (ACA, basin water authority) Public Health Secretary (PHS) (Ministry of Health of Catalonia) Department of Agriculture, livestock, fisheries and food (Catalan government) AMB (Metropolitan area of Barcelona)
Local government	Consortium of the Delta del Llobregat Municipalities Parc Agrari del Baix Llobregat: Palleja, Sant Vicenç dels Horts, Santa Coloma de Cervelló, Sant Boi de Llobregat, El Prat de Llobreta, Viladecans, Gavà, Castelldefels, El Papiol, Molins de Rei, Sant Feliu de Llobregat, Sant Joan Despí, Cornellà de Llobregat i l'Hospitalet de Llobregat.
Food processors and distributers	Mercabarna (wholesale market for the city of Barcelona)
Inhabitants - consumers	Inhabitants of the action lab area

AMBITIONS

Network formation	• Stimulate the involvement of various actors by using the contacts already established • Stimulate the water operator AB to take op the leading role as they are very interested in sustainability and willing to promote water reuse
Exchange and continuation	• Increase confidence of actors in reused water by ensuring the required quality for irrigation water and thereby making it possible to expand the model to other areas
Knowledge building	• Identify quality needs of reused water depending on the type of agricultural production • Specific treatment and characteristics of the Water Waste Treatment Plant (WWTP) producing regenerated water
Actor awareness	• More awareness on the problem and the solutions in general
Farmer practices	• Implementing BMP's (mechanical systems against herbs, marigold plants in field margins/greenhouses, management of remnants of prohibited phytosanitary products, biological control, cleaning places for the spraying equipment, calibrated sprayer for appropriate and optimized application, clean water

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		loading points for application machines, solutions for cleaning of treatment tanks, introduction of mycorrhiza to the roots for better use of nitrogen) • Adapt plantation frames depending on the quality of regenerated water the system could ensure
✖	**Sanitation safety plan**	• Set-up a sanitation safety plan for continuously ensuring the quality of reused water for irrigation based on the WHO concept of Sanitation Safety Plans

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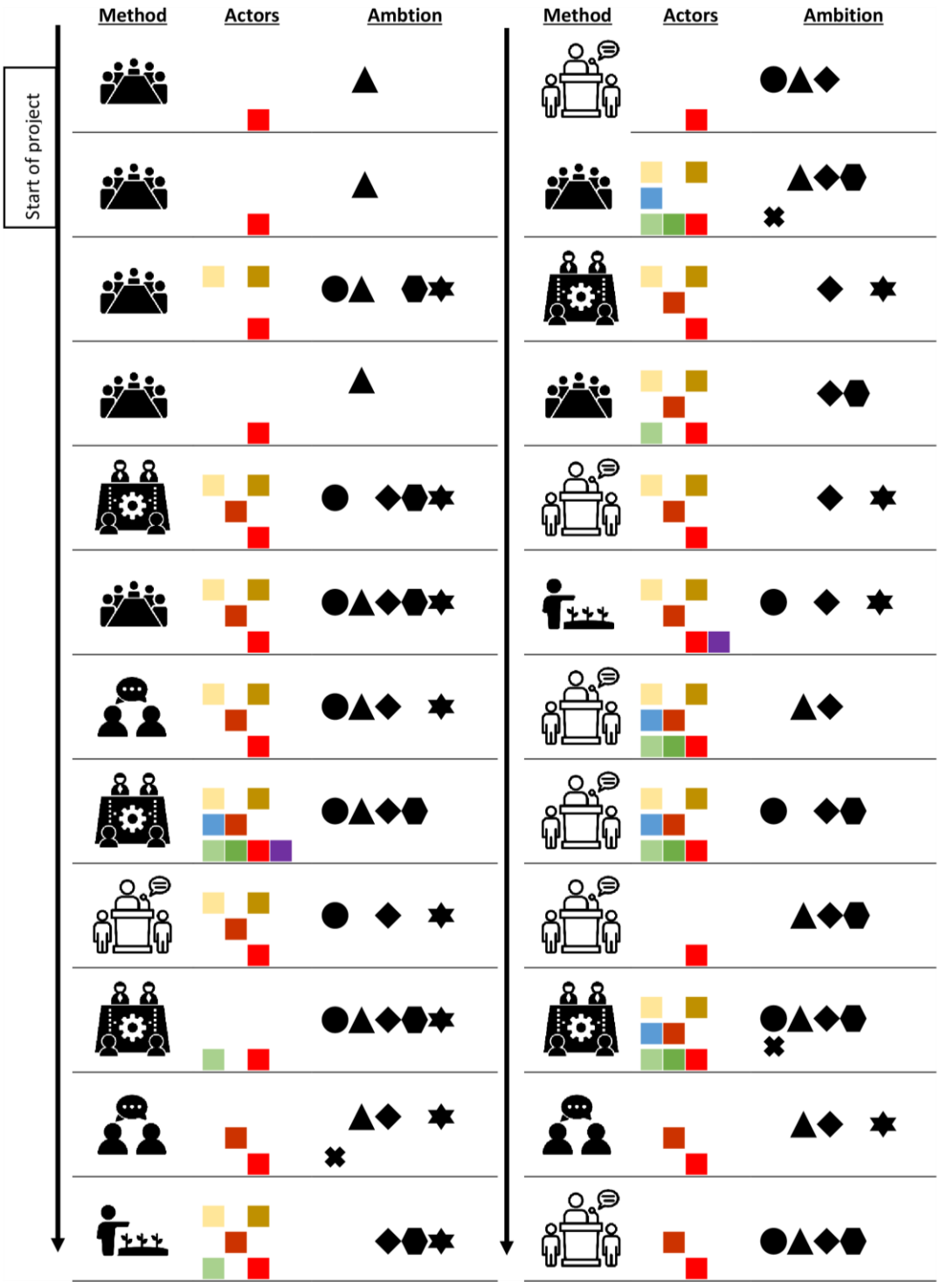
COMBINED VISUAL REPRESENTATION



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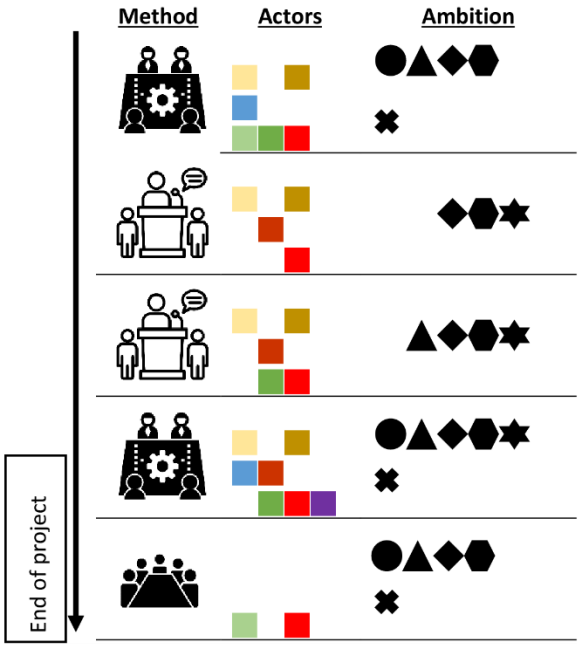

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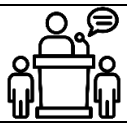
PROCESS SUMMARIZED IN FIGURES

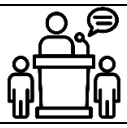
		METHODS				
						
		3	9	7	2	8
ACTORS INVOVLED	Action lab leader(s)	3	9	7	2	8
	Farmers	1	6	6	2	4
	Farmer advisory and unions	1	6	6	2	4
	Drinking water industry		2	4		1
	Food processors and distributers			1	1	
	Regional/national government		2	4	1	3
	Local government		3	4		1
	Research	3	7	5	2	2
AMBITIONS	Network formation	1	4	6	1	3
	Exchange and continuation	3	5	5		7
	Knowledge building	3	9	7	2	4
	Actor awareness		5	6	1	5
	Farmer practices	3	4	4	2	2
	Sanitation safety plan	1		3		2

8.3.2 Evaluation and lessons learned of the process

METHODS

				
3	9	7	2	8

- Bilateral conversations were successful when an actor needed to clarify or explain something to a specific public.
- Very helpful when one of the actors needed to obtain information on specific activities/uses of different actors in the action lab. This was the case for the survey of famers on BMP's and the survey of all water actors on quality and governance.
- Highly time consuming.



- Enables project actions and results to be visualized, knowledge sharing and networking.

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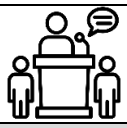
- To share knowledge and experiences on water management in the current context of climate change and water scarcity.

- Most efficient method to involve different actors (farmers and their organizations, environmental and regional regulators, municipalities, etc.).
- Made it possible to bring together different actors with very specific objectives. Sometimes, conflicts were discussed and resolved in consultation with the involved stakeholders.
- Good method to create innovative ideas.
- Enables discussions about the possible and desired governance strategies or about the roles that actors could play in governing the water quality problem.
- Time needs to be considered. Most of the stakeholders won't come to a discussions that takes hours. However, too little time for in-depth discussions isn't good either.

- Demonstration-field visits were good to put into practice different methodologies and to show farmers how can they adopt BMP's into their work without big efforts. Action lab leaders think that demonstrations are essential to prove the benefits of a specific BMP to the farmers in real-life settings.
- Farmers had the opportunity to test the tools in situ. The usual commercial fairs only exhibit tools without the possibility to test them.

- Allowed the evaluation of current water governance and agricultural practices in the action lab and the identification of new ways to improve them.
- Discussion is good for mutual understanding and consensus. Famers' priorities are not the same as researchers or environmentalists' priorities.

INVOLVEMENT OF ACTORS

						
ACTORS INVOVLED	Action lab leader(s)	3	9	7	2	8
	Farmers	1	6	6	2	4
	Farmer advisory and unions	1	6	6	2	4
	Drinking water industry		2	4		1
	Food processors and distributers			1	1	
	Regional/national government		2	4	1	3
	Local government		3	4		1
	Research	3	7	5	2	2

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Farmers	• Lever to involve farmers: more and more farmers are currently aware of the problem of water contamination and of the fact that they can apply BMP's so that their activity interfere less with the environment. • Barrier to involve farmers: farmers think they have limited influence on water governance in the area. They think that they can only give their opinion and that it is very difficult to change the current situation. • Perhaps farmers were not reached soon enough. If they would have been reached at the start of the project, their implication could have been greater. • There were some time constraints as farmers had to participate after finishing their daily work. • The fact of bringing together different actors in multi-actor events contributed to an increased trust of the farmers in water authorities. • The historic relationship of more than twenty years between ADV's (farmers counsellors) and farmers results in a high confidence level among these actors. ADV's work in close contact with farmers and with the Consorci Parc Agrari, and because of this, they know the farming activities in the area very well. This is of high importance in order to promote the implementation BMP's according to the needs and possibilities of the farm/farmer.
Regional/ national government	• The Public Health Secretary (PHS), Ministry of Health of Catalonia and the ACA proved to be important actors to involve. • The fact of bringing together different actors in multi-actor events increased trust of the farmers in water authorities.
Consumers	• Participation of end users is hardly achieved.

8.3.3 Progress of the process, considerations and points of attention

- It would have been very helpful that ACA (the Catalan Water Agency, which is the main water authority at regional level) had been part of WaterProtect project because many decisions on water governance depended on them. However, they were reached during the progress of the project and were keen on getting involved.
- A strong point in the project has been the different profiles and roles of the participating partners and stakeholders, the exploitation and expansion of the existing relationships between them and the commitment and interest shown by all of them in the project and its objectives.
- Much remains to be done to solve problems and resolve conflicts between the different actors and their respective interests and jurisdictional boundaries.

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- The catchment scale is the appropriate scale to reflect local conditions and bring together the different actors. This is also a perfect scale to have a functional entity, where activities such as monitoring, involving stakeholders, identifying the causes of pollution, etc. can be realised.
- Training of farmers on BMP's required funding. Trainings had to be done under contract.
- BMP promotion workshops have to be repeated on a regular basis in order to make farmers implement those BMP's in their agricultural practices.
- Actors from universities considered that the experiments should be done with a larger number of replicates and that other aspects that could contribute to its scientific value/reliability should also be taken into account. However, ADV's explained that the human resources at their disposal do not allow doing that. They prefer to perform experiments that give practical information about the different crops and also do not intend to publish the studies in a scientific way.

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8.4 Achievements by the WaterProtect process

8.4.1 Ambition 'network formation'

		NETWORK FORMATION				
		1	4	6	1	3
ACTORS INVOLVED	Action lab leader(s)	1	4	6	1	3
	Farmers	1	2	5	1	2
	Farmer advisory and unions	1	2	5	1	2
	Drinking water industry		1	4		
	Food processors and distributers			2	1	
	Regional/national government		1	5		1
	Local government		1	3		
	Research	1	3	4	1	1

Achievements

⇨ **Stimulate the involvement of various actors by using the contacts already established**

- We think that WaterProtect has allowed a better relationship between different stakeholders in the Baix Llobregat area.
- The network has improved considerably in number as the attitude and willingness to collaborate of all stakeholders increased also.

⇨ **Stimulate the water operator AB to take op the leading role as they are very interested in sustainability and willing to promote water reuse**

- ACA has to manage water in the total Catalan territory and thus they may not act well as a leader for the small area of the action lab. Because of this, action lab leaders think that another actor specific to this territory, for instance, Area Metropolitana de Barcelona, should take the lead on this. Area Metropolitana will be part of the consortium from March 2020 onwards. It seems that they will be able to take the lead in the management of irrigation and drainage water in the Llobregat basin.

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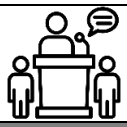
8.4.2 Ambition 'exchange and continuation'

EXCHANGE AND CONTINUATION						
						
		3	5	5		7
ACTORS INVOLVED	Action lab leader(s)	3	5	5		7
	Farmers	1	2	4		3
	Farmer advisory and unions	1	2	4		3
	Drinking water industry		1	4		1
	Food processors and distributers			2		
	Regional/national government		1	4		2
	Local government		2	4		1
	Research	3	3	3		1

Achievements

⇨ **Increase confidence of actors in reused water by ensuring the required quality for irrigation water and thereby making it possible to expand the model to other areas**

- All actors agreed on the need of optimizing the use of water in agriculture, increasing water reuse in the Baix llobregat and improving the quality of regenerated water.
- Multi-actor conversations were organized to discuss possible and desired governance strategies.
- There are still things that need to be done to make and improve the governance and the quality of the water in the action lab. This work needs to be followed after WaterProtect has finished.
- Through the multi-actor meetings undertaken, action lab leaders increased their knowledge on the activities of the different actors in the action lab. Moreover, they became aware of the willingness of these actors to cooperate in the future in order to achieve common objectives.

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8.4.3 Ambition 'knowledge building'

		KNOWLEDGE BUILDING				
		3	9	7	2	4
ACTORS INVOLVED	Action lab leader(s)	3	9	7	2	4
	Farmers	1	6	6	2	3
	Farmer advisory and unions	1	6	6	2	3
	Drinking water industry		2	4		1
	Food processors and distributers			2	1	
	Regional/national government		2	4	1	3
	Local government		3	4		1
	Research	3	7	5	2	2

Achievements

⇨ **Identify quality needs of reused water depending on the type of agricultural production**

- It has been determined what the quality of water regenerated for agricultural use should be in conductivity, pH, metals and microbiological parameters.

⇨ **Specific treatment and characteristics of the Water Waste Treatment Plant (WWTP) producing regenerated water**

- Action lab leaders are working hard to determine what the protocol should look like within the Sanitation Safety Plan. This work is still in progress.

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8.4.4 Ambition 'actor awareness'

		ACTOR AWARENESS				
			5	6	1	5
ACTORS INVOLVED	Action lab leader(s)		5	6	1	5
	Farmers		3	5	1	4
	Farmer advisory and unions		3	5	1	4
	Drinking water industry		1	4		1
	Food processors and distributers			2		
	Regional/national government		1	4	1	3
	Local government		2	4		1
	Research		4	4	1	2

Achievements

⇨ **More awareness on the problem and solutions in general**

- Improved knowledge of the area and the data available to users regarding water quality.
- Free access to data on the physical-chemical status of local water resources. These data sources are also easy to consult by farmers (on internet access).
- All stakeholders (health, agriculture, water and civil administrations, farmers, water users and research centres) are more acquainted and involved in the various issues of water quality and use in the area.
- Increased awareness of the need to develop and participate in an integrated water management system.
- The newsletter: successful as a unidirectional communication system to all public interested in the project progress and results. Approximately 50 to 70 newsletters with project conclusions were send to the public.
- A very important success is the launch of GISEL as a program that stores all data about the quality and quantity of water from several sources: groundwater, surface water and supply water. These data are available to all water users.
- Conferences made it possible to share knowledge and experiences on water management in the current context of climate change and water scarcity.

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- More and more farmers are currently aware of the problem of water contamination and of the fact that they can apply best agricultural management practices so that their activity interfere less with the environment.

8.4.5 Ambition 'farmer practices'

		FARMER PRACTICES				
		3	4	4	2	2
ACTORS INVOLVED	Action lab leader(s)	3	4	4	2	2
	Farmers	1	4	3	2	2
	Farmer advisory and unions	1	4	3	2	2
	Drinking water industry			1		
	Food processors and distributers			1	1	
	Regional/national government			1	1	
	Local government		1	1		
	Research	3	4	3	2	1

Achievements

⇨ **Implementing BMP's (mechanical systems against herbs, marigold plants in field margins/greenhouses, management of remnants of prohibited phytosanitary products, biological control, cleaning places for the spraying equipment, calibrated sprayer for appropriate and optimized application, clean water loading points for application machines, solutions for cleaning of treatment tanks)**

- Farmers are motivated to start implementing the techniques for biological control of pests in their crops. They see this practice as an alternative tool to fight agricultural pests, given the banning of efficient phytosanitary products or the low effectiveness of newly introduced phytosanitary products. For example: farmers can use marigold plants on the margins of their fields, which could be a useful help in pest control.
- Biological control: farmers had the possibility to talk to an expert who has been working with these techniques for a long time and is achieving good results with it.
- Farmers could see the products of biological control in situ. They received information about pest cycles and they were showed how to use the alternative biological techniques.

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- Action lab leaders are looking for solutions to create shared loading and cleaning points, distributed in the territory.
- Farmers that attended the meetings were very surprised of the product yield of the experimental fields where almost no fertilizers were applied, but where mycorrhizas were used instead.
- By virtue of the ADV's (farmers counsellors), the Consorci Parc Agrari Baix Llobregat and the universities in the area work is being done to implement best management practices.

⇨ **Adapt plantation frames depending on the quality of regenerated water the system could ensure**

- The crops adaptation is something progressive. Historically, farmers have already made adjustments to low quality water. From now on farmers will be able to improve the productivity of their crops by improving water quality.
- The proposed adaptations will depend of each farmer and his/her decisions.

8.4.6 Ambition 'sanitation safety plan'

✖ SANITATION SAFETY PLAN						
						
		1		3		2
ACTORS INVOLVED	Action lab leader(s)	1		3		2
	Farmers			3		1
	Farmer advisory and unions			3		1
	Drinking water industry			3		1
	Food processors and distributers			1		
	Regional/national government			3		2
	Local government			2		1
	Research	1		2		

Achievements

⇨ **Set-up a Sanitation Safety Plan for continuously ensuring the quality of reused water for irrigation based on the WHO concept of Sanitation Safety Plans**

- The plan is in process to be accepted by ACA. It will involve changes in the work processes of treatment plants and it takes time to do so.

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9 Conclusion

This report gives a structured overview of the different steps the action labs have taken to analyse and improve the local governance situation in their action lab. By doing so, they tried to establish a long-term cooperation between the relevant stakeholders, which fosters the effective uptake and realisation of management practices and mitigation measures to protect drinking water resources.

In order to draw conclusions and formulate some lessons learned, a cross-comparison between the action labs now has to be performed. This will allow to designate explanatory characteristics, i.e. context factors and action lab characteristics that might have an important influence on the functioning of the governance system and thus the water quality in the action labs. Also the experiences of the action labs with the different contact methods will be compared and assessed. All these insights will be bundled in Deliverable 2.4, which will serve as a guide or manual for managers of water catchments willing to work on the water quality in an environmentally and socially sustainable way.

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