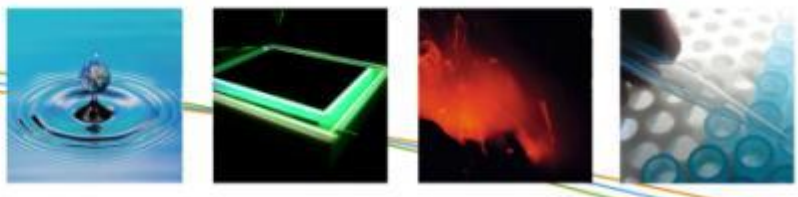
WATERPROTECT

D6.1 Complete comparative case study assessment:

mapping existing cases

water management systems

WaterProtect Action Labs



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1.0	29/06/2018	Initial version
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3.0	31/08/2018	Revised chapter on comparative assessment
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Public Report

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Preface

High-quality, safe, and sufficient drinking water is essential for life: we use it for drinking, food preparation and cleaning. Agriculture is the biggest source of pesticides and nitrate pollution in European fresh waters.

In May 2017, a European consortium started the EU project 'WATERPROTECT', supported by the European Commission Horizon 2020 program (Grant Agreement no. 727450).

The overarching objective of WATERPROTECT is to contribute to effective uptake and realisation of management practices and mitigation measures to protect drinking water resources. Therefore, WATERPROTECT will create an integrative multi-actor participatory framework including innovative instruments that enable actors to monitor, to finance and to effectively implement management practices and measures for the protection of water sources.

In close cooperation with actors in the field, at local and EU level, WATERPROTECT will develop innovative water governance models investigating alternative pathways from focusing on the 'costs of water treatment' to 'rewarding water quality delivering farming systems'. Water governance structures will be built upon cost-efficiency analysis related to mitigation and cost-benefit analysis for society and will be supported by spatially explicit GIS analyses and predictive models that account for temporal and spatial scaling issues. The outcome will be improved participatory methods and public policy instruments to protect drinking water resources.

WATERPROTECT Work package 6: Upscaling to EU

Upscaling the results and outputs of the WaterProtect project to European level will be critical to ensure the exploitation of the solutions identified. In order to facilitate this, the information needs to be applicable and communicable to potential end users at regional level. This work package starts by setting the stage and exploring the playing field in terms of how stakeholders in Europe are adapting farming systems to ensure sustainable water management. Linking WaterProtect results to other best examples and using that information in the broader communication and dissemination of the project, will allow the project to have greater impact.

A thorough comparison of the results and the process in the different case studies will provide important insights into good governance strategies that work and can help improve water quality in other EU regions. The project will upscale the lessons learned to other areas of Europe via a blend of direct knowledge share through participatory and facilitated workshops and more broad information dissemination targeting relevant/interested stakeholders that will be identified during the project lifespan.

The goal of this report is to learn from other examples of best practices in terms of water quality protection. It is a non-exhaustive desk study categorizing existing, parallel case studies, projects, tools and initiatives throughout Europe. The report – deliverable 6.1 of the Water protect project - is executed relatively early in the project, to serve as input for the next steps of WATERPROTECT.

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T. Vereijken, rapporteur

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Executive Summary

In 2013 the European Commission, 13 years after the introduction of the Water Framework Directive in 2000, published 'A Water Blueprint for Europe'. The purpose of this review was to define if additional European Regulation was required to face future water challenges in Europe. It also describes the status of the quality of Europe's Waters in 2013.

While the Blueprint concludes that Europe's legal water regulation system is fit to face Europe's future's challenges - including Climate Change - it is much less positive on the development of the water quality in Europe:

- Unless stronger action is taken, 47% of EU surface water will not meet good ecological status by the deadline;
- There is still a great deal of uncertainty related to the chemical status of surface waters due to information gaps;
- About 25 % of ground waterbodies are still expected to suffer from poor chemical status;
- 60 % of European cities over-exploit their groundwater resources, and
- 50 % of wetlands are endangered.

According to the 'Blueprint' stronger action is needed for Europe's water. Indeed, society is increasingly initiating regional activities bottom-up, to improve water quality. Often, regional authorities do respond to initiatives with supporting actions and/or additional policies. This trend, observed in the field of 'Agriculture and Water' can also be observed for other sectors. Examples can be found on 'Health and Water' (specifically on antibiotics and medicines-residuals) and on 'Waste and Water' (for instance with regards to micro plastics).

This report brings together 16 European Case Studies in Agriculture and aims to build a comparative assessment of the case study findings, and to inspire the seven so-called Action Labs in WaterProtect. All case study descriptions are reported in the same way, to allow for easy comparison between the cases, with specific attention given to:

- Water Governance
- Best Management Practices
- Participatory Monitoring
- Collaborative Management Tools

Section 1 of the report presents a description of the Action Labs in WaterProtect. These Action Labs build on the results of European case-studies, of which a selection of 16 case studies is presented in Section 2. Many more example cases exist in Europe, and many other projects are currently initiated, which will be providing input to WaterProtect on an ongoing basis. It is valuable to bring them together, to share the experiences, and develop learning curves towards successful approaches. In this report we have gathered different approaches, without applying a selective rating system nor using success-criteria. The templates used are annexed in Appendix 1 and 2.

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Comparative Case Study Assessment

General observations

The case studies described all created a significant added value to their stakeholders: information exchanged, results found, and approaches developed were of very significant value to the stakeholders. Most case studies experienced unanticipated delays in their execution due to for example, cultural differences, the time required for the alignment of goals and working methods, budgetary constraints, (missing) scientific input, reporting issues. This is understandable: on top of challenges seen within 'normal' projects, these case studies must deal with additional complexities, such as social aspects, the proper definition of the situation at the start, and a proper evaluation of (unexpected) effects observed.

Methodology

The table below presents the case studies in relation to the environmental concerns addressed, based on three categories:

- Case studies focussing on the role and management of pesticides,
- Case studies focussing on the loss of nutrients into water,
- Case studies with a focus on other topics, such as multi-sectorial cooperation or management experiences.

	Case Study	Pesticides	Nutrients	Other
1	EWS One year pilot project Cyprus			√
2	Sol et Eau en Segala, France			√
3	UK Freshwater Partnership, Norfolk, UK.			√
4	Evian Naturel Mineral Water (NMW1), France	√	√	√
5	Henniez Natural Mineral Water NMW2, France		√	
6	Waldquelle, Urguelle, Naturquelle NMW3, Austria	√		√
7	CVBB, Belgium		√	
8	Water Monitoring Project Grote Kemmelbeek (GKB), Belgium	√		
9	Cicindria catchment, Sint-Truiden Belgium	√		
10	High natural value farming in Maramures, Romania			√
11	Life ArtWet Project, Italy	√		
12	V.I.V.A. Project – VIVA "Sustainability and Culture", Italy			√
13	Action plan Soil & Water – Flevoland, The Netherlands	√	√	√
14	West Cork, Ireland		√	
15	Groundwater collaboration, Aalborg, Denmark	√	√	
16	Oddderbær Watershed - Odderbæk Steam Association, Denmark			√

Table: *Overview of environmental concerns addressed for each case study*

The case studies represent a broad spectrum of activities. While some case studies describe the specific impact and management of pesticides, other cases broadly focus on the impact of agricultural practices to find other ways of resource management and cooperation.

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Lessons learned

The case studies have the following main targets in common:

- Prevention of the impact of human action in agriculture,
- Definition of impacts and water related risks,
- Development of mitigation measures,
- Emphasis on nitrates, crop protection residuals, water system stability, awareness,
- Development of simple on-site treatment technologies.

Some case studies have a very exploratory nature, created to answer questions such as:

- How is the exact water situation in our area?
- What are influencing factors?
- How can we cooperate to mitigate the risks?

Others have very clear but broad targets, such as a goal to increase biodiversity. All have one result in common - the need to continue and expand the actions. There is also a common need to measure and monitor catchments much more intensively because causal data is lacking – and evidence is needed to demonstrate the added value of technical and non-technical measures.

All studies actively involve farmers, and involve them at the farm level. In addition, multiple stakeholders are involved: chain partners, local authorities (mayors), regional authorities and some case studies involve national legislative authorities. Commonly, NGOs and Research organisations are part of the network. Case studies with a high impact have clear leadership, often an industry. The chemical and the beverage sectors are amongst the first movers in these types of case studies. Civil society - although being a recognised stakeholder - is not usually seen as being an active participant. They could be very useful in dissemination and acceptance of results and measures found.

The platforms formed by the case studies do not have a very strict formal setting. A core group might have a contractual arrangement amongst themselves, but the involvement of the other parties is usually more informal. This could be a recommendation: to use more define roles. This could lead to more concrete and even richer results and deliverables from the case.

Governance Pillars

Work package 2 of WaterProtect covers the Governance System. Based on an extensive inventory, six pillars have been identified in WP2 as important building blocks for a well-functioning governance system. These building blocks are:

1. Clear roles and responsibilities allocated
2. A leadership role identified
3. Transparency
4. Stakeholder engagement
5. Coherence
6. Appropriate scale of the project

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The case studies presented support that these building blocks are indeed important elements for good governance and effective operation of the case. In cases where a building block is not properly addressed, system failures are reported, which is slowing down progress.

For instance: in absence of a clear leadership (2), more coordination costs can be observed. Another example is: the lack of transparency (3) can cause a lack of trust. Trust is essential, for instance for meaningful interpretation of field data monitored.

The building blocks are therefore important elements of the whole governance system, which WaterProtect will further develop.

Best Management Practices (BMP's)

Broad experiences in the case studies have led to a series of suggested 'best management practices'. They can be distinguished between (management-) processes, methods, exploratory measures on the one hand and technical, hands-on practical measures at the other. Both types of BMP's are needed.

Examples of technical measures, reported by case studies:

- *Track surfacing and drains, gate relocation, water course fencing, sediment ponds and traps, pesticide handling facilities, financial support (Norfolk, UK)*
- *Tackle direct discharges; fertilisation strategy/plan, incl. fractional fertilisation (CVBB)*
- *High resolution monitoring gives accurate, high quality model. Grass filter strips, conservation tillage; micro-dam technology; green cover crops; drift reduction nozzels; buffer zones; bioremediation systems; filling area with biobed (GBK)*
- *Bentonite concrete platforms*
- *Biopurification system (Biomass bed); water footprint applied (Artwet)*

Examples of (management-) processes, methods, and exploratory measures:

- *Identification of sensitive areas (Cyprus)*
- *Engaging river basin authorities, educating local citizens, monitoring info as basis for discussion (Sol et Eau)*
- *Establish stakeholder association; understand local water cycle; integral water cycle approach, subsidies, manure collection, better environmental management of sources (Evian)*
- *Prohibition of agriculture in most important zones; promotion of organic farming; reconition of farmers needs, create benefits fort their business (Henniez)*
- *Better understanding to define protection zones; monitor farmers on their obligations (Waldquelle)*
- *Certification combined with measurements and analysis (Soil & Water)*

Participatory Monitoring

For effective participatory monitoring, awareness rising before the monitoring starts seems to be a vital element for success. In one case (Cyprus) a participative farming group model was tested, to include farmers in river basin management activities, and to prove the benefits of monitoring to them. As a result, farmers reported an increase in awareness towards sustainable water management. On the basis of this, they have been working to develop and implement a 'joint response strategy' on water management. These response strategies included a clear set of

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procedures, also to handle accidents related to spills or miss-use of inputs. Another group was able to identify several additional actions for implementation to minimize their joint water quality risks.

While some group members already had a comprehensive understanding of the types of polluting substances used on-site, as a next step they worked to establish records to indicate the number and volume of applications in order to understand the potential for diffuse pollution. They also classified the substances used on-site according to the Priority Substances list of the Water Framework Directive in order to have a better understanding of the potential for aquatic pollution. In addition, they also started to analyse and monitor the quality of water used for irrigation in order to exclude accumulation of substances due to recycling.

Authorities when overseeing the monitoring activities have a very positive effect on the success and impact of the monitoring efforts. More cases report the extension of the monitoring scope because of the involvement of authorities.

Monitoring results are commonly shared with the farmers at information meetings, and results are sent by mail to the farmers who have indicated to be interested. Data sharing is considered an essential element as well. Several forms of data sharing have been observed: periodic monitoring and reporting, results published (realtime) on the organization's website, etc. One quote from Case 5 is typical: *"More holistically, we plan to gather all key data around water resources, water balance and water challenges in the format of a 3D block diagram that will be shared with local stakeholders everywhere we operate".*

In Case 13, all events are registered and reported via a dedicated website, but also shared at the highest level of the Water authorities (i.e. Board level), and within the farmers' communities. There are active exchanges between regional initiatives alike, sometimes resulting in joint national events. This increases the value of monitoring results enormously, and their broadened use for policy development, accreditation, reward schemes, investment decisions, etc. becomes more evident. Results are even used to determine a fertilisation strategy for the catchment (Case 7). Frequent visits of Eco-specialists to the farms were reported to be extremely useful, and have become structural in some cases (Case 10). As can be learned from case 16, observations in relation to mammals and birds is a useful form of participatory monitoring. For instance, the effect of sand traps have been monitored successfully in collaboration with Denmark's Fiskeriundersøgelse.

Collaborative Management Tools

The use of collaborative management tools is not yet a common practice in the cases reported. In two cases, the EWS Water Stewardship Standard is seen as a useful collaborative tool to harmonize the actions of farmers on overall goals set forth by water authorities in the basin. A stewardship guideline specifically developed for agricultural purposes would be a useful tool.

Other tools include:

- (web based) platforms for knowledge exchange created by the group members;
- a five-point vision for restoration objectives (case 3)
- software (case 4: "The APIEME is an effective collaborative management tool").
- Teagsc and ACP have even developed an online nutrient management tool (Case 14).
- In one case (16) , the 'Landscape Strategy' is mentioned a useful tool to develop joint action.

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Real time monitoring is used in Case 13, to create evidence and responses when water quality issues arise. It also increases the awareness amongst citizens, who in turn also respond and get active in their own environment as well (using less microplastics, keep medicin residuals in-house, etc.).

All case studies have broadly reported on their lessons learned. A selection of experiences is here:

*"The project highlighted that the contribution and dedication of a **group of farmers** to improve water management in the river basin **is far more effective** than single farmer implementation."*

*"Farmers typically want to receive coherent and exhaustive **training** on the content, the requirements and overall objectives."*

*"Farmers can **prioritize their actions for water quality** protection by identifying vulnerable areas at the farm and estimate the impact on potential destinations."*

*"Involvement of **authorities provide a driver** for the project."*

***"** Wider **community involvement** has also contributed to the long-term success of the case study."*

*"As **long-term financing is essential** to the successful collaboration in this case study, a key element has been linking activities in the catchment (the impact of beet farming) to corporate sustainability goals to help ensure diverse funding sources."*

***"**Success is achieved by applying a comprehensive and **integrated approach** to all interests and actions in the catchment linked to water management and protection, and mutual economic and social benefit."*

*"Water **Stewardship** is the most effective path for sustainable water management."*

*"Robust measurement **network** is essential to minimize fluctuations of results."*

*"**Direct communication** to farmers is having a large impact."*

*"The voice of the farmers in Maramures has been heard by the representatives of the most important **decision making institutions** in rural environment in Romania."*

*"Furthermore, communication of the results and the formation of end users (farmers), using a basic and **comprensible language** is mandatory."*

*"It is required to understand the processes and drivers of nutrient loss for a targeted and efficient mitigation strategie. Win-win situations improve the uptake of measures. Some "**easy wins**" have been identified that could improve water quality with small resources."*

*"It is a challenge to monitor the efficiency of current measures when the **weather patterns** are changing. An intensified weather over the catchment has influenced the water quality."*

***"Declaration**s are an effective measure to ensure future protection of groundwater as compared to management agreements restricted to short term periods."*

***"Education is an extremely important** element, to learn the farmers and others involved how watermanagement can be an integral part of the farmer's daily work, and that his impact on water quality is actually very large."*

*"Strong and **committed leadership** is neccesary."*

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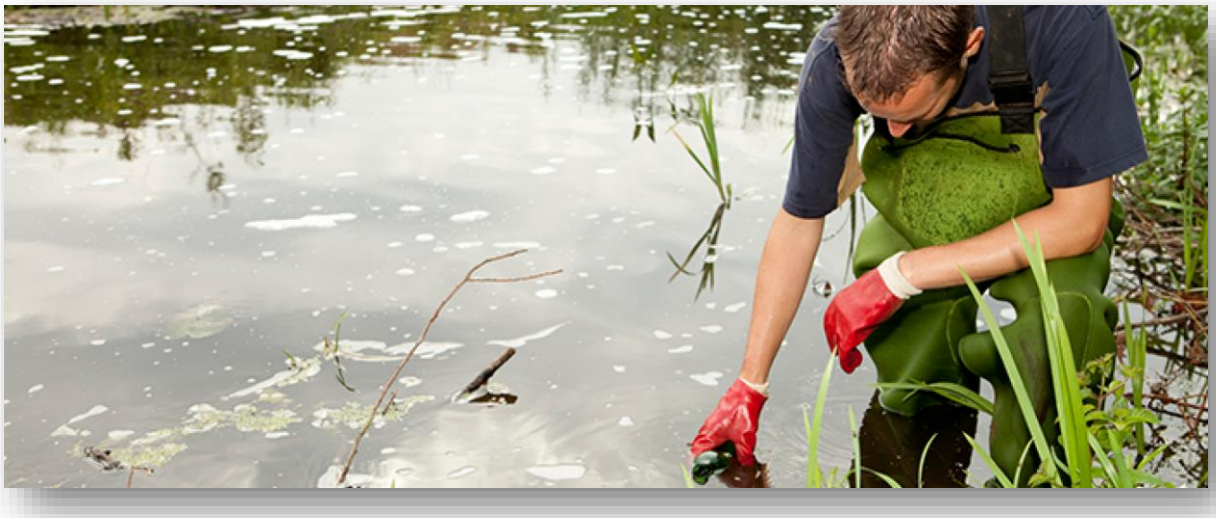
Section 1: Action labs



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1. Action lab Bollaertbeek Catchment Belgium

1.1 Description of the context:

The Belgian case study is the Bollaertbeek catchment. This study area has a surface of 22.6 km². It includes the villages Voormezele and Wijtschate and parts of the village Kemmel and the city Ieper. The Bollaertbeek catchment has a mainly agricultural land-use (81%). There are 167 farmers in the study area.

The Bollaertbeek catchment is part of the surface water capturing area of the drinking water production company 'De Watergroep'. They take water at the outlet of the Bollaertbeek catchment to produce drinking water. There are several water quality problems in the Bollaertbeek catchment, but in the WaterProtect project we focus on Plant Protection Products.

1.2 What is action lab trying to achieve within the project timeframe:

The main objective in this project is to achieve better water quality related to pesticides.

1.3 Actors involved in multi-actor platform in the action lab:

Water company Watergroep, Flemish water agency (VMM), National and Flemish governments, province, municipalities, farmers, farmers unions, Phytofar (Belgian union of crop protection industry), Phytodis (Belgian distributors of plant protection products), civil society organisations.

1.4 Existing governance model:

The policy regarding the water quality and the use of pesticides is drawn up by the European Commission and translated to Flemish legislation. These policies determine the formal legislation and obligations related to the use of pesticides and the obligations related to minimize the impacts on the water body. Further, there exist some financial support incentives in order to support investments on the farm that benefit for a better environment and water quality. Farmer's organisations and research organisations give education and communication incentives to improve the knowledge of farmers on the water quality and the best management practice.

1.5 How is action lab using multi-actor platform/approach to achieve the objectives:

We try to involve all actors that influence or are influenced by the water system in the project. We organize interactive sessions to discuss the problem and to look for solutions, which can be realized in practice. In the first event in November 2017, the participants got to know the project and each other; we got a first idea about their vision on the water quality of the Bollaertbeek and their use of the water. In the second event in February, we informed the participants on the situation based on the monitoring results. Further, we do interviews with farmers and the different organisations to gain information about their individual views on the problem and possible solutions.

1.6 Best Management Practices:

Based on the results of the interviews with farmers in the catchment, we will select some measures to implement in the catchment, which are suitable and feasible for farmers. Some examples of measures to reduce point pollution of pesticides are using a correct filling and cleaning place for the sprayer and purification of remnant water. Some examples of measures to reduce diffuse source of pesticides are the use of drift reducing nozzles to reduce drift of pesticides and buffer strips and erosion measures to reduce runoff and erosion of pesticides.

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1.7 Participatory monitoring:

The Flemish water agency (VMM) and the drinking water production company (Watergroep) are monitoring the water quality related to pesticides in the Bollaertbeek catchment. However, the monitoring data of the VMM are publicly available after a period of several months and they are very difficult to find on the website of VMM. The monitoring data of the Watergroep are not publicly available. Therefore, the awareness of the farmers of pesticides in the Bollaertbeek is quite low. We will make the monitoring data more easily and faster available by presenting them in meetings, in the WaterProtect newsletter for the farmers and in the WaterProtect tool. By making these data faster and easier available, we would like to increase the awareness and involvement of the farmers.

1.8 Collaborative management tool:

The collaborative management tool 'WaterProtect app' is currently under construction. This tool will visualise the water quality in the Bollaertbeek in a fast and easy way and explore optimal sollutions to improve water quality related to pesticides. The tool will be easily accessable by actors and stakeholders. The tool will also be used by Inagro to advise farmers on water quality and measures to improve water quality.

1.9 Other innovative tools used in the action lab:

Our approach is innovative: we put a lot of effort in involving all actors, including all farmers. By doing this, we want to create awareness among them and gaining trust of the farmers. We will see at the end of the project if our efforts will reflect in the implementation of more measures and a better water quality.

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2. Action lab Gowienica Catchment, Poland

2.1 Description of the context:

Gowienica River is a relatively small river of some 15 km length, located in the north-western part of Poland. It constitutes one of the inflows to Lake Miedwie, which is a water source for the city of Szczecin – the capital of the West-Pomeranian region. The Miedwie surface water intake supplies water to 330 000 people. Area of the Gowienica catchment is characterised by very good agricultural soils, hence it is dominated by intensive arable farming.

There are 8 villages scattered within the Gowienica catchment with 2600 inhabitants. There are 3 municipal groundwater intakes within catchment area and three wastewater treatment facilities with variable technologies and capabilities discharging directly into the Gowienica River.

The Gowienica catchment lies within a Nitrates Vulnerable Zone (NVZ) and the Lake Miedwie water intake protection zone. Monitoring within the area has been ongoing since 1982 including data on water quality (both surface and groundwater) and nitrate load.

Despite a large number of orders and bans introduced in land use management within the area, problem of high nitrate concentrations in surface and groundwater feeding the lake still exists and despite the relatively low flows, the Gowienica river brings high loads of nutrients into the lake Miedwie (estimated at 15,5T/year of NO3). Inappropriate communal sewage systems might be an important source leading to nitrate problems in the area (although currently mainly attributed to agriculture). The relative contribution of different sources is still unknown.

2.2 What is action lab trying to achieve within the project timeframe:

The main objective of the project is to initiate cooperation between different stakeholders within the catchment with an aim of developing better water governance strategies at different management levels. This further shall lead to improvements in water quality in the catchments.

A series of meeting with and between stakeholders is being undertaken throughout the length of the project in order to analyse existing environmental issues seen from different perspectives of various stakeholders, trying to understand their cause and finding common and commonly accepted solutions for them. Bringing different parties together allows for better understanding of actions taken by other stakeholders within the catchment as well as identifying strengths and weaknesses in current governance structures and legislations that could be re-developed for the better water protection in the region. The basis for actions will be a thorough analysis of the catchment including building a conceptual and numerical hydrodynamic model, which will allow understanding how the catchment physically functions.

Extensive data from different sources, including state and local governmental institutions, research institutions as well as private sources such as water supply companies and big agricultural farms will be brought together into one database, that will be available to various stakeholders, who manage or make use of the catchment. Access to a wider data sources shall improve decision-making process at different levels. For some stakeholders it is envisaged that participation in meetings and having an access to digital environmental data will have an educational value of raising awareness of consequences of actions they take.

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2.3 Actors involved in multi-actor platform in the action lab:

1. Research actors (project partners):
    a. Polish Geological Institute – National Research Institute – research partner responsible for groundwater monitoring/reporting and providing local hydrogeological expertise;
    b. West Pomeranian University of Technology (ZUT, university/research) – research partner, who has a long history of working on agricultual and envioenmental issues within the Gowienica cachment and is considered a local expert by farmers and local sociaties;
    c. Institute of Technology and Life Sciences (ITP, research institute) - research partner, who has a long history of working on agricultual issues within the Gowienica catchment, expert in Best Management Practices;
2. State institutions responsible for water management and monitoring
    a. Voivodship Inspectorate for Environmental Protection (WIOŚ) in Szczecin - competent authority for monitoring water quality in the River Basins of the Water Framework Directive and Nitrate Vulnerable Zones as well as controlling of implementation of PoMs – supportive partner;
    b. Regional Water Management Authority in Szczecin (RZGW) - competent authority for water management in the area – supportive partner;
3. Water supply companies:
    a. Szczecin Water Services (ZWiK) - local drinking water company abstracting water from the Miedwie lake and supplying water to Szczecin – supportive partner;
    b. West Pomeranian Water Services (ZW) - state company responsible for the exploitation of water intakes, sewage treatment plants, water and sewage networks and the water supply in West Pomerania Voivodenship, including the Gowienica catchment area – supportive partner;
4. Local authorities:
    a. Warnice Commune – local authority responsible for an area of the Gowienica catchment - supportive partner;
5. Farmers:
    a. West Pomeranian Farmer's Advisory Centre (ZODR) – supportive partner, an advisory for farmers having direct contact with all farmers within the catchment;
    b. Food producers (Agrofarma Witkowo)
    c. Local Farmers

2.4 Existing governance model:

Generally, in July 2017 a revision of the major legislation in the area of water governance in Poland called the Water Act was agreed. This came into force on the 1st of January 2018 and introduced significant changes to the organisational structure of institutions responsible for water management in Poland. Changes included moving responsibilities for water management between different ministries, introduction of a new state-owned company called the *Polish Waters*, revision of river basin districts, introductions of water fees, etc. In addition to that, further changes to related legislations were introduced, or are in a process of being agreed. This concerns for example an organisational structure of the Inspectorate of Environmental Protection and its divisions responsible for controlling the state of the environment and implementation of BMPs. Not all areas of water management have been agreed yet and are fully operational. Changes that have been introduced to the law have generally little implementation on the ground yet, mainly due to the lack of executive regulations

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being agreed, hence it is difficult to describe the existing governance model in a complementary manner.

The most important change of the system is gathering all rights and responsibilities for water governance into one institution called the State Water Farm *Polish Waters.* The *Polish Waters* is no longer a governmental administration; it is a state own company of a state legal person status with authorisation to undertake administrative decisions. Before that, responsibilities were split between three separate levels of governmental administration at national, regional (province) and local (commune) levels. In the civil-law sense, *Polish Waters*, although dispose the states' property; it is a separate entity from the State Treasury.

Supervision of the *Polish Waters* lies within responsibility of a ministry responsible for water governance and this, from the 9st of January 2018 has been moved from the Ministry of Environment to the Ministry of Water Management and Inland Navigation.

The *Polish Waters* is financed mainly from water fees and has very large spectrum responsibilities at different areal scales. For that reason, *the Polish Waters* include operational authorities at state, regional and local levels respectively. These are the National Water Management Board, Regional Water Management Boards, Management Boards of Catchments and Water Supervisions.

a. The National Water Management Board (NWMD) is a central entity located in Warsaw and has a nationwide responsibilities and capacities. NWMB develops strategic documents such as a national municipal wastewater treatment plan, a set of environmental objectives, river basin management plans, programs of measures, flood risk assessments, plans for counteracting the effects of droughts. It is also responsible for the national water management information system as well as sharing of spatial data contained by this system. It can also provide financial and material support to self-governmental units (local adminstration) in terms of ensuring the use of water resources for the purpose of supplying people with water intended for human consumption.

b. Regional Water Management Boards (RWMBs) are competent in matters of water management within its administration districts (11 in the country). Its resposibilities include, among other, coordination of investments undertaken within water regions; planning of water and inland waterway maintenance; protection against the risk of flood; management of water resources (surface and underground); implementation of activities aimed at sustainable water management; gathering, processing and sharing data for spatial planning; water management control; conducting matters related to water law regulations. They are also responsible for undertaking administartive decissions with respect to issuing water decisions and water permits. The competent Regional Water Management Boards for the Gowienica Catchment is located in Szczecin.

c. Management Boards of Catchments (MBCs) are competent in matters of water fees for water services as well as carry out tasks related to water drainage (planning and control of actions). They record data regarding quantity and quality of waters abstracted from surface and groundwater as well as discharged wastewater and rainwater. The competent Management Boards of Catchment of the Gowienica catchment is located in Stargard.

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d. Water Supervisions (WSs) lead, among other, decision matters, water law reports, cooperate in the implementation of actions for the purpose of sustainable water management, undertake water readings for water charges. The competent Water Supervisions for the Gowienica catchment are located in Stargard and Pyrzyce.

The Ministry of Water Management and Inland Navigation, as a competent state authority in matters of water governance, is also responsible for developing programmes of measures (PoM's) to decrease water pollution with nitrates originating from agricultural inputs. From the 1st of January 2018 these measures apply to the entire area of Poland (previously only ca. 5% of the country – the Gowienica catchment was included) and shall be enforced based on an executive regulation by the Cabinet; however, this has not been yet passed and is still under development. At the moment, a draft version of PoMs is being consulted. According to the draft, PoM's are obliged to be applied by all entities that carry on an agricultural business, where fertilizers and/or manure is used or stored.

A statutory control of the proper implementation of PoM's lies in responsibilities of Inspectorate of Environmental Protection, which is a government administration responsible for controlling adherence to environmental regulations. The inspectorate operates via its state and local offices. Activities on a national scale such national water monitoring programme and assessment of the water status with respect to European directives such as Water Framework Directive and Nitrates Directive is agreed and executed at the national level by the Chief Inspectorate of Environmental Protection, while activities on a local level such as environmental control activities and local scale monitoring are executed by Voivodship Inspectorates of Environmental Protection. At present the Chief Inspectorate of Environmental Protection and Voivodship Inspectorates of Environmental Protection operate separately with little coordination between them. Inspectors of the Voivodship Inspectorates of Environmental Protection are appointed by province governors and have independent budgets. Up to the end of the 2017 only ca. 5% of the country was designated as a nitrate vulnerable zone, water monitoring within these areas was undertaken by Voivodship Inspectorates of Environmental Protection; while reporting to the EC was responsibility of the Chief Inspectorate of Environmental Protection. Voivodship Inspectorates of Environmental Protection were also responsible for undertaking control measures with respect to water governance and protection against pollution from agricultural sources as well as implementation of programmes of measures. In practice Voivodship of Environmental Protection were underfunded and were not able to succeed with its responsibilities. Currently, a revision of the Inspectorate for Environmental Protection Act is being preceded. Changes proposed create direct connection between the Chief Inspectorate for Environmental Protection and Voivodship Inspectorates for Environmental Protection that will allow for better coordination of works and rationalisation of costs. Control mechanisms are also proposed to be strengthened. Responsibility for undertaking control measures with respect to water governance and protection against pollution from agricultural sources will be retained within Voivodship Inspectorates for Environmental Protection; however, it is expected that due to proposed changes effectively of the Inspection shall increase.

Implementation of PoM's is also a subject of supervisor of The Agency for Restructuring and Modernisation of Agriculture (ARMA), which was established with the aim to support agriculture and rural development in Poland. ARMA is a by a governmental paying agency, which provides farmers with funding from EU and national funds. Farmers applying for funding must apply PoM's and BMPs at their farms and need to provide respective documentation of proof.

In addition to PoM's, Ministry of Agriculture and Rural Development, which is a competent authority in matters of agricultural management, develops recommendations of best management practices on

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a voluntary basis. The Ministry supervises the Farmer's Advisory Board (FAB), which is a state-owned company created to undertake a wide spectrum of training activities aimed at economic progress in agriculture. FAB is responsible for advising and provision of trainings to farmers, also those with respect of BMPs and PoM's.

On a local level communes are local authorities responsible for provision of water supply for the commune's inhabitants as well as wastewater facilities or, if not available, control of proper wastewater management by individual users. Majority of the Gowienica catchment lies within Warnice commune, some areas are located within Stargard commune.

Water producers are companies that belong to local authorities. They are established to produce water and ensure its good quality and quantity. According to recent changes to water regulations, water abstraction licences are given based on decisions of respective (depending on an amount of water to be abstracted) either River Basin Management Boards or Management Boards of Catchments. For all communal water intakes, it is required to undertake a risk-based analysis within its zone of contribution/recharge zone, aimed at identification of hazards to the quality of abstracted water, resulting from land use and land development. Such analysis has to be undertaken by water producing companies using hydrogeological or hydrological methods and is submitted to a respective province governor. Based on results of the risk analysis, a water producer or, in case a water producer have not done so – RBMB/MBC, can apply to a province governor for establishing a protection zone (PZ) for an intake, where special rules of land management apply. PZ are legally established by the power of provincial law; however, they need to be consulted with respective RBMB/MBC. Cost of establishment of a PZ, as well as compensations for restrictions to land use resulting from implementation of a PZ lay within responsibilities of a water producer. Two water-producing companies operate within the Gowienica catchment. Groundwater intakes are located in villages of Wójcin and Warnice. In addition to that a private water intake is located at a food producing (agro farm) company in Reńsko, which supplies community in close proximity to the farm.

2.5 How is action lab using multi-actor platform/approach to achieve the objectives:

Three types of meetings are planned during the duration of the project:

a) meetings with institutional stakeholders such as Regional Water Management Board, Voivodship Inspectorate of Environmental Protection, Szczecin Water Services, West Pomeranian Water Services, Warnice Commune, West Pomeranian Farmer's Advisory Centre
b) farmers and West Pomeranian Farmer's Advisory Centre
c) all stakeholders

Type a) meetings are organised periodically (1-2 times a year) to discuss water governance issues, problems identified during analyses undertaken during the project. Information about project findings is provided, exchange of views between different institutions as well as exchange of information about data availability and potential for exchange occurs. Usually around 12-15 people from different institutions participate.

Type b) meetings are organised in order to provide trainings on BMPs as well as raise awareness regarding consequences of agricultural pressure and how to counteract them. 5-10 meeting are organised annually. These are held in villages within the catchment and usually a small (up to 20) number of farmers participate. Discussions are informal.

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Type c) meetings are organised annually and aim at identification of problems that need to be solved at highest legislative level. Views between farmers and water governance representatives are exchanges; brainstorming is facilitated in order to develop commonly accepted solutions.

2.6 Best Management Practices:
The intention is to actually record BMPs that are being applied within the catchment as well as to assess willingness of farmers to implant new BMPs. Such information is not available from any database, however is necessary to assess effectiveness of implemented programmes of measures. No new BMP is planned to be developed or implemented during the project.

2.7 Participatory monitoring:
In the first step data acquisition and harmonisation from different stakeholders took place. Additional water monitoring strategy was developed in cooperation between PIG-PIB, ITP and ZUT. Monitoring locations from existing networks run by PIG-PIB, ITP and ZUT were selected based on previous data and are mostly located at farmer's fields. Supplementary analyses such as isotopic analyses of nitrogen as well as infrared scanning along the river were scheduled in order to assess communal input of nitrates into the Gowienica catchment. Farmer's attention to water monitoring is being raised during sampling campaigns. Institutional stakeholders are interested in the results for better understanding of the system.

2.8 Collaborative management tool:
The idea for the collaborative tool was to build a new GIS platform with the following functionalities:

- Integration and harmonization of all available monitoring data,
- Visualization of geological, hydrogeological, hydrological and land use data with determination of water pathways,
- Determination of pressures (including sewage) and land management practices,
- Determination of vulnerable and risks zones for water pollution,
- Visualization of water quality monitoring results in color coded maps and time series in relation to land use and land management.

During the project development, user requirements were collected and these indicated strongly that stakeholders to whom the tool is dedicated are mainly interested in data exchange. Hence the tool will be mainly a data exchange platform and data visualisation tool, for which data will be provided from public sources via WMS and REST services. Stakeholders on national/regional levels usually have their own decission support tools in place, therefore no need for extensive data analyses tool was defined at the UR stage.

Data collected during the project are subject to full or partial confidentiality. Access right to their visualisation will be decided during development of the tool and will be dependent on relations developed between stakeholders of the project during its duration.

2.9 Other innovative tools used in the action lab:
No.

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3. Action lab Val Tidone Catchment Italy

3.1 Description of the context:

The Val Tidone Catchment (206.72 km2/ 455 farmers) is placed in the northwest of Italy in Emilia Romagna region and is characterized by a mix of urban, peri-urban and rural areas. The area covers five municipalities: Ziano Piacentino, Castel S.Giovanni, Nibbiano, Pianello, and Borgonovo for 28548 inhabitants.

It is a hilly zone characterized by an elevation level between 100 and 350 above sea level and is known for the deeply rooted tradition and vocation to viticulture. The main culture is the vineyard, with 2941 Ha in 2016 (Fig 1). The inhabitants of the rural villages are mainly involved in grape and wine production, organised as private farms or as social wineries. Two types of farm structure are present:

1. 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 on the investigated area.
2. 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 on the investigated area.

The peculiar orographic features of the territory have determined the development and adoption of agricultural/hydraulic plumbing systems called "ritocchino" that already represent a sort of mitigation measures applied in order to limit the erosion and control the water speed, slowing down the water flow and that shapes hills, turning them into an orderly sequence of longitudinal line.

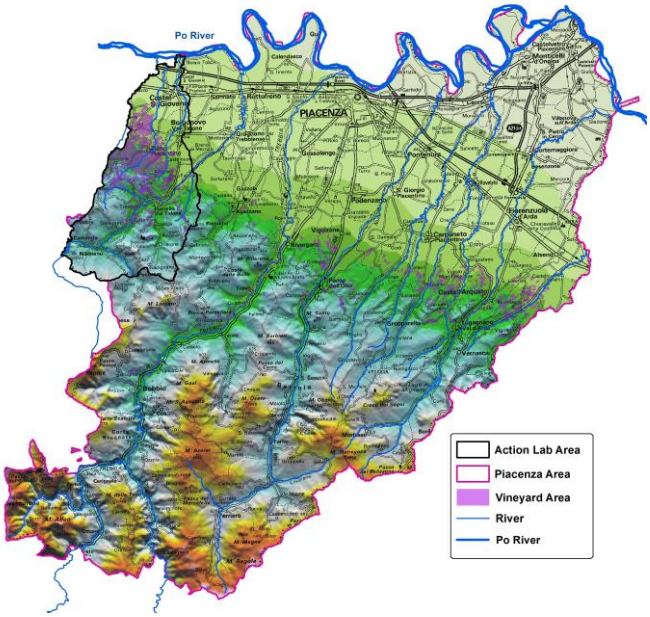

Fig. 1 Italian Action Lab in Piacenza Province.

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3.2 What is action lab trying to achieve within the project timeframe:

In the Italian Action Lab, the pollutants under investigation are nitrates and pesticides, used in vineyards. We focus the attention on groundwater. By now, the impact of the grape cultivation on pesticides and nitrates groundwater contamination was never investigated. The area under investigation is partially under the zone sensitive to nitrates, while concerning the sensitivity to pesticides, the regional map is under development and therefore, no information for our zone is available now.

In particular, the groundwater in Val Tidone Catchment presents a significant concentration of pesticides and nitrates as articulated by the local Environmental Agency and partner of the project ARPAE-ER. The ground water contamination by pesticides and nitrates is caused by both diffuse and point sources. However, the most prevalent source of contamination is the diffuse contamination. The point source contamination is mostly accidentally. Concerning the nitrate's presence in water, part of it is naturally occurring while an important part is produced by the fertilization of agricultural lands.

Therefore, the main objective in the Italian Action Lab within the framework of the project is to determinate the real contribution of the grape cultivation on the general contamination of groundwater by pesticides and nitrates and to implement best Management Practices (BMPs) and Mitigation Measures (MMs), specific for grape cultivation in areas with a slope > 2%, to mitigate the impact.

3.3 Actors involved in multi-actor platform in the action lab:

Three Italian partners in the project:

- UCSC - Università Cattolica del Sacro Cuore, research institution,
- ARPAE-ER - Agenzia Regionale Prevenzione Ambiente e Energia Emilia Romagna, Environmental Agency,
- APCS - Associazione Piace Cibo Sano, consumer's association.

Support partners and stakeholders:

- AUSL – Local Health Authority,
- IRETI – drinking water supplier,
- Consorzio Bonifica di Piacenza – Reclamation authority,
- Cantina Sociale di Vicobarone – farmers association,
- Consorzio Fitosanitario di Piacenza- farmers advisory,
- Coldiretti – farmers' union,
- Confagricoltura – farmers' union,
- CIA – farmers' union,
- Consorzio Vini Piacentini – farmers association,
- Cantina Sociale Valtidone – farmers association.

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3.4 Existing governance model:

The governance model in the Italian Action Lab, Tidone Catchment, is articulated in the activities of actors acting from a European level until a local level. In particular, the European Parliament/ European Commission/Council of the European Union, have the role of legislating, planning and finance the water governance at European level. Furthering, the Italian national government (Parliament, Lower House and Senate and several ministries involved in water governance: Environment, Health, Public Works, Agriculture, Industry and Economy and Finance) based on the European legislation, legislate, plan and finance the water government at national level. The national government, trough the Italian Collegial Organisation, interacts with the regional government (Regione Emilia Romagna) for the actuation of European legislation at regional level. Indeed, Regione Emilia Romagna has the lead of water saving and conservation, water demand-side management and pollution control, and development of innovative infrastructural facilities.

However, the Integrated Regional Water Manager (ATERSIR- Agenzia Territoriale dell'Emilia Romagna per I Servizi Idrici e Rifiuti) on behalf of Emilia Romagna Region, is planning at regional level the water governance: strategic decisions and founds allocation. ATERSIR is also in charged with establishing the multi-utility company for water collection, treatment and distribution. In its activity, Regione Emilia Romagna collaborates with Po River Hydrographic District Basin Authority (ADBPO) for defining the River Basin District Management Plan. All other water management plans (regional, provincial and local) under the district should accomplish the rules established by the River Basin District Management Plan. Regione Emilia Romagna together with Provincia di Piacenza develops the Provincial Territorial Plan (including water management plan) in compliance with the Regional Plans (Air Plan, Waste Plan, Water Protection Plan). Furthermore, Provincia di Piacenza together with the municipalities develops the Municipal Structural Plan, in accordance with the Provincial Territorial Plan. However, Regione Emilia Romagna interacts with Consorzio di Bonifica di Piacenza, IRETI, AUSL, ADBPO, Municipalities, Provincia di Piacenza, ARPAE-ER and ATERSIR during the authorisation procedure for surface and ground water use.

3.5 How is action lab using multi-actor platform/approach to achieve the objectives:

In the Italian Action Lab two main stakeholders groups were individuated: farmers and other stakeholders. For the engagement of the farmers, farmers associations (Cantina Sociale Vicobarone, social winery) and farmer's unions (Coldiretti, CIA, Confagricoltura) were first contacted and the goals of the project were presented. Further one, a preliminary survey was developed and farmers were informed about the gaols of the project. Additionally, several information about the area of them vineyards, the existence of best management practices (for point source contamination) in them vineyards, them knowledge on water protection legislation, existence of training programs, existence of wells for water monitoring in the area of them vineyards and existence of collaboration platforms for data sharing, were collected. For data collection, several approached were used: face-to-face meetings, telephone meetings, online questionnaire compilation. 175 farmers were reached

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in this way between August and November 2017. Furthermore, between them, groups of 23 and 50 farmers, respectively, were contacted again for the development of monitoring campaign (November 2017 – May 2018) and collection of data for the existence of best management practices (diffuse contamination sources – February – May 2018).

In parallel with the first survey, the other stakeholders were contacted by phone and e-mail, informed about the goals of the project, and asked to collaborate. The "other stakeholders" group is formed by: AUSL – Local Health Authority, IRETI – drinking water supplier, Consorzio Bonifica di Piacenza – Reclamation authority, Cantina Sociale di Vicobarone – farmers association, Consorzio Fitosanitario Provinciale- farmers advisory, Coldiretti – farmers' union, Confagricoltura – farmers' union, CIA – farmers' union, Consorzio Vini Piacentini – farmers association.

All stakeholders, farmers and "other stakeholders" group were invited at the "launch "event of WaterProtect Project, on 6th of December 2018, at the Santa Giustina farm, Arcello (PC), Italy, http://santagiustina.com/; 40 people were present.

The other stakeholders group, with except of AUSL and Consorzio Vini Piacentini, were contacted in the period February - March 2018 via e-mail for a survey for the development of WaterProtect collaborative tool. Later, on 16th of March, UCSC, APCS and ARPAE-ER meet the other stakeholders group for the presentation of the first results and the further actions in the project. There is a continuous collaboration with Consorzio Fitosanitario Provinciale and IRETI for the participatory monitoring activities.

In conclusion the farmers are divided in three groups: initial group – 175 farmers, water monitoring group (they have a well that is and will be monitored during the project) – 23 farmers (may change), best management practices group – 50 farmers. The initial group contains the other two and some of the farmers are part of both latter groups.

3.6 Best Management Practices:

In the Tidone catchment there are 455 farms present for 2941 Ha with 6,5 Ha average surface area. As already mentioned, during the preliminary survey, 175 farmers were interviewed for the existence of BMPs for point source contamination and 50 of them (the ones available to participate further in the project) also for the existence of MMs and BMPs for diffuse contamination sources.

A detailed analysis of the survey data for diffuse contamination sources show that 10 MM and BMPs are adopted in almost all the farms, in particular:

- The 88% of respondents know the factors that affect run off, as for example slope and soil type, and 58% indicate the presence of a water body /well to be safeguarded from runoff. In Italy this topics are training object of the compulsory certified training for professional users (MM 1).
- The Vegetated filter strip (VFS) at edge-of-field is applied in the 52% of the farms, in some cases it is used for the passage of vehicles (inaccurate knowledge) in other cases it was already present as hydraulic arrangement (MM 2).

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- Vegetated ditches are present in 78% of sample and barriers are present in 24% of farms while considered effective in containing the run-off (MM 3).

In general the responded are not concerned about run off, that is perceived of moderate intensity. Respondents believe that the measures taken (hydraulic arrangement, drainage channels, good practice on field as Inter-row processing and weeding on the row) are sufficient to contain the phenomenon.

- A buffer strip of size (width) not less than 5 meters and not more than 15 meters is applied by 97% of the respondents. The respect of non spray buffer zone is compulsory in Italy if indicated on the label (MM 4).
- The regular technical inspection of pesticide application equipment, is compulsory by Article 12 of Legislative Decree No 150/2012, and shall be performed by Test Centres. In addition to submitting the equipment to regular technical inspections, professional users shall conduct adjustments and calibrations of the equipment to ensure spraying of the correct amount of pesticide mixture, and to keep the equipment in proper working order, thus ensuring a high level of safety and protection of human health and the environment. For this reasons questions on this topics were not included (MM 5).

In general technical devices for drift reduction and special equipment to reduce spray drift are considered effective in reducing drift exposure and air Injection drift reducing nozzles are used by 52% of the respondents.

- Spraying the last row from the outside towards the inside is adopted as good agricultural practice by the 98% of respondent (MM 6).
- Regarding nutrients soils analysis for pH, macro elements, organic matters and C/N, are performed by almost 50% of respondents and correlated to the fertilization plan (MM 7,8).
- Farmers that declare to weed are 44% of the interviewed farmers. Of these 73% apply the good practice of inter-row processing and weeding on the row, while 27% undertake permanent grassing in the inter row and weeding on the row (GAP 9,10).

Concerning the point sources contamination, 4 mitigation measure/GAPs where selected and used in the survey. A detailed analysis of the survey data allows to state:

- Machine-washing in dedicated areas equipped with wastewater recovery or disposal systems are present in 39% of farms (MM1).
- Dedicated areas for mixing and for filling the sprayer (MM) are present in 44% of the farms. Of these for 19% of the interviewees this area is used both for sprayer washing both for waste management at the end of the treatment. The 28% use this area for external sprayer washing (MM2).
- Storage of pesticides in appropriate places and proper disposal of containers (MM and GAP). This mitigation measures and GAP are applied by 90% of the survey. Correct handling and appropriate storage of plant protection products and for the treatment of their packaging and remnants are compulsory. By 1 January 2015, all professional users must comply with the provisions of Annex VI of the Italian National Action Plan (MM/GAP 3).
- The 39% of the interviewees are interested in the adoption of bio purification system (as biobed, heliosec etc) (MM 4).

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Furthermore, in both surveys the potential for uptake of new BMPs and MMs was investigated. The results state that:

- 10 farmers would be interested in having information on the percentage of runoff reduction of the vegetated buffer strip at edge of the field.
- To minimize risk for moderately concentrated runoff and erosion with all viable in-field measures, edge-of-field buffers and landscape measures are not considered necessary for the majority of farmers interviewed while runoff and erosion events in farm were observed only by 18 respondents (36%) and there is the feeling that measure already taken are sufficient to prevent or contain runoff and erosion events. However 4 farmers (of which one of 31.4 Ha and one of 70 Ha) expressed their interest in obtaining more information on how to mitigate this runoff and erosion events and on the mitigation measure proposed at field level and landscape level.
- 34 respondents (68%) consider the adoption of vertical barriers to intercept the drift (hedges, trees, artificial windbreak) in addition of the buffer zone useful tools to manage spry drift generated by sprayers.
- Proper pesticide storage and handling as the treatment of their packaging and remnants are compulsory but improvements and actions could be implemented to ensure that handling, storage and disposal of pesticides and their containers are performed correctly
- While the 56% of respondent declare to do not have a dedicated area for mixing and filling the sprayers, actions supporting farms to upgrade or create equipped product-mixing areas and for filling the sprayer could be of interest.
- The use of Biopurification systems in Italy is limited as a specific authorization is required, however there is an interest of 39% of farmers in their adoption.

3.7 Participatory monitoring:

In the Italian Action Lab, the participatory monitoring includes historical data from the environmental agency ARPAE and the water supplier IRETI and data produced during the three years of the project, under the responsibility of UCSC. The monitoring data consist of pesticides and nitrates concentrations in groundwater. However, the groundwater in the area under study (Fig 1), where the grape cultivation covers 2941 Ha, was poorly investigated by date, therefore the available data covers just some marginal wells, part of the monitoring network and campaigns of ARPAE and IRETI. For this reason, big efforts were needed at the beginning of the project for the development of the monitoring network in the Action Lab and the individuation of representative wells on the territory. By date a network of 28 wells were individuated and sampled in the period November 2017 - May 2018, including 4 wells part of the network of ARPPAE-ER and IRETI. The number of wells may change, as the intent is to not include more than 25 wells, as declared in the working document of the project. This represents the first sampling campaign of the project while the second campaign will start at the end of June and beginning of July 2018. The treatments with PPPs in vineyards are undertaken mostly in the period April-June. The four wells of ARPAE and IRETI, historical data for pesticides and nitrates in groundwater were collected and included in the database of the collaborative tool. However, due to the fact that the scope of the project in the Italian action lab is to evaluate the impact of viticulture on the general contamination of ground water by pesticides and nitrates, during the project a number of

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18 pesticides (the number my change) used in viticulture will be analysed. In addition, the historical data will comprise only the pesticides used in viticulture.

3.8 Collaborative management tool:

The existing WaterProtect-BE platform will be used and developed into a WaterProtect-EU tool for three EU case studies, Belgian, Italian and Romanian, to:

- Visualize monitoring data of several stakeholders in color coded maps and time series
- Visualize land resources data (land use, soil characteristics, digital elevation model and hydrological network) in relation to water quality at monitoring locations
- Delineate water pathways in the watershed and determine vulnerable zones for water pollution
- Assess suitable measures in the vulnerable zones in the catchment aiming to improve water quality

In particular, for the Italian Action Lab collaborative tool integrates groundwater level data, precipitation data, land use data and measurement data (temperature, pH, conductibility, nitrates and pesticides used in vineyards) type of pesticides used in vineyards data. The groundwater level, precipitation and soil use data come from ARPA-ER while the measurement data comes from ARPE-ER, IRETI and UCSC. The data is then integrated in different maps and made available for the users. The maps are provided by ARPA-ER and are created with ArcGIS software, developed by ESRI, California, United States (www.esriitalia.it). The available maps include: land use data, soil geology data, land hydrology data, conceptual model of groundwater aquifer.

3.9 Other innovative tools used in the action lab:

No.

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4. Action lab Lower Llobregat River basin Catchment, Spain

4.1 Description of the context:

The lower Llobregat River basin is an alluvial plain that covers an area of 486.1 km^2 (29 municipalities) and extends in direction NW-SE from the Montserrat mountain range to the Llobregat River mouth, where a delta is formed.

The Baix Llobregat and particularly the Agrarian Park, where most irrigation farmland of the area is located, presents Entisols and Alfisols (USDA Soil Taxonomy) and very soft slopes. They are between 7 and 15 % at the Vall Baixa area (the lower fluvial terraces), and between 0 and 7% at the Delta area.

The climate is the typical Mediterranean. Due to its proximity to the sea, the temperature does not experience big oscillations (average annual temperature is 15.6ºC). Average annual pluviometry is 583 mm. Minimum rainfall occurs during winter and summer and maximum rainfall occurs during spring and autumn.

The basin has a high infiltration capacity and a low drainage capacity (only 530 Hm^3 out of the 3200 Hm^3/year of rainwater that fall on the Llobregat River basin flow into the Mediterranean Sea). There exist different surface water bodies in addition to the river in the area: the Delta lagoons and some arid extraction pits converted into ponds.

There are two main aquifer systems in the area: one formed by alluvial gravels (Llobregat valley) and one formed by detritic sediments of gravel, sand, and lime (Delta). Groundwater has been crucial for economic development in the area.

The aquifer of the Llobregat Low Basin is considered a strategic water body as it represents a water reservoir for ensuring continuous supply to the population when surface water does not meet the minimum quality or quantity requirements for potabilization. Preserving its integrity is thus a primary interest of all stakeholders.

All water resources (surface water and groundwater) 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 – wastewater and industry (e.g. volatile organic compounds) derived pollutants). The impact of pollution coming from agriculture in the area of the Agrarian Park is less relevant. In fact, agrarian activity in the Agrarian Park can: a) be a filter or decontaminant factor of surface water and catchment for later uses; b) help natural groundwater recharge in an area with very high urban pressure.

Furthermore, mining activity upstream the Llobregat River is related to the increase of surface water salinity, and over-exploitation of the aquifer (more than 700 wells at the Vall Baixa and Delta aquifers that extract about 105 Hm3/year for human consumption, and industrial and agricultural uses) led to seawater intrusion. Different actions have contributed to reduce water salinity (chloride ions), e.g., hydraulic barriers by injecting reclaimed water into the confined aquifer.

The Agrarian Park of the Llobregat lower basin extends over an area of 2,938 Ha (1,954 Ha of effective agrarian space) distributed in 14 different municipalities. Most of the activity in the Agrarian Park is carried out in family-run agricultural farms: 200 - 250 professional farmers that own

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farmland 3 - 10 Ha; only 5 big agricultural companies that develop their activity in areas 30 - 50 Ha.; about 300 farms with an extension 0.5-1 Ha are run by retired people and part-time farmers; and 1000 small (80-100 m^2) vegetable gardens for recreational purposes.

The water used for irrigation has different sources, depending on the location of the farmland. Thus, there are farms irrigated with Llobregat River water, farms irrigated with a mixture of the Anoia River water (tributary of the Llobregat River water) and reclaimed water, farms irrigated with a mixture of groundwater and reclaimed water, farms irrigated with groundwater, and farms (at the Delta area) irrigated with a mixture of reclaimed water, groundwater, and field, urban, and forest areas run-off.

Livestock farming is limited to few chicken farms for chicken meat production with a geographical indication (Catalana del Prat breed) (<8 individuals per m2) and few sheep farms for meat production (breeded by extensive grazing).

4.2 What is action lab trying to achieve within the project timeframe:

a) To improve agrarian practices both in terms of plant protection products and introduction of water efficient measures.
b) Infrastructure improvements (for irrigation uses and to increase the use of reclaimed water).
c) Monitoring and control of agrarian enterprises (with any size)
d) Monitoring the improvement of water quality capacity through irrigation uses.
e) To achieve transparency on quality information in all water supply points.
f) To increase water availability when is irrigation time (everybody uses the water at the same time – *Canal Dreta*) and to improve organoleptic aspects of drinking water.
g) Overall to transfer to the Catalan Water Agency the needs of all stakeholders in order to take them into account for future planning.

4.3 Actors involved in multi-actor platform in the action lab:

Local government (municipalities and municipalities Council (Consell Comarcal), local consortium to protect the Delta Area and wetlands and to manage the Agrarian Park), regional government (Public Health Agency and Catalan Water Agency), waterworks (drinking water supply companies: Aigües de Barcelona, Aigües del Prat, and ATLL Concessionària de la Generalitat SA, wastewater treatment plants: Aigües de Barcelona), individual farmers, Plant Protection Associations, Farmers' Union, food trader (Mercabarna and Agropecuaria Gavà), a civil society organization (assoiació catalana d'amics de l'aigua), local water administrations (associations of water users), and research organizations (CSIC, UB and UPC), as shown in S*cheme 1.*

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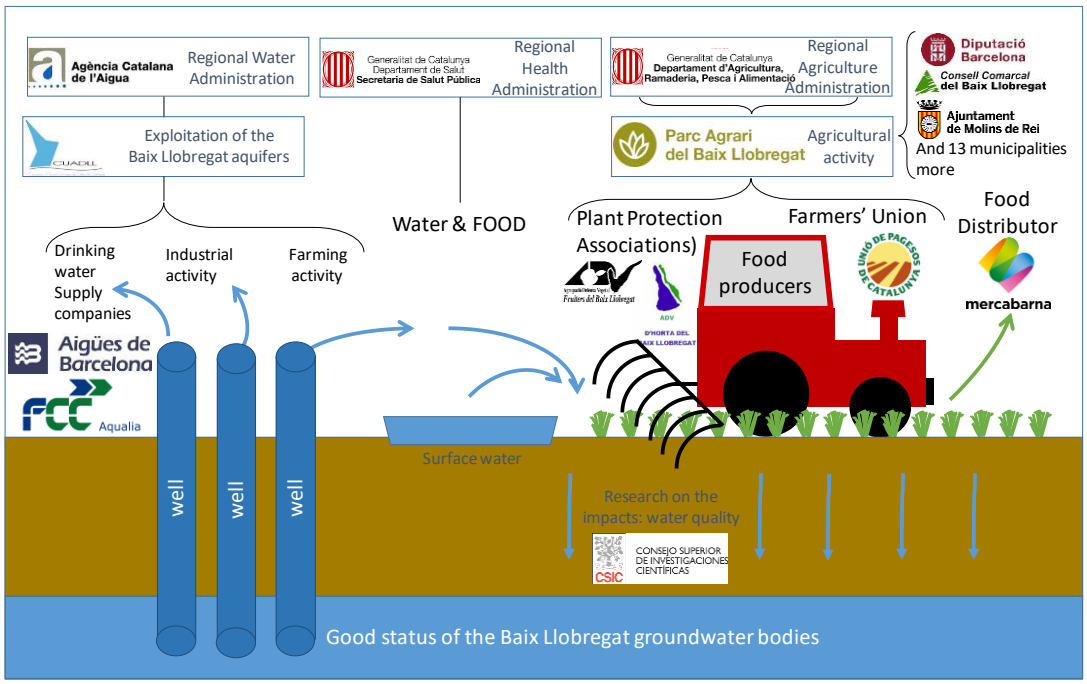
Scheme 1 – Water governance in the Spanish action lab.



4.4 Existing governance model:

There are already many relationships (although most of them are not formalized) established within the different actors in the area. These relationships aim at exchanging data on water quality or communicate incidences in the water system, and also at following an administrative procedure (apply for activity licence, request of water use) and improving water management in the area in terms of quantity and quality (research collaborations and trainning workshops).

Water quality in the area is already being monitored by different actors and most information is shared among them, and part of it is publicly availabe (i.e., Catalan Water Agency surveillance programme). Any data generated by any stakeholder are considered valid and valuable by other stakeholders. Each stakeholder does the monitoring according to their own interests, which could create a gap in the information (for instance data produced by drinking water treatmen plants are not relevant for environmental purposes or agricultural uses). Conflicts among stakeholders are minimized because their roles (defined in most cases by law, but also by signed agreements) or interests do not or minimally overlap.

Policy in this area is mainly set by separate institutions for public health and environment/food/agriculture/water administrations at national and regional level. Lack of coordination among them may result in contradictory regulations at national and regional level. Moreover, these institutions (mainly those at national level) hardly communicate with municipalities, users and other stakeholders in the area.

The leadership in water management in the actionlab is taken by the Catalan Water Agency (river basin authority).

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Economical resources have historically contributed to improve water quality, and actually the lack of funds is the most limiting step to further improve in this respect (technical competences of the different stakeholders are ensured). Increasing funding could contribute to include in the water management system the use of rainwater (greenhouse channels), nature-base solutions (areas with permanent vegetation to control runoff), mixture of different waters to improve quality, and to extend the use of reclaimed water, and to relate uses and sources of supply depending on water availability.

4.5 How is action lab using multi-actor platform/approach to achieve the objectives:
Different multi-actor events have been held to analyse:

- Water governance system in the area
- Aspects to improve in terms of water management in the area
- Best management practices in agriculture carried out at the Agrarian Park
- Promote contact/discussion/collaboration between the different stakeholders

So far, the multi actor platform has contributed to increase our understanding of the role and needs of each stakeholder in the action-lab as well as to outline possible ways of collaboration and activities that could be undertaken by the different actors in future action plans.

4.6 Best Management Practices:
Different projects regarding BMP implantation to improve water quality have been carried out in the area in the past and some of them are still being evaluated when in use – outcomes of these experiences will be taken into account when deciding about future expansions o modifications of the assessed practices:

- Aquifer recharge through injection of reclaimed wastewater or infiltration of river water to stop the advance of seawater intrusion and increase groundwater reservoir,
- Upgrade of drinking water treatment plant to reduce water salinity by osmosis,
- Upgrade of WWTP to generate reclaimed water and improve wastewater treatment,
- Construction of a brine collector to reduce *salinity* of the Llobregat river water,
- In situ bioremediation techniques to remove pollutants from soil and groundwater.

In order to reduce to a minimum the potential impact of the agricultural activity in the water resources of this area, we evaluated the BMPs carried out in this respect by face-to-face interviews with farmers. After evaluation, all BMPs related to the Integrated Pest Management (IPM) System (i.e., licence for PPP application, PPP holding register) have a high potential of being implemented because they are mandatory. In this regard, filling in the PPPs holding register is the most difficult BMP to implement due to lack of time and expertise. As for obtaining the PPP application license, some difficulties on implementation can be found due to temporal employment. Furthermore, BMPs related with irrigated water and avoiding runoff water are highly suitable because the action lab is located in a plain surface. These BMPs may have positive impact on the natural arena and will benefit indirectly the community.

Out of date PPPs and PPPs container are a big problem for farmers and environment. Plant Protection Associations (PPAs) are working to facilitate safe places to fill and clean spraying equipment's. Economic costs are the most important limitation. An additional limitation to

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implement this measure is the effort to make a consensus among farmers to work together. The Agrarian Park consortium and PPAs of Baix Llobregat also work to reduce this limitation.

4.7 Participatory monitoring:

There are many data regarding water quality in the area already available, as different monitoring plans are being carried out by different stakeholders. The information obtained during these monitoring campaigns is routinely shared among the different stakeholders, and presented to water users (annual report of CUADLL about the status of water quality), which contributes to increase the level of trustness among them. However, some information gaps have been detected during the analysis of existing data:

- Water quality of the deeper aquifer used for drinking water production by Aigües del Prat (nearby areas of drinking water supply wells)
- Quality of the water in the Agrarian Park drainage channels that discharge into the LLobregat Delta lagoon and of the surface waters in this natural area.

Thus, intention is to analyse these waters to obtain a first picture of the occurrence of nitrates and PPPs in these scenarios and to use the analytical methodologies available in the WaterProtect consortium to evaluate also new BMPS of potential application in the area.

4.8 Collaborative management tool:

The existing collaborative tool was introduced to stakeholders attending multiactor events, and they were asked about their willingness to use it and their needs, i.e., what information they would like to find in it. All of them where very interested in this tool, and a very positive feedback was obtained. The collaborative managament tool is thus being further developed taking into consideration this feedback.

4.9 Other innovative tools used in the action lab:

Two innovative tools are planned to be explored within WaterProtect in the Spanish action lab:

- The use of isotopic analysis of nitrogenated species (ammonia, nitrate) at a local level to identify their origin (manure vs inorganic amendment)

- The potential implementation of innovative BMPs such as point source bioremediation based on the use of white rot fungi (WRF) in agrarian drainage channels (in connection with the on-going Spanish Research Agency funded project BECAS).

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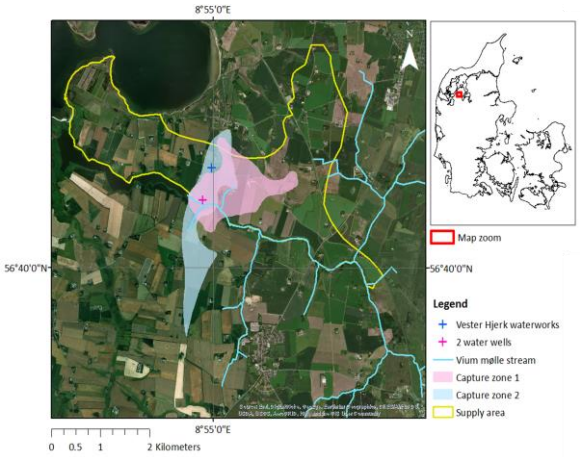
5. Action lab Vester Hjerk Catchment, Denmark

5.1 Description of the context:

The Danish Action lab is located on the peninsula Salling in the north western part of Denmark, where the local waterworks Vester Hjerk (in the municipality of Skive) has an abstraction license of 30,000 m3/year and supply the local community of approximately 80 households with drinking water purely based on groundwater. Covering 85% of the area, intensively managed agriculture is the dominating land use, and both nitrate and pesticides pose a potential risk for the drinking water.



The geology in the area generally consists of a quaternary sequence of limited depths overlaying nearly impermeable pre-quaternary clays. Close to the waterworks, buried valleys are found to a substantial depth with varying clay and sand in-fill. Water is abstracted from two wells screened in a shallow sandy aquifer between 20 and 30m below the surface. The capture zone for the abstraction wells has been delineated by two versions of a groundwater model, resulting in the identification of two different capture zones, as displayed in the figure. The origin of the water abstracted is thus uncertain, which poses a large challenge in designing a local protection plan that can be accepted by all actors.

The aquifer utilised for abstraction is only moderately protected by a capping clay layer, and since the 1980'ties the nitrate concentration has been steadily increasing. In recent years, the nitrate concentration has exceeded 50 mg NO3/l in a few samples and in the past 10 years it has generally been above 37.5 mg NO3/l, which is the limit at which actions must be taken according to the WFD.

Reverting the trend in increasing nitrate concentrations will require a different land use, either by changing the agricultural praxis, e.g. crop rotation, introduction of new crops or by changing to a new land use type, e.g. afforestation. The abstraction wells are located at the edge of a field and the waterworks has an agreement with the farmer not to use fertilizer and pesticides on one hectare surrounding the wells. This is, however, not sufficient, but due to its size, the waterworks has limited resources and are unable to fund a general groundwater protection.

5.2 What is action lab trying to achieve within the project timeframe:

The goal of the activities in the action lab is to reach a solution for the local waterworks, which is acceptable to all actors. Different potential solutions may be relevant to study: 1) protecting of the water abstracted, by making agreements with more farmers to reduce the risk for nitrate leaching, 2) establish a new well in an unpolluted aquifer, or 3) closing the waterworks and get the water supply from a neighbouring waterworks. All three options are associated with significant costs, which can only be paid by the consumers.

Approximately twenty waterworks are located at the peninsula Salling and nitrate and/or pesticides pose a risk to almost all waterworks. The municipality prioritise to maintain the decentralised abstraction structure, but several smaller waterworks have been closed during the last decade in the area. The analysis of possible solutions for Vester Hjerk will thus be relevant for several additional

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waterworks in the area. Solutions for the waterworks will therefore also be considered with respect to its potential for upscaling at Salling.

5.3 Actors involved in multi-actor platform in the action lab:

The primary actors are the board of the local waterworks, farmers, citizens in the supply area together with Landbo Limfjord (farmers advisory) and the municipality of Skive, of which the two latter are partners in the project. Secondary actors/stakeholders include the boards of the other waterworks on Salling, and "Danske Vandværker" (the association of the smaller waterworks in Denmark). Other stakeholders included in a stakeholder group are: Danish Agriculture and Food Council (Farmers political association), DN (Danish Society for Nature Conservation), DANVA (association of Danish Water Utilities), MST (Danish Environmental Protection Agency).

5.4 Existing governance model:

Water governance in Denmark follows two broad tracks: a decentralized track where small consumer owned waterworks (private) provide drinking water to small local areas and a more centralized track where bigger waterworks, usually owned by the municipality, supply larger regions with drinking water.

While the Vester Hjerk waterworks is responsible for the water supply the municipality of Skive is responsible for assuring that the water meet the quality demands. The municipality is in charge of assuring an appropriate level of ground water protection. This is done through local protection and actions plans. The municipality is also responsible for taking action in case of exceeded levels of nitrate in the drinking water.

The waterworks is responsible for monitoring of the water quality, in accordance with the national legislation. All water quality data are made public accessible via the national database JUPITER. With regard to nitrate the Danish Agricultural Agency are in charge of the regulation of fertilizer uses.

5.5 How is action lab using multi-actor platform/approach to achieve the objectives?

The multi-actor approach has been organised by consulting the local waterworks and the local farmer's advisory, to understand the local conditions and identify possible conflicts, barriers and possibilities in the area. A public meeting was arranged to learn the knowledge and attitude in the public towards water abstraction and quality. This meeting was cancelled due to an insufficient number of people signing up.

The present outcome has been:

1. Meetings involving both the public and farmers may create high tension, as the public may provide suggestions, but it is the farmers who will have to deliver. Hence, joined meeting should not be arranged when specific solutions are to be identified.
2. (Some) farmers are tired of having restrictions on their land. Although they are compensated, it can be difficult for the farmer to evaluate whether the compensation is fair, also in a 20-year perspective. Some thus prefer that the land is bought up and used for "producing" of groundwater solely. Also, some farmers feel that they are overwhelmed by repeatedly meeting new restrictions, either by national legislation or local agreements.
3. There is a large degree of trust in the public that the waterworks deliver water of high quality, and that this is assures through the legislation stipulating the observation of the.

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water quality. Hence, as long as there is water in the taps there is no concern by the consumers. If consumers are to be engaged in and be part of the solution, they have to be approached directly.

The multi-actor approach will evolve throughout the project to adapt continuously to the experiences gained. The next step in the multi-actor involvement will be to engage the general public by distributing information materials followed by individual interviews with people in the supply area. The purposes of the interviews are to gain information on people's knowledge about the drinking water situation and to hear their opinions on different solutions. Based on information from these interviews a focus group will be established and a focus group interview on possible solutions will be held. The farmers are approached by arranging dedicated meetings/workshops to identify possibilities in the local area. Further, the waterworks at Salling are already organised in a network, which will be used as an entry to discuss if solutions can be found collectively among all waterworks in the municipality.

5.6 Best Management Practices:

In the Danish action lab, focus is on BMPs and mitigation measures targeting a reduction in the leaching of nitrates to the groundwater. Denmark has had an extensive regulation on agricultural use of nitrogen developed over the last three decades. Some of the measures suggested for testing in WaterProtect (such as fertilizer planning and slurry tank coverage) are thus already implemented in the Danish legislation and obligatory for the farmers. A total of 16 measures have been included in a telephone-based survey on the adoption and acceptance of the measures. The most widely adopted are not surprisingly the ones that are linked to the current regulation system (such as different options for plant cover during autumn and winter) and measures with a positive effect on the production (such as phase feeding). The less accepted measures are the ones that have the largest negative effect on production (such as set aside) or require large investment (such as burning of the dry fraction of manure).

In the next phase of the project, we will test the individual measures in depth in workshops with farmers based on collaborative modelling of the Nitrate cycle (see 1.9). However, a main ambition is to seek solutions that go beyond the single measures and beyond the level of the individual farm. We will therefore have a focus on collective measures such as constructed wetlands and afforestation, but we will also test options based on collaborative actions such as land consolidation and common crop rotations.

5.7 Participatory monitoring:

All existing data in the area are stored in national databases that are public and freely accessible. These data are integrated directly in the collaborative management tool. Additional data are collected in the Vester Hjerk area, including both geological and hydrological data as well as water quality data. Sampling points for water quality will include the waterworks, shallow groundwater, drainage, stream and private wells, to the extend permission for sampling can be obtained.

The intention of the monitoring programme is to get a better understanding of the system in order to minimize the uncertainty in the delineation of the capture zone for the waterworks and identify areas with high nitrate loads to the groundwater. Collecting, analysing and discussing local monitoring data also serves the purpose of building credibility among the local stakeholders. The

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monitoring data including what and where to monitor will be discussed with the stakeholders, who can suggest new sampling location.

Status of the participatory monitoring is that the local farmers with land adjacent to the waterworks have been contacted for permission to collect samples, including water samples and geological and geophysical data. Data are analysed and interpreted and the results will be presented and discussed with the local actors in the autumn 2018.

5.8 Collaborative management tool:

The collaborative tool will be used as a dialogue platform with farmers. Data of the bio-physical system and model results will be visualised and will include a scenario builder to explore different possible solution in collaboration with the stakeholders.

The “Landscape model” is used in the Vester Hjerk action lab. The Landscape model is a GIS platform integrating existing data in the area including system data such as soil properties, land use, crop rotation and tile drainage as well as monitoring data. The landscape model additionally includes a module to perform “on-the-fly” calculations of nitrate leaching under different management scenarios and its effect on nitrate load to the surface water. The platform further provides a basis for interactive involvement of farmers with local knowledge, allowing the correction of data, e.g. information on which fields are drained and crop rotation. By a coherent integration of system and monitoring data together with the ability to evaluate scenarios, the model provides the collaborative management platform where local actors and stakeholders can monitor and share information on local water quality and discuss how future mitigation measures can be designed.

Specific functionalities of landscape model include:

- Consistency and harmonization of monitoring data
- Visualizes of monitoring data from different sources
- Visualizes land resources data (land use and hydrological network) in relation to water quality at monitoring locations
- Estimates nitrate leaching for current and future land use and management (scenarios)

The landscape model has been developed in a beta version for assessing nitrate loads to the surface water system. In WaterProtect the model will be further developed to also include the ability to assess nitrate loads to the groundwater system. Additionally, the model interface will be improved for ease of use and to make the involvement of local farmers more intuitive.

5.9 Other innovative tools used in the action lab:

There are no additional tools used in the action lab.

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6. Action lab Mara river Catchment, Romania

6.1 Description of the context:

The Mara catchment (20 km^2), Maramures County, Romania, is representative for small scale/ subsistence farming systems in the Carpathian Mountains – cattle and sheep breeding. The study area is a typical cultural landscape shaped by traditional practices. Mara River is a tributary of the Tisza River and an important natural resource which also supports high biodiversity, including many protected species. Mara river is a protected area of local interest due to the presence of important protected species: trout (Salmo trutta), grayling (Thymallus thymallus) whose survival depends on the water quality. Breb village represents focus village of the RO case study. The territory of Breb village is crossed by a rich hydrographic network. In the local toponymy, the main watercourses that spring from the Gutâi Mountains and flow into Mara are known under the following names: Valea Breboaia, Valea Mare, Valea Sunatoarei and Valea Caselor. Water supply in the village with 378 households is secured by communal pipeline distribution and private wells used by more than half of the households in the village. 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. Nitrates and nutrient levels are monitored only in surface water downstream on two sections of the Mara River. There is no centralized sewage system in this case study, which poses major problems for surface and underground water quality.

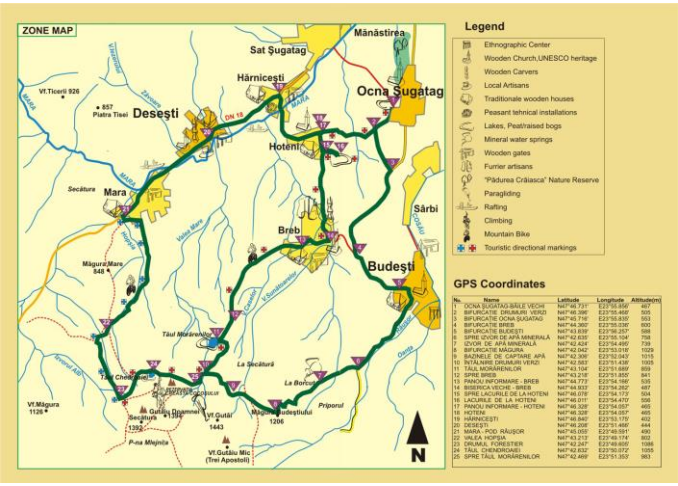

Fig 1. Location of Breb village

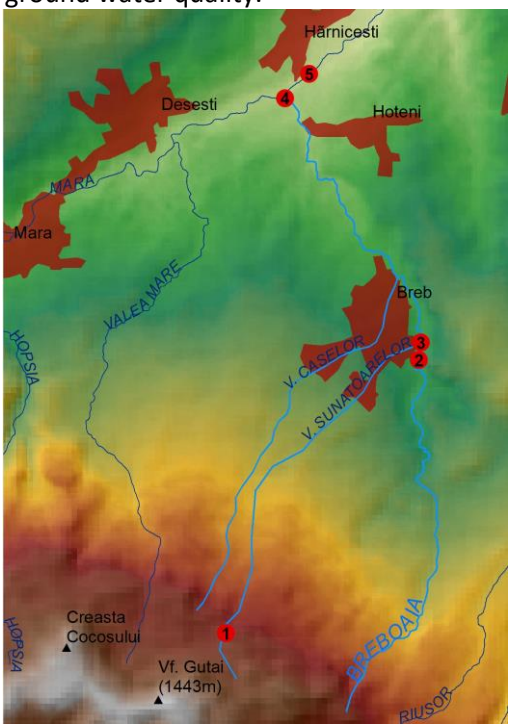

Fig 2. Monitoring sections in RO case lab

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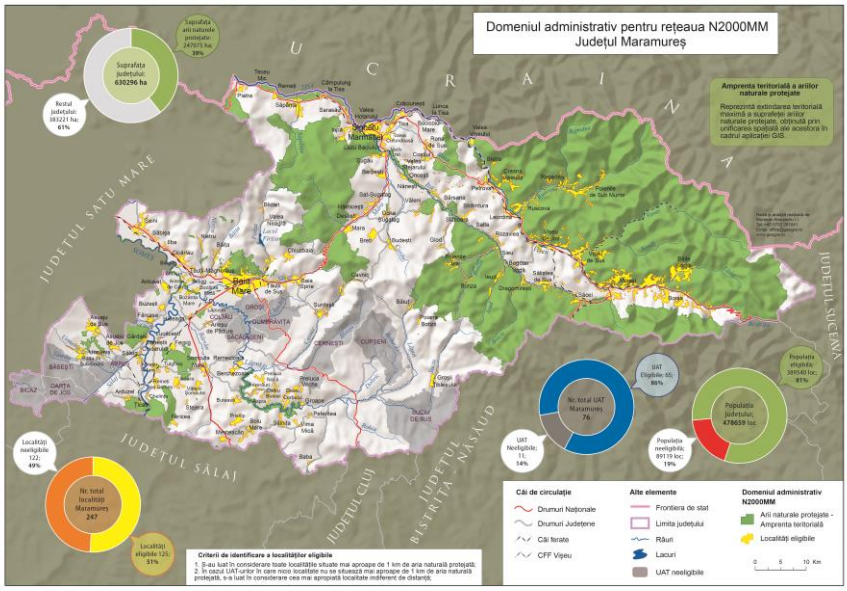

Fig 3. Protected areas in Maramures County

6.2 What is action lab trying to achieve within the project timeframe:

Project objectives relate to:

- mapping the distribution of ecological status of surface waters in case study area;
- reporting water quality in relation to land use.
- determine vulnerable and risks zones for water pollution

Nitrate pollution is relevant for the area due to manure leakages from small scale farms and lack of a centralized sewage system; project envisaged to monitor water quality (surface, wells) via participatory approach; furthermore several good practices and innovative solutions for mitigation of risks of water pollution will be implemented in the current project framework:

- raising awareness on the importance of providing framework for improvement/maintananve of water quality (in the context of participatory monitoring of nitrates via involvement of school children from Breb village; meetings with farmers (various evants as well as dircet billateralmeetings)
- 4 Manure storage platforms for individual households;
- 4 compost bins in individual households and guesthouses in Breb village;

Assessment of current national legislation will be performed and recommendations on actual implementation of mitigation measures will be provided during the project.

6.3 Actors involved in multi-actor platform in the action lab:

Major actors relevant for RO lab, involved in the WaterProtect project in RO lab:

- RO lead partner, EcoLogic Association (lead), local NGO nature conservation, sustainable rural development
- Local research partner - North University Centre Baia Mare (university)
- Romanian Waters – Regional Water Management Unit
- Department of Agriculture Maramures
- Ocna Sugatag Mayor House
- Environmental Protection Agency Maramures (EPA MM)
- National Environmental Guard, Maramures County Inspectorate
- Maramures County Council (department for plans, programs and investments

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- Farmers and farmers Association in Breb (Shepherds Association)
- CET, Center for Ecology and Tourism Maramures

6.4 Existing governance model:

As an existing governance system at County level focusing on management of protected areas (informal at this moment) the N2000 PlatforMM is being used as a basis for the WaterProtect-RO collaborative management platform for the Romanian case. As part of the N2000 PlatforMM, EcoLogic and Technical University are members, as well as other key stakeholders: Romanian Waters – Regional Water Management Unit, Department of Agriculture Maramures, Environmental Protection Agency Maramures (EPA MM), National Environmental Guard, Maramures County Inspectorate, Maramures County Council; this ensures a favorable strategic framework for successfully delivering of case study results and will make possible the creation of a thematic collaborative management platform, the WaterProtect-RO, for monitoring and sharing of information on local water quality and trigger the debate for improved measures and uptake.

County and local level institutions interact with sectoral institution Romanian Waters even if there is not a very good structure for interaction between these actors. When there are challenges related to water quality or quantity Maramures County commissions are formed to tackle the emergency situation. But there is no constant organized framework for meetings between SH.

6.5 How is action lab using multi-actor platform/approach to achieve the objectives:

During project in RO case lab, we have organized formal meetings with county and local level stakeholders, presenting the project and its targeted ipact for RO case lab. Farmers participated in the meetings as well; furthermore, during application of BMPs survey in Breb to 40 farmers, discussions were held regarding water quality in the action lab as well as different measures they apply in agricultural activities impacting water quality. Project dissemination included participation in Maramures Symposium on Natural Patrimony on may2018 when some of the project results were presented to stakeholders (research institutions, county level administration, civil society working on sustainable development). For the next project phase, when there will be in place the collaborative tool a bigger meeting will be organized in order to get stakeholder's view on the tool and propose further improvement/adaptation (if needed).

6.6 Best Management Practices:

Nitrate pollution is relevant for the area due to manure leakages from small scale farms and lack of a centralized sewage system.

Within WP 4, 40 farmers from Breb village (RO case lab) were interviewed regarding a set of BMPs they use. Methodology for surveying farmers in Maramures action lab included:

- Initial research phase of available recommendations and obligations at national level related to use of fertilizers in Romania, good environmental and agricultural practices used by farmers in the field of environment, climate change and good agricultural conditions of fields.
- Development of questionnaire using the agreed BMP list and adapting it to Romanian context of the action lab; questionnaire included general questions related to location, age, surface of land owned by farmers; the central section of the questionnaire included 18 BMPs that were tested on a sample group of 40 farmers from a target area of Breb village; in the village there are 140 families involved in agricultural work (animal breeding, cereal production, potatoes mainly for family consumption).
- Farmers were selected using data from the Ocna Sugatag agricultural registry where all farmers are registered. Discussions included meetings with representatives of sanitary and

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veterinarian experts in the village, who have a database on farmers owing animals in their farms.

- Questionnaire was applied face to face, directly to farmers in the target area; during three site visits (7.02.2018, 21.02.2018, 12.03.2018) project team (from EcoLogic and UTC) visited the target area of Breb and after presenting the WaterProtect project there were discussions with interviewees of farmers with respect to their daily farm activity with a focus on BMPs which they apply and would like to apply.
  For the coming period, there will be made vailable abstracts for the top 5 BMPs that are under use/to be implemented in RO case lab, positively impacting on water quality:

- Temporary depositing of organic manure on the agricultural field;
- Depositing manure on the field with taking into consideration certain distances from water courses for preventing pollution of water (min 20 m from rivers, min 50 m from wells/springs, min 250 m from wells used for drinking water);
- Incorporate organic manures immediately after application on cultivated land;
- Land conservation works (crop rotation, non -mechanized seeding);
- covered manure platforms.

Project envisages to raise awareness on the impact of manure on water quality (eg wells that are still used for drinking water, even if not recommended by authorities) and bring into light and practice construction of simple efficient manure platforms.

6.7 Participatory monitoring:

According to official information, the water quality of the Mara River is good, and the vulnerabilities are recorded only at the nutrient regime, but at a moderate level.
In the study area located in the Mara river basin, the rural type communities practice traditional semi-subsistence agriculture. Thus, hand labor and animal energy are widely used on small fields, along with natural fertilization and simple rotation of crops. As a result, pesticides or chemical fertilizers are not used in the region. Thus, there is a moderate impact on the environment, including on the aquatic life.
Problems only occur due to household waste, due to the use and storage of manure, due to their defective management.
Monitoring from official authorities is performed on larger scale and thus not include study area of Breb.

Monitoring plan in the Maramures action lab includes:
The **surface water monitoring plan** to be carried out within the framework of WaterProtect consists of evaluating nitrates occurrence from manure and other waste in the Mara catchment area.
Samples will be collected twice a year (spring and autumn). Up to this moment monitoring was performed in 2 seasons in 2017: July and September 2017, 1 season in 2018 (spring).
The **groundwater monitoring plan** under the framework of WaterProtect will be carried out in an area of the action lab (Gutai Mountains). Data on microbiological status of water (provided at central pipeline) from Ocna Sugatag municipality/ Maramures Directorate of Public Health will be used. No other analysis is required.
Additional minor field monitoring studies will be implemented, eg assessment of nitrofile vegetation in the proximity of water courses in the action lab (once/year).
As far as water quality from wells is concerned, a participatory approach will be started in 2018, involving school children from Breb village in assessment of water quality (by using specific kits).

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6.8 Collaborative management tool:

The WaterProtect tool shall be used by three action labs The Bollaertbeek (Belgium), Val Tidone (Italy) and Maramures (Romania).

The WaterProtect tool will be used to follow up the water quality status of the catchement, to determine the water pathways in the watershed and vulnerable zones for water pollution. The tool should help to create more transparency on the link between farming systems and water quality at one side and at the other side the link between the application of nitrates (coming from organic fertilizers: manure) and their occurrence in drinking water intake.

In the Romanian case study, the database component integrates water quality data, water flow data, and information on measures into one database. The water quality data comes from Romanian Waters – Regional Water Management Unit, management plan of Tisza River Basin, monitoring in the field performed by Partner UTC; the information on measures from Partner UTC. The Web tool component visualises the different types of data integrated with different maps (hydrography, topography, land use, monitoring sections, nitrate sensitive zones etc). The maps for Maramures will be developed by a GIS consultant and it will use open source GIS. The users of the WaterProtect RO tool are Romanian Waters – Regional Water Management Unit, Ocna Sugatag municipality – providing the drinking water for the area and the farmers. As general characteristics the Romanian tool will be developed in a friendly, easy to access manner, in Romanian language (English could be included as well), in open source (GIS) and shall work on pc, tablet or smartphone (farmers will most probably use the smartphone).

6.9 Other innovative tools used in the action lab:

Not applicable

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7 Action lab Wexford catchments, Ireland

7.1 Description of the context:

Water quality is monitored since 2009 in the Ballycanew and Castledockerell catchments in County Wexford, south-east of Ireland as a part of the Irish Agricultural Catchments Programme (www.teagasc.ie/agcatchments). These catchments now form the basis of the Irish Acltionlab.

The area, which consists mainly of farmland, has a maritime temperate climate with an annual mean temperature of 10.6°C and annual total rainfall of 906 mm.

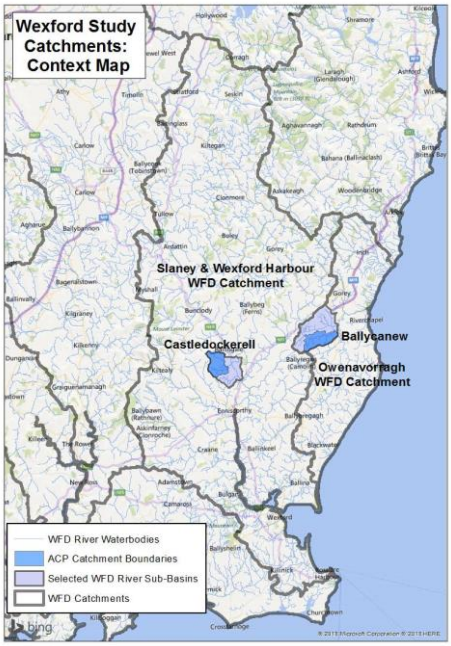

Fig 1. Location of Ballycanew and Castledockerell catchments in County Wexford, Ireland.

The Ballycanew catchment is approximately 12 km^2 with beef and dairying as the main farm enterprises and spring barley as the main tillage crop where soils permit. It is mainly representative of the heavier soils used for grass-based production in the south and south-east of Ireland. Approximately two thirds of the catchment has poorly drained soils due to its location on the edge of the Macamore soil association (fine loamy over clayey calcareous Irish Sea till). As a result phosphorus is the main nutrient at risk of loss from this site through overland and near surface flow. There is also a risk of nitrogen loss through leaching on the more freely drained soils to the west and covering approximately one third of the catchment (Clonroche soil association - fine loamy drift with siliceous stones). The geology consists of rhyolitic volcanic and grey/black slates of the Campile formation. Thirty-seven percent of the land has slopes greater than 5%. The hydrology is “flashy” (high ratio of storm flow to base flow magnitudes) due to soil sensitivity to surface runoff and quick shifts in weather.

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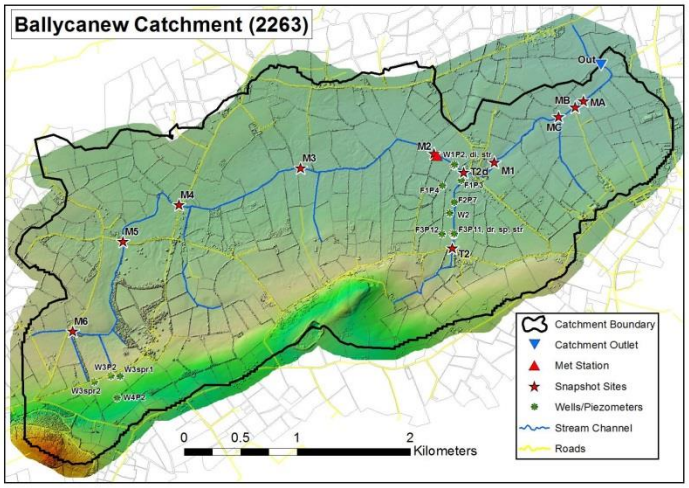

Fig 2. Ballycanew catchment.

Castledockerell catchment (11 km^2) mainly consists of arable land (54%) mostly used for spring barley production, while beef, sheep and some dairy production are the main grass-based enterprises. Approximately 80% of the catchment is well drained due to the predominance of the Clonroche soil association (fine loamy drift with siliceous stones). The remaining 20% is poorly drained mostly due to the River Alluvium soil association (silty) and the Kilpearce (fine loamy drift with siliceous stones) soil association adjacent to alluviums. The high ground to the north-west is typically the Black Rock Mountain soil association (loamy over gneiss and schist bedrock). As a result nitrogen is the main nutrient at risk of loss from this site through leaching. The bedrock is Ordovician slate and silt stone of the Oakland formation. The water contribution from the unconfined aquifer is poor. Eighteen percent of the land has slopes greater than 5% (mostly to the north-west). Dominant flow pathways are expected to be subsurface within the stratified zones of highly permeable weathered and fissured rock overlying the fresh bedrock. Dominating hydrological pathways are below-ground and stream water is highly reflective of groundwater conditions.The drinking water resources are threatened by nutrients from inorganic/organic fertilisers as well as point sources (e.g. farmyards and septic tanks), pesticides and metabolites from crop production, and microbials and emerging organic contaminants from organic fertilisers and septic tanks.

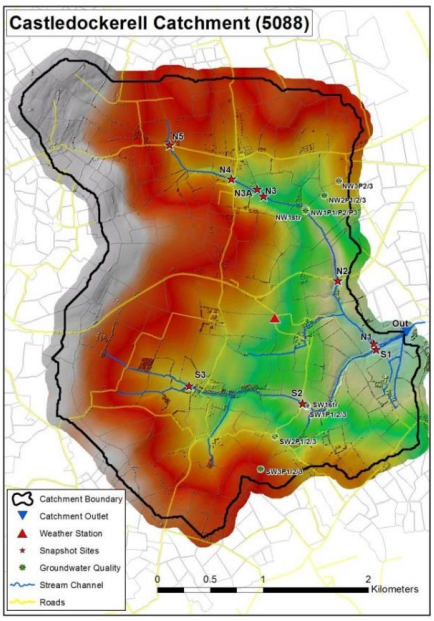

Fig 3. Castledockerell catchment.

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7.2 What is action lab trying to achieve within the project timeframe:
The main objective in this project is to achieve better water quality by awareness and education about nitrate and pesticides, in particular MCPA.

7.3 Actors involved in multi-actor platform in the action lab:
Teagasc (research and advisory), Wexford County Council, Local Authority Waters and Community (LAWCO), Glanbia Ingredients Ireland, Irish Water, Environmental Protection Agency, Government departments (DAFM, DHPLG and DCCAE), National Federation of Group Water Scheme and Landowners (farmers and householders).

7.4 Existing governance model:
Legislative steps have been taken to govern the sale and use of PPPs on a European and Irish level. In Ireland, the main regulations that control the marketing and use of PPPs include the Sustainable Use of Pesticides Regulations and the Plant Protection Products Regulations. Pesticides are regulated in Ireland by three closely linked divisions of the Department of Agriculture, Food & the Marine. At present there is a consultation document of the Irish National Action Plan for the Sustainable Use of Pesticides (May 2018) in progress. Training for farmers and other professional users on the protection of drinking water from pesticides is provided. Only a trained and registered professional user can apply pesticides authorized for professional use.

7.5 How is action lab using multi-actor platform/approach to achieve the objectives:
We involve multiple actors by on-going meetings, advice and information exchanges. For example information stands at college open days, engagement with farmers and householders (private well owners) in discussion groups and meetings, engagement with state bodies, regulators and industries. Colated and collected data will be presented and discussed with the involved actors using the collaborative management tool.

7.6 Best Management Practices:
The Irish GAP measures have been mandatory since 2006 and include measures to mitigate farm point sources, incidental losses and diffuse losses. These include:

- Point sources: Requirements for storage facilities (winter housing, storage for soild water etc.).
- Incidental losses: i) Buffer strips for water courses (2 m–200 m) and ii) “Closed periods” for landspreading (fertiliser: 15th Sep–12th/31st Jan, slurry: 15th Oct–12th/31st Jan, farmyard manure (FYM): 1st Nov–12th/31st Jan).
- Diffuse losses: i) Restrictions on stocking rates (170 kg ON ha^{-1} yr^{-1}), ii) maximum fertilisation rates = crop requirement, and iii) no external nutrient inputs on P Index 4 soils (equivalent to > 8 mg L^{-1} of Morgans P).

Based on the results of a questionnaire with the catchment farmers held during discussion groups, five to six measures will be selected based on the ease and barriers to their implementation. Knowledge transfer is seen as an important part of implementation of BMP’s within the action lab.

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7.7 Participatory monitoring:

Within the action lab existing data from local authorities, service providers and national agencies are collated and then harmonized with current and future WaterProtect research data such as private well sampling (engaging the well owners), passive river sampling and pesticide field trials.

7.8 Collaborative management tool:

The existing WaterProtect-BE platform will be used and developed into a WaterProtect-EU tool for visualisation of spatial and temporal data to multiple stakeholders. The tool will serve as the basis for discussions with stakeholders, to identify problem areas and times, and to select a suitable and feasible BMP.

7.9 Other innovative tools used in the action lab:

The Teagasc Nutrient Management Planning (NMP) Online tool allows agri-professionals to produce high quality nutrient management plans for farmers by combining their expert knowledge of soil fertility with a range of information sources (https://www.teagasc.ie/about/our-organisation/connected/online-tools/teagasc-nmp-online/).

For the action lab catchments a biophysical pesticide model is under development to allow individuals to view and interprets water quality and hence identify problem areas.

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Section 2: **Case Studies**

WaterProtect Partners have identified a total of 16 case studies, of which 12 case studies identified by project partners in the project proposal, including:

- Belgium: CCVB, (BE), Kemmelbeek (BE), Cicindria (BE),
- Denmark: Aalborg/Aarhus (DK),
- Czech Republic: KMV by EFBW,
- France: Evian by EFBW (FR),
- Ireland: West Cork (IE),
- Italy: Val d'Asta (IT), Vicobarone (IT),
- Romania: Hoteni (RO),
- Switzerland: Nestle by EFBW (Switzerland).

In this section we present a selection of case studies.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 727450

1 EWS One year pilot project, Cyprus

1.1 Description of the context:

Agriculture plays an important role in the Cypriot river basin as it uses around 60% of the available water resources. The river basin is located in a semi-arid climate and has numerous small catchments and suffers from long, repetitive drought periods combined with an increasing demand for water has led to both quantity and quality issues. Recent technological innovation is helping to improve the efficiency of water use, but even despite these measures, sustainable water management is not always achieved. This case study was based on farmers producing table grapes.

1.2 Objectives, actions and results:

A group of 10 farms in this case study piloted the European Water Stewardship (EWS) standard for studying the sustainable water management of a group of water users in a shared catchment. EWS is a holistic framework developed by a broad group of water stakeholders, supported by the European Commission, to allocate water risks and to facilitate a structured way of sustainable use of water. The standard is built on 4 principles, and 49 indicators are used to show the performance and the areas to improve. (ref. www.ews.info). The standard assesses water use both in terms of water quantity, quality, protection of ecological and socially important areas and governance with the end goal to ensure the achievement and maintenance of good water status in terms of chemical quality and biological elements. By applying the EWS standard, farmers were able to have a complete risk assessment of their risks associated to water and to collectively identify some measures which would help them overcome those risks.

1.3 Multi-actor approach:

The group was led by representatives from the Eruopean Water Parternship, a Brussels-based NGO and the EWS standard-holder in order to provide technical support on the implementation of the standard. The main stakeholders involved in the project at Cyprus level included:

- **AgroPlus**: Agrotechnical consultancy and responsible for GlobalGAP group certification.
- **Lacon**: Certification body in charge of organic and GlobalGAP certification.
- **COFA**: Farmers association as the representative of 10 farmers in the catchment
- **Irrigation Committee of Pissouri**: Control of irrigation system and billing of water consumed.
- **Biollos**: Retailer for table grapes.

1.4 Innovations in water governance:

The assessment against the standard revealed that in terms of water governance, the pilot had the highest potential for improvement when it came to governance issue for water management. The case study revealed that as a starting point the fact that the group has a person or department identified to ensure compliance with legal requirements linked to water has been the most useful for the group to come together on the topic of good water governance. Furthermore, thanks to the fact that group is GlobalGAP certified, the farmers have a set of common procedures which are established, implemented and monitored to ensure that legal aspects and compliance with the law of the production sites' water abstraction, reuse or discharge are entirely disclosed and kept up-to-date.

The assessment also identified areas of improvement which the group was able to implement, whereby each farm developed a simple procedure to optimize their water management and identified a few preventive measures to mitigate impacts of water use. Furthermore, by exploring the requirements of the EWS standard, the farmers' groups started to engage with the local river basin authorities in order to represent farmers' benefits and needs for sustainable water management.

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1.5 Agricultural Best Management Practices employed:
Previously, the group had previously worked together to study the most optimal use of inputs in order to reduce their application where possible. In order to build on that further, the farmers identified sensitive areas on their land which could be potentially high risks for pollution (i.e. eutrophication, leaching and run-off) in order to target reductions at those locations. Although not directly related to water quality, farmers performed a similar assessment on the sensitivity of water sources in order to reduce water abstraction from those sources where possible by using alternative sources for irrigation (i.e. captured rainwater).

1.6 Participatory monitoring:
Within the scope of the project a participative farming group model was tested on-site, resulting in how to include farmers in river basin management activities and to prove the benefit of this model to the farmers and the entire river basin. As a result, farmers reported an increase in awareness towards sustainable water management. On the basis of this, farmers have been working to develop and implement a joint response strategy on water management and identify whether other measures need to been taken to improve their water management performance. These response strategies include a clear set of procedures to handle accidents related to spills or misuse of inputs.

Through the assessment of existing water quality measures and their efficiency, the group was able to identify several additional actions for implementation to minimize their joint water quality risks. While group members already had a comprehensive understanding of the types of polluting substances used on-site and how and where they were stored in order to prevent spills, as a next step they worked to establish records to indicate the number and volume of applications in order to understand the potential for diffuse pollution. They also classified the substances used on-site according to the Priority Substances list of the Water Framework Directive in order to have a better understanding of the potential for aquatic pollution. In addition, they also started to analyse and monitor the quality of water used for irrigation in order to exclude accumulation of substances due to recycling.

1.7 Collaborative management tools:
Within the scope of this case study, no web-based management tool was used, but rather the collective participation of farmers applying the EWS standard was used as a collaborative tool to monitor their farming and water systems, identify vulnerable zones and risks areas and elaborate a strategy for managing inputs. Furthermore, as part of implementation of the EWS standard, the group was able to demonstrate their external communciation efforts on water-related issues whch helped to establish better transparency. Additional efforts made to connect the farmers with with river basin authotities via the farmers' organization has helped to harmonise the actions of farmers with the overall goals set forth by water authorities in the basin.

1.8 Other best practices from the case study:
Aonther requirement in implementing the EWS standard was that farmers were required to estimate the potential impact of water pollution on potential destinations and define actions to prevent those impacts. Performing this exercise was extremely useful for the group in order to gain a collective awareness on the existing and potentially occurring impacts. Since the group had also gained awareness on some of the high conservation value areas (nutrient-sensitive zones, Natura 2000 etc.), future protection measures such as buffer strips were then established as a priority in areas upstream from these areas.

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1.9 Lessons learned:

Since the suitable implementation of EWS in agriculture is at farmers' group level, in which a farmers' association/cooperative plays a coordinating role monitoring the standard implementation, the project highlighted that the contribution and dedication of a group of farmer groups to improve water management in the river basin is far more effective than single farmer implementation. In this sense, the standard works as a tool to bring the group together, while providing farmers with direct practical support and guidance to develop strategies and measures for better water management. Within the scope of implementing the standard, farmers typically receive coherent and exhaustive training on the content, the requirements and overall objectives.

More specifically in terms of water quality protection, since the EWS standard requires reporting to be established, the standard is proven most useful to fully report and classify all inputs. Lastly, farmers can prioritize their actions for water quality protection by identifying vulnerable areas at the farm and estimate the impact on potential destinations.

1.10 Funding and long-term strategy for the case study:

This project was funded by INNOWATER and DESIRAS for coordination as well as COFA in terms of personnel. The project funding for the pilot has ended and no further action is foreseen.

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2 Sol et Eau en Segala, France, Almayrac, France. Cérou-Vére River (ongoing)

2.1 Description of the context:

This project with a group of farmers in the Adour-Garonne catchment in Southern France focuses specifically on protecting the local drinking water catchment from agricultural pollution by the implementation of Conservation Agriculture (CA) practices. 74% of the territory is occupied by agricultural use surfaces that require heavy tillage and pesticide use resulting in diffuse pollution and creating numerous challenges in the drinking water catchment downstream.

2.2 Objectives, actions and results:

The main objective of the case study was the protection of a priority, designated drinking water catchment suffering from erosion and pollution problems related to agricultural activities. Farmers who have adopted CA practices have stopped tilling their fields and simultaneously implemented the use of cover crops to reduce the vulnerability of highly erosive fields and protect local sources of drinking water in the area. The Food and Agriculture Organization reports that farmers who have adopted CA practices could improve their crop yield from 26%-100% in as little as three years as soil quality improves.

2.3 Multi-actor approach:

The case study was lead and financed partly by the **local water agency Ardour-Garonne** with the involvement of:

- **Local farmers:** Responsible for the implementation of CA practices.
- **Cegala:** Local environmental organization for support in training and monitoring activities
- **Syndicat de Rivière**: River basin authority responsible for overseeing he good implementation of the Water Framework Directive
- **Association for the Promotion of Sustainable Agriculture (APAD):** Project coordinator and provision of technical expertise on CA practices.

2.4 Innovations in water governance:

There were several factors, which ensured that the project contributed to better water governance including:

- Engaging river basin authorities to ensure that actions taken by farmers were in line with environmental objectives of the national and EU regulation.
- Educating local citizens on the status of the protected catchment as well as training the next generation of farmers to make them aware of the opportunities provided by no-till agriculture.
- Sharing knowledge and experiences to give easy access for farmers to potential solutions.
- Jointly monitoring and evaluating the economic and environmental benefits of such practices.

2.5 Agricultural Best Management Practices employed:

The two key agricultural BMP's applied in this project include 1) stopping tillage and 2) planting nutrient-fixing cover crops bring nitrates to the soil and increase soil biomass. The combination of these two practices functions to create a stable soil environment, which not only reduces the likelihood of erosion, but gives soil a higher retaining capacity, both for moisture and any products applied. This means less of chemicals end up in the nearby surface waters and in some cases, soil can even use these products as a reserve. There is even some evidence that healthier soils, which are rich in microorganisms provided by cover crops, can degrade pesticides more rapidly; thereby decreasing the chance they have to have any impact on the local environment.

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Farmers were persuaded to make the switch to CA practices thanks to the establishment of a strong business case. Reducing pesticides, herbicides and fertilizers applied allowed them to save money while also possibly also increasing their yields as the vitality of the soil improved.

2.6 Participatory monitoring:
Monitoring of the drinking water quality in the Ardour-Garonne is overseen by Cegala and with support from the local water agency Ardour-Garonne. APAD is working to help translate any improvements in water quality into the direct benefits of applying CA practices both in terms of their economic impact (for the farmer, drinking water supplier and water authority), social (for the farmers) and environmental benefits for all.

2.7 Collaborative management tools:
Beyond the joint application of CA practices and the platform for knowledge exchange created by the group members, there were no specific collaborative management tools used in scope of this case study.

2.8 Other best practices from the case study:
One of the key factors for success of the on-going Sol et Eau en Ségala project has been its ability to create and maintain a close-knit community that simulates a virtual platform to share knowledge and experiences. Rather than receiving farm advisory services from an outside source, farmers have easy and direct access to potential solutions straight from their peers. This is particularly useful when problems arise in the application of new practices, which are completely unknown to a farmer.

2.9 Lessons learned:
The key factor for success of this project has been the community of practice by engaging a number of farmers in the shared catchment. Targeting a shared challenge has successfully guaranteed a widespread implementation the best agricultural practice and engagement of a wide range of stakeholders. Additionally, involvement of local water authorities to provide the necessary support and drive for the project.

2.10 Funding and long-term strategy for the case study:
The actions in this case study have been funded by local water agency: Ardour-Garonne. The group also aims to seek project funding from European calls for proposals as well as from private partners to continue its activities over the long-term.

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3 UK Freshwater Partnership, Norfolk, UK. Broadland Catchment (ongoing)

3.1 Description of the context:

The River Nar, located in Norfolk, UK, is the second longest chalk stream in the area. Compared to other chalk streams, which are known to be alkaline and clear, this river fails to meet the standards of the Water Framework Directive. Sugar beet farming, which is prevalent in the area, is one of the key culprits for reduced water quality. The wet weather in the region contributes to runoff into the River Nar, causing excessive algal growth that has negatively impacted local aquatic ecosystems. The fact that the river has been channelized over the years has created a dysfunctional floodplain which is subject to flooding and erosion, further exacerbating the water quality situation.

3.2 Objectives, actions and results:

The main goal of the case study is to "bring life back" to chalk streams in England and enhance catchments rich in biodiversity which are failing to achieve EU targets of 'good status' where agricultural pollution is major causes of that failure. The main objectives are to improve the hydro morphological structure of the river and improve the biodiversity and water quality of the catchment. This is done by providing support to 200 sugar beet farmers over 2000 acres to implement changes in land management that help to enhance soil quality and improve water efficiency in order to reduce both the likelihood and impacts of run-off pollution.

3.3 Multi-actor approach:

The main actors involved in this project include:

- **WWF-UK:** Liaise with farmers, influence farm practice and involve stakeholders;
- **The Coca-Cola Company:** Funding a Farming and Water Project Officer for the project and driving sugar beet suppliers to improve their farming practices;
- **Norfolk Rivers Trust:** execute a program of silt-trapping wetlands and other measures to improve water quality as close to source as possible;
- **Natural England:** Designee and promoter of the Catchment Sensitive Farming Priority Catchment;
- **Environment Agency:** Designee and promoter of the Catchment Sensitive Farming Priority Catchment;
- **Norfolk Rivers Drainage Board:** Maintenance of restoration measures;
- **Castle Acre Fishing Syndicate:** Maintenance of restoration measures;
- **West Acre Fishing Syndicate:** Maintenance of restoration measures;
- **Private landowners:** Maintenance of silt traps.

3.4 Innovations in water governance:

This case study has been an excellent example of how a multitude of different actors working towards a shared goal in a catchment can help strengthen water governance at local level. Members of the case study were actively involved in creating local catchment plans to explain the vital actions needed to restore rivers, contributing from the get-go their knowledge and expertise.

Since creating ownership by the local community proved to be a vital part of the success of the case study, coordinators also supported community members to respond to public consultation on future national plans for local rivers, thereby ensuring public participation in on going policy developments that might affect them in the long-term. These actions were coupled with efforts of the group to engage with civil society actors to demonstrate the achievements along the timeline of the project and push for the strengthening of laws to protect river.

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3.5 Agricultural Best Management Practices employed:

The River Nar has been designated as a national Catchment Sensitive Farming Priority Catchment as part of a joint venture between Natural England and the Environment Agency. Farmers receive free farm advisory services (i.e. on planning nutrient applications to avoid excess) and support implementing new water sensitive practices to reduce pollution, such as installing silt traps or other buffers to reduce sediment running off hot spot fields into rivers. The installation of the following infrastructures has been identified as the most appropriate measures for farmers in the catchment: track surfacing and drains, gate relocation, watercourse fencing, sediment ponds and traps, pesticide handling facilities and yard works, and some financial support is provided to farmers who implement them.

3.6 Participatory monitoring:

The Norfolk Rivers Trust has been charged with ensuring the monitoring programm of the initiative. Since the main objective of the programme was ecosystem restoration, DOC, water flows, conductivity, turdibidty, water temperature and pH, macroinvertebrates, macrophytes fish, riparian vegetation and other species are all measured as part of the monitoring programme. Biannual monitoring results are published on the organization's website.

3.7 Collaborative management tools:

The River Nar Catchment Plan has been formulated and implemented as a collaborative effort on the part of multiple stakeholders, with a five-point vision for restoration objectives. The document notes that key impacts and challenges in the catchemnt and names some of the overarching solutions and benefits as reccomendations.

3.8 Other best practices from the case study:

A key element that contributed considerably to the uptake of new pracctices by farmers has been the direct support from a locally-based Project Officer to help them put in place measures to reduce nutrient and pestcide runoff and reduce erosion. In order to ensure the success of wider water quality measures put into place in the catchement, such as sediment traps, agreements were made directly with landowners to oversee their management (i.e. clearning periodically) in exchange for the use of the soil produced to be spread on their fields . Identifying win-win solutions where all parties mutually benefit from specific actions has helped ensure the longevity of the project.

3.9 Lessons learned:

Wider community involvement has also contributed to the long-term success of the case study, this was fomented by: eenlisting volunteers to undertake river restoration activities in the catchment, engaging local fishermen in the maintenance of restoration activities and involving schoolchildren in macro invertebrate monitoring. Project coordinators found that having farmers share their experience, lessons learned and results of the project directly with local businesses and government through workshops and visits has been successful in widening the network of stakeholders and prompting action by other partners. As long-term financing is essential to the successful collaboration in this case study, a key element has been linking activities in the catchment (the impact of beet farming) to corporate sustainability goals to help ensure diverse funding sources.

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3.10 Funding and long-term strategy for the case study:

Actions were funded primarily via support (184k euros) from WWF UK and The Coca-Cola Company. These resources were used to finance a Farming and Water Project Office who was charged with liaising with farmers to influence their water management practices, implement good management practices at catchment level (i.e. silt trapping) as well as to engage other stakeholders. The CSF scheme has some incentive payments for aforementioned BMPs for farms, which have a high potential impact on water quality. Additionally, farmers can take advantage of capital grant schemes that provide 50% of costs for installation of other BMPs.

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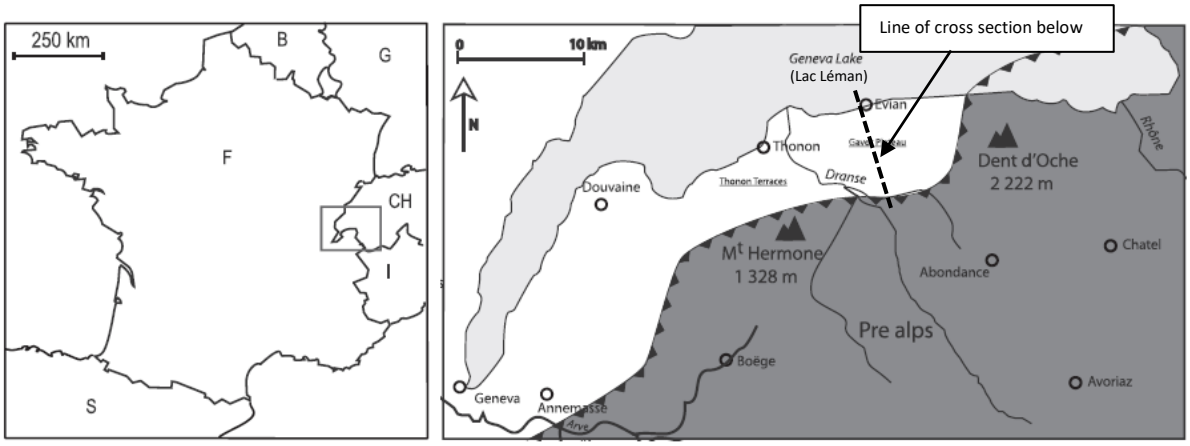
4. Evian Naturel Mineral Water (NMW1), France (ongoing)



4.1 Description of the context:

- NMW is abstracted from natural springs and boreholes drawing from a single aquifer at a total annual rate of 1,500,000 m3 (approx 4100 m3/day average).
- The aquifer is of sand and gravels of glacial origin overlain by glacial till (mix of sand, gravel and clay). The till cover provides protection against infiltration of surface water and pollution. In the spring and wells area, the aquifer is protected by a thick cover of impervious till. Recharge to the aquifer occurs at higher elavation (the Gavot Plateau) with less till cover, enabling infiltration. The aquifer extends from the Plateau de Gavot in the south (where the recharge zone is located) to Lake Geneva (Lac Léman) in the north, where the sources emerge about 30 m above the lake, without any hydrogeological connection to it. Groundwater flow is from south to north. The site lies within the surface water catchent of Lake Geneva. See cross-section below.
- The water source is critical to the Evian business. Without this source, and if it should become polluted, the business would cease. There are no other users of the same aquifer.
- Dominant land use on the recharge zone is: 50% grass meadow, 20% forest, 10% wetlands, 10% crops, 10% human infrastucture (villages, roads, etc), and no industry. Around the spring area, it is villages, forests and meadows, but the aquifer here is very efficiently protected by the overlying impermeable layer (till).
- The project is focused on protecting groundwater quality, and groundwater quantity to a lesser extent.
- The principal threats to protect against are:
    - Human infrastructure: domestic wastewater, road de-icing, removal of impermeable cover, pesticides on public 'green' areas, fuel storage tanks.
    - Agriculture: Livestock waste (mainly from cows), crops (which use manure as fertiliser and limited pesticides)
- The quality parameters presenting a risk are nitrates, road de-icing salts, pesticides and emerging contaminants (from a range of sources).

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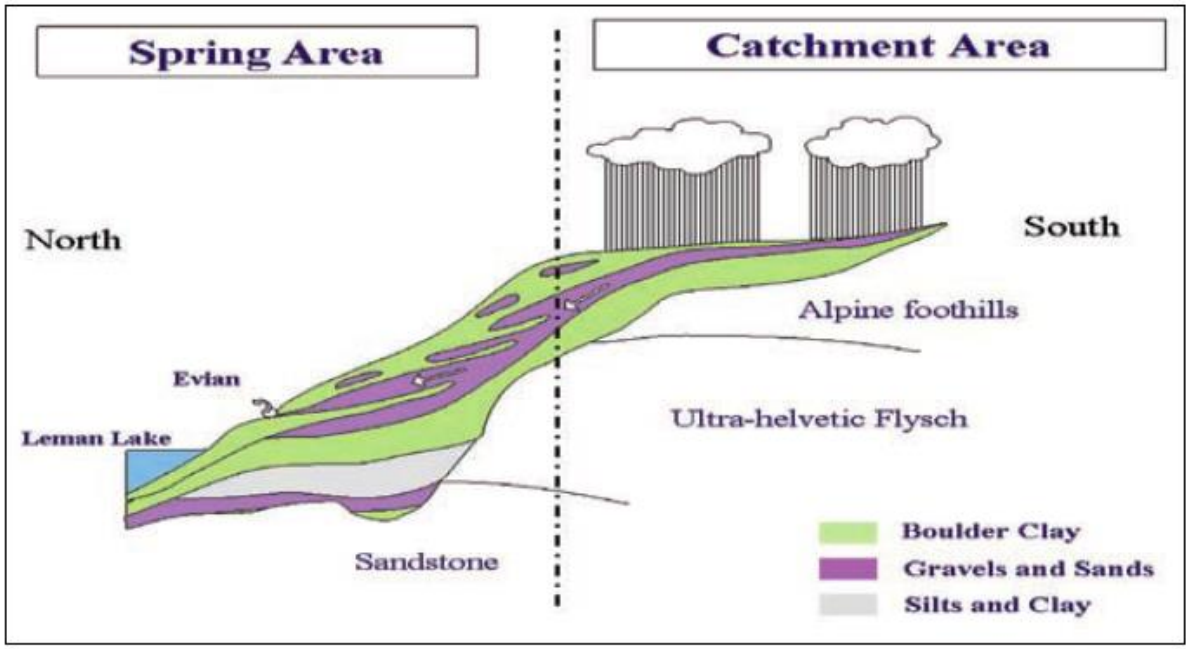

4.2 Objectives, actions and results:

- The objective of the programme is to protect the natural purity, and stabilityof the groundwater, and therefore its formal recognition as a NMW source. An additional objective (of lesser importance) is to prevent the loss of soil permeability in the recharge area.
- The approach is to work with local elected representatives, and all actors of the recharge area that may have an influence on water quality: administrations in charge of roads maintenance, villages in charge of waste water collection and treatment, town and country planning, etc., farmers to agree on methods to protect the aquifer from surface pollution, and with actions which are mutually beneficial.
- Principal actions to protect groundwater from pollution are:
    - Livestock manure is controlled since more than 25 years by helping the farmers to mantain the traditional agriculture that has 2 advantages: low pressure on the groundwater quality due to low density of livestock by hectare and higher income for the farmers
    - Livestock manure is also controlled through the Terragr'Eau project – a biogas facility. Manure is collected from farms in the recharge zone to supply the facility, thus removing it as a pollution source. Then, the safer byproduct – digestate – is used as fertiliser, but in a controlled way, at the appropriate dose on each plot. This Project was mainly designed to avoid overfertilisation near the farms.
    - Road de-icing policy. There is an ongoing programme of research and experiment to find ways to reduce use of de-icing salts, but so far, this is difficult to do without compromising road safety. One approach is to encourage more drivers to use winter tyres. Another is to priorize de-icing on main roads.
    - Promote responsible and compliant management of domestic wastewater so as to prevent groundwater contamination, and supporting upgrading of treatment factilities.

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  - Provide subsidies to help replace old single wall domestic fuel tanks.
- Success is dependent on a number of factors:
  - Good technical knowledge of the hydrogeology combined with good design of spring-capture structures and boreholes adapted for water source protection
  - Good knowledge of the socio-economic context to help design win-win actions
  - Partnership with stakeholders to identify and achieve mutual benefits
  - Regular consultation to agree actions and funding
  - Establishment of a formal water goverance organisation: APIEME, a partnership of Evian and local municipalities (see question 4)
  - Monitoring

4.3 Multi-actor approach:

- The main actors are Evian and the leaders of village municipalities (mayors). In a second level, other institutions or community professionals (like farmers) are included when projects concerning them are developed.
- The programme is managed through APIEME, Association de protection de l'impluvium des eaux minerales d'Evian (Association for the protection of the recharge zone of Evian natural mineral water), founded in 1992. Its members consist of Evian and the mayors of 13 village municipalities: 4 from the spring area and 9 from the recharge zone. APIEME meets 3 to 4 times a year to agree the annual budget and actions. Working groups meet more often (at least every 15 days).
- Evian is ensuring the technical implimentation, but in the spirit of cooperation and with the aim of unanimous agreement.
- APIEPME is a public-private association operating through both formal and informal agreements.

4.4 Innovations in water governance:

- The programme is focused on protecting the existing natural purity, not about changing or improving water quality.
- A priority is to understand the local water cycle: where water is recharged, and where it flows, and where are the threats from pollution. This then helps define which prevention actions are most applicable and where. This action is not an 'innovation', but one not always given sufficient priority in water stewardship projects.
- Innovation: to establish a formal stakeholder association, APIEME, with regular meetings to agree actions and allocate budgets.
- Innovation: to take into account the whole water cycle. For example, part of the programme is to protect natural wetlands in the upper catchment (Ramsar sites), and to recognise that keeping these healthy is important to also protecting the aquifer.
- Innovation: Education and awareness raising in the local community: Evian employees are educated on the importance of water protection, and to act as 'ambassadors' to their families and communities; running factory tours for the public. For example, a wetland near to a school on the recharge area was equipped with visitor facilities to enable school visits as a means to raise awarness of children (many from farming families) about the need to protect wetlands.

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- Transparency and trust are built through: consultation, communication, and demonstrating and providing benefits to stakeholders. Eg. Inhabitants of recharge areas have access to:
    - Subsidies for replacement of old fuel tanks
    - Subsidies for wastewater treatment plants
    - Subsidies to farmers to improve fertilising practice and also raise their hygienic standards (milk processing, cheese processing)
    - Manure collection for use in bio-gas facility
    - Subsidies for improved green area management equipment and training on how to manage these areas without herbicides
    - Protection of drinking water sources and biodiversit through improved environmental management
    - Etc.

4.5 Agricultural Best Management Practices employed:

- Establishing positive engagement and partnership with farmers and gaining their long term trust.
- Collecting manure from farms on recharge zone to use in biogas facility. The safer by-product is redistributed to farmers with guidance on best practice for application in terms of how, where and timing.
- Subsidies to farms (with 1 to 3 active people) to help them gain AOP (designations of origin) status for their products, which they can then sell at higher prices. AOP status requires farmers to respect sustainable practices, which in turn helps protect groundwater: limited number of cows per hectare, no silage (livestock waste). Farmers sell their milk to cooperatives producing cheese with product quality policy (registered designations of origin): AOP Abondance, AOP Reblochon, IGP Tome. A few farmers also transform milk into cheese themslevles, and sell it directly at the farm. These labels help raising the farmers' income with a better milk price, encouraged (with subsidies from the APIEME) during the last decades to maintain this low impact agriculture. As a result, the number of farmers on the recharge area has been stable during the last 30 years.
- Proposing technical solutions and experimentations to farmers to reduce the use of undesirable pesticides
- In summary, improved sustainability practices improve farm profitability.

4.6 Participatory monitoring:

- Monitoring:
    - Evian's water sources are routinely monitored for flow and quality
    - A number of piezometers (groundwater monitoring wells) are monitored regularly for chemisty and quality (recharge and spring zones)
    - Other superficial natural springs on the recharge area are monitored for chemistry and quality (some are used for potable supply) in order to provide early warning of any degradation of water quality.

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  - All protective actions are monitored and discussed through APIEME
  - Fertiliser: The use of biogas plant byproduct as fertiliser is monitored in terms pf GPS location and amounts
- Data sharing and use:
  - Data on municipal springs in recharge zone are shared with municipalities
  - Data are mostly used by Evian, but also to support discussions of APIEME regarding new projects, and to measure efficiency and success of existing projects.

4.7 Collaborative management tools:

The APIEME is an effective collaborative management tool.

With regard to data management software, this is used internally by Evian, but is not really applicable to the external stakeholder context, where dialogue and communication are more relevant than detailed data sharing.

4.8 Other best practices from the case study:

- Agreement with local municipalities not to drill into the NMW aquifer for drinking water supply.
- Communications to municipalities to discourage drilling for geothermal heating projects by inhabitants
- Demonstrating the contribution of the NMW business to the local economy (taxes, jobs, tourism…).
- Developing positive relationships with conservation NGO's through promoting activities to protect Ramsar wetlands and wild flower meadows.
- Partnering with academic institutions to better understand hydological and socio-economic knowledge.

4.9 Lessons learned:

In summary, success is achieved by applying a comprehensive and integrated approach to all interests and actions in the catchment linked to water management and protection, and mutual economic and social benefit.

4.10 Funding and long-term strategy for the case study:

- AIPEME is funded 2/3 by Evian and 1/3 by the four participating spring area municipalities. The person who runs it technically is financed by Evian (as employee).
- Depending on the programmes, government agencies can also contribute to certain studies or projects.
- Where there are subsidies (eg. For oil storage tanks, wastewater treatment systems, fertiliser management, etc) it means there is co-funding by others (landowners, municipalities)
- Some costs become part of the famers' routine costs when actions become incorporated into their normal working methods.
- The long terms strategy is to continue with the APIEME programme, to monitor the effectivness of actions and to adapt or develop new actions as appropriate. The programme is required so long as the Evian NMW business continues, which is indefinite.

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4.12 Contact person / reference document:

At EFBW: Ermis Panagiotopoulos (ermis.panagiotopoulos@efbw.org)
At Evian: Patrick Laschassagne (patrick.lachassange@danone.com)

4.13 Is there anything else about the case study you'd like to share:

It is easier to address agricultural issues if it is not the only activity targeted. That is, to recognise that agriculture is one amongst a number of potential risks to groundwater.

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5 Henniez Natural Mineral Water NMW2, France

Henniez Natural Mineral Water (NMW), Nestlé Waters, Switzerland

Henniez originates from the hills of La Broye, a protected natural reserve located in the French-speaking region of Switzerland, near Lausanne.

This is an example of ongoing operational water management (not a fixed time project).

Yellow line: Boundary of ecological protection zone (under Swiss Federal designation OQE = Ecological Quality Ordinance)

Red/orange line: Boundary of natural and technical protection zone (120 ha)

Blue shaded zone: Regulatory protection zone (approx. 60 ha)

5.1 Description of the context:

- The mineral water source is abstracted from six natural springs and one borehole, with water from another seven springs for industrial water (washing, rinsing, etc). Total annual water abstractions are 178,000 m3.
- The surface terrain is as shown on the satellite image map. It is gently rolling hills with a mix of woodland, agriculture and human infrastructure. It is in an area known as the Swiss Plateau between the Jura mountains and Lac de Neuchatel to the north, and the Alps and Lake Geneva (Lac Léman) to the south.
- The aquifer is of Quaternary alluvial material (sand and gravel laid down since the last ice age), within a channel excavated by earlier glaciers. It is underlain by impermeable marls. The water originates from Burdigalian sandstones. The aquifer is quite well protected by overlying rocks of low permeability (glacial till and consolidated Quaternary deposits).
- Other water users: the Henniez municipality abstracts some water from the same aquifer for public supply. Some farmers abstract from surface water.
- It lies within the Moyenne Broye river basin (Middle Broye).
- The central recharge zone for the aquifer is the blue shaded are on the map. But the larger recharge zone is about 700 ha (yellow bounded zone on map).
- The water source is critical to the Henniez business. Without its water sources, and if the aquifer should become polluted, the business would cease.
- Dominant land use on the 700 ha recharge zone is: 75% agriculture and 25% woodland, interspersed with human infrastructure (houses, roads, etc). There is no industry (other than

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- Henniez bottling plant and biogas plant). Dominant agriculture is dairy cattle, but also a few cereal crops. Downstream of the recharge area are more intensive maize, and beekeeping.
- The project is focused on proteecting groundwater quality.
- The principal threats to protect against are:
    - Agriculture: pesticides and manure
    - Human infrastructure: principally roads and risk of spillages from accidents

5.2 Objectives, actions and results:

- The objective of the programme is to protect the natural purity of the aquifer, and therefore its formal recognition as a NMW source.
- The approach is to work with regulatory agencies, landowners and farmers to agree on methods to protect the aquifer from surface pollution, and with actions which are mutually beneficial.
- There is a regulatory protection zone around the springs of about 70 ha, supported by both local and regional goverment. This incorporates the Swiss standard regulatory approach:
    - Zone 1: Direct infrastructure protection zone
    - Zone 2: Close protection zone based on 10 days travel time (to protect against microbiological threats)
    - Zone 3: Distant protection zone based on 100 days travel time (to protect against undesirable contaminants)
- The company also has formal agreements linking 72 farmers to a “biodiversity network” with indirect payments from the Swiss Confederation, whereas contracts are signed between 27 of them with the biogas station (hosted on Nestlé Waters industrial land) for the management of their manure. Good manure management reduces the risk of aquifer contamination.
- Principal actions to protect groundwater from pollution are:
    - Establish regulatory protection zones
    - Work cooperatively with farmers and other stakeholders
    - Support and promote specific actions to reduce risks
- The most important action for success is to operate transparently and through stakeholder engagement to dientify relevant ‘collective actions’ with mutual benefits.

5.3 Multi-actor approach:

- Main actors and stakeholders:
    - Organic farmers, who already have a conviction for protecting natural land and water quality
    - Farmers Association which is supportive of innovative farming practices to move away from intensive farming practices
    - Wildlife associations (NGOs) which provide external support for biodiversity projects and promote environmental benefits of an ‘integrated environmental approach’.

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  - Agroforestry, permaculture and beekeeper groups who use the Henniez protected area to apply sustainable practices, which support their own businesses and local economic development.
  - Innovative start-ups, providing relevant agro-technology (i.e. drones or autonomous robots to apply homeopathic doses of organic herbicides…)
  - Local energy supplier, converting local major threat (manure) in renewable energy by combining it with other regional by-products (i.e. coffee ground, but also mills by-products) through biogas station
- Conflicts are managed through consultation
- Henniez Nestlé plays a leading role, but working closely with all stakeholders in the spirity of cooperation and mutual benefit.
- Formal agreements are linking 72 farmers for "biodiversity network" with indirect payments from the Swiss Confederation, whereas contracts are signed between 27 of them with the biogas station (hosted on Nestlé Waters industrial land) for the management of their manure

5.4 Innovations in water governance:

- The programme is focused on protecting the existing natural purity, but has had success in reducing nitrate concentrations.
- Nitrate concentrations of 20 mg/l in the aquifer (in the 1980s) reduced to around 12 mg/l over time following the prohibition of agriculture in the 'Domaine d'Henniez' protection zone, thus reversing a trend that could have become a concern.
- Transparency and trust are built through: consultation, communication, and demonstrating and providing benefits to stakeholders

5.5 Agricultural Best Management Practices employed:

- Prohibition of agriculture in most important zones through regulatory protection.
- Partnership with a biogas energy plant to collect manure from dairy farms, so as to remove this quality threat from the recharge zone.
- Promotion of organic farm and other low intensity approaches.
- Recognising that farmers need to see and achieve benefits to their own business to be supportive.

5.6 Participatory monitoring:

- Monitoring: Intensive water resources monitoring – from both quantitative and qualitative standpoints, i.e. pressure probes in piezometers, continuous discharge for wells, "porous candles" for soil water quality… - is part of the daily activities of several specialists that are in the field, meeting with the local stakeholders. In parallel, advanced and complete hydrogeological studies, vulnerability studies, soil studies and environmental studies with local, regional or international entities (i.e. academics) is bringing trust and relevancy.
- Data shring: For the moment, data are shared on purpose, with relevant stakeholders depending on their involvement in the different projects. More holistically, we plan to gather all key data around water resources, water balance and water challenges in the format of a 3D block diagram that will be shared with local stakeholders everywhere we

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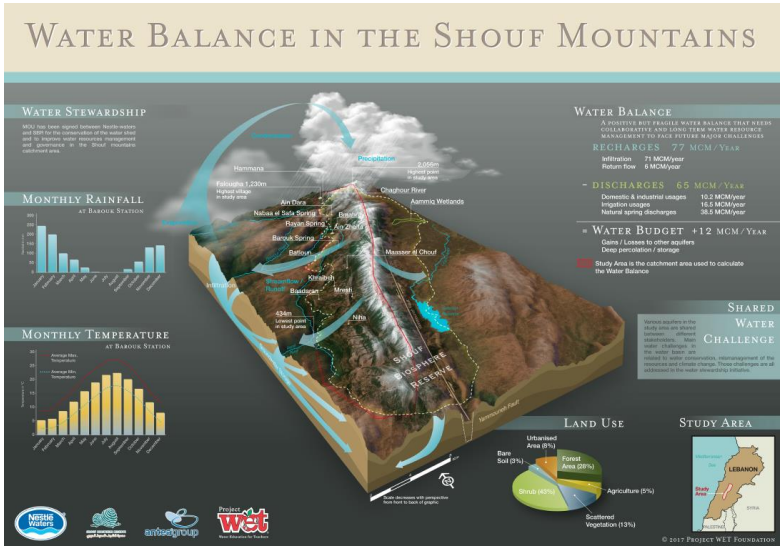
operate (see here under the example of Lebanon). The idea is to make this synthetic information available to the local stakeholders during "factory open day", typically celebrating the World Water Day, in order to further discuss any water concerns or challenges, and to trigger relevant water "collective action".

Example diagram of the local water situation. Henniez will develop a similar diagram for local and stakeholder communication.



5.7 Collaborative management tools:

- The effective collaborative management tool is that of management stakeholder enagagement and communication, and working with stakeholders on a mutual beneficial basis.
- With regard to data management software, this is used internally by Henniez, but is not really applicable to the external stakeholder context, where dialogue and communication are more relevant than detailed data sharing.
- Data are shared with stakeholders where this is relevant.

5.8 Other best practices from the case study:

- All this "holistic environmental approach" is now driven through Nestle Waters' global "Water Stewardship Strategy", consisting of engaging wherever possible with the local stakeholders, in order to identify relevant water protection projects with mutual and sustainable benefits
- Nestle Waters has a dedicated water resources team and specialists at global, regional and site levels, applying internal strategy and good practices

5.9 Lessons learned:

- Water Stewardship mindset, when applied and certified, represents currently the most efficient path towards sustainability, especially when local water regulations are not strong or mature enough

5.10 Funding and long-term strategy for the case study:

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- Much more than through financing, dedicated persons and time are absolutely crucial to convince and drive other stakeholders and water users of a catchment in a suitable and sustainable way for a shared water resource

5.11 Contact person / reference document:

- At EFBW: Ermis Panagiotopoulos (ermis.panagiotopoulos@efbw.org)
- At Henniez / Nestle Waters: Cédric Egger, Corporate Water Resources Manager. (cedric.egger@waters.nestle.com)

5.12 Is there anything else about the case study:

Arrogance or little consideration for other stakeholders with economic interests in the same catchment creates an unfavourable and unsuccessful approach to water management

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6 Waldquelle, Urguelle, Naturquelle NMW3, Austria (ongoing)

Waldquelle Kobersdorf Ges.m.b.H

Location: A-7332, Kobersdorf, Auwiese, Austria

The business has three bottled water products: Waldquelle, Urguelle and Naturquelle. Still and sparkling natural mineral waters (NMW). The NMW originates from an aquifer lying the south east of the town of Kobersdorf.

6.1 Description of the context:

- The mineral water source is abstracted from five boreholes with official NMW designation under EU Directive rules. Total annual water abstractions are 190,000 m3.
- The surface terrain is as shown on the attached map. It is very gently rolling hills dominated with farmland, but with some woodland and some human infrastructure, including none dense housing and some roads. The landscape is dominated by the low lying extinct Pauliberg volcano to the west.
- The aquifer is of Tertiary sediments, including sandstone, overlying fractured crystalline bedrock (which forms part of the effective aquifer, contributing water flow and dissolved CO2). Groundater is abstracted from between 60 and 200 metres depth.
- The water source is critical to the Waldquelle business. Without its water sources, and if the aquifer should become polluted, the business would cease.
- It lies within the surface water basin of the Schwarzbach river.
- The aquifer is recharged from the west, some from where the Tertiary rocks are exposed, and some from the volcanic rocks of the Pauliberg volcano.
- In the protection zone, the aquifer is protected from surface pollution by 3 to 5 metres of clay. However, it is not entirely sealed and therefore still requires protection through control of land use activities.
- Dominant land use is agriculture, some isolated housing, the village of Kobersdorf to the west, road infracstructure. There is no industry apart from the Waldquelle bottling plant.
- The principal concern for groundwater quality is pesticides from agriculture.
- The project is focused on protecting groundwater quality.

6.2 Objectives, actions and results:

- The objective of the programme is to protect the natural purity of the aquifer, and therefore its formal recognition as a NMW source.
- The approach is to work with regulatory agencies, landowners and farmers to agree on methods to protect the aquifer from surface pollution, and with actions which are mutually beneficial.
- There are regulatory protection areas, as shown on the attached map.
- There is no intensive agriculture directly on the protection area, based on agreement with farmers.
- In other parts of the catchment, there is crop rotation (between wheat, maize and rapeseed) to allow soil to recover and minimise the potential impact on groundwater infiltration from a single dominant crop (monoculture).
- Farming is at small scale: a combination of smallholders and family farms.
- With the appropriate protection in place, there is no specific water quality risk. Pesticides represent a risk if there were no protection.

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- The Kobersberg community is the only other user of grounwater, for public supply, but not from the same aquifer.
- Success is based on: defining a protection area, and then controlling land use in some way. The ideal is to own the land for complete control (which we do for some parts), or, to sign contracts with landowners, as we do with local farmers, that they will not use pesticides.

6.3 Multi-actor approach:

- Main actors and stakeholders:
  - The Waldquelle businesss, through control and monitoring of the protection area, and engaging with land owners through consultation and contracts.
- Conflicts are managed through consultation
- Waldquelle takes the leadership role, but within the spirit of consultation and agreement.

6.4 Innovations in water governance:

- There are no major innovations.
- Critical is to understand the hydrogeology, and therefore to define a protection zone.
- Mapping the protection zone helps provide the influence for consultation with regulators and land owners.
- Understanding that pesticides would represent the principal water quality risk, allows us to focus on engagement and agreement with farmers.

6.5 Agricultural Best Management Practices employed:

- Not using pesticides in the defined protection zone.
- No sewage or wastewater disposal permitted in the protectoin zone
- Monitoring farmers regarding their adherence to their contracts.

6.6 Participatory monitoring:

- Waldquelle monitors the use of pesticides by farmers under contract, in autumn and spring. Farmers are aware they are observed.
- Data are shared internally, with no need to share externally.

6.7 Collaborative management tools:

- N/A

6.8 Other best practices from the case study:

- N/A

6.9 Lessons learned:

- It is best to gain as much control as possilbe over land in the protection, ideally through ownership.
- Buying farm land is becoming more feasible as there is a trend away from farming.

6.10 Funding and long-term strategy for the case study:

- All project funding is from the Waldquelle business.

6.11 Contact person / reference document:

- At EFBW: Ermis Panagiotopoulos (ermis.panagiotopoulos@efbw.org)
- At Waldquelle: Klara Halova (klara.halova@mattoni.cz)

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7 CVBB, Belgium

CVBB ('Coordinatiecentrum Voorlichting en Begeleiding duurzame Bemesting': Advisory service for sustainable fertilisation) works in many catchments in Flanders from 2012 until now.

7.1 Description of the context:

CVBB works in many catchments in Flanders mainly on nitrates in surface water. The water courses, showing nitrate concentration above the tresholds, are intensively monitored and farmers in the catchment are coached in their fertilisation strategy. CVBB coached 764 farmers in 99 catchments in 2015, 936 farmers in 107 catchements in 2016 and 1168 farmers in 124 catchements in 2017. This coaching in the fertilisation strategy includes a fertilisation advice based on soil samples and the crops of the farms and guidance on fertilisation during the whole growing season.

CVBB performed also 'water quality meetings', where the water quality of the water course is discussed with the farmers of the catchment. There have been 447 'water quality meetings' since the start of CVBB. Approximately 3000 unique persons attended the meetings. A lot of farmers attended more than one meeting.

CVBB gives also fertilisation advice: 1888 unique farmers got fertilisation advice since the start of CVBB. Several farmers got fertilisation advice during several years.

Figure 1 shows the numbers of farmers per catchement, who got fertilisation coaching by CVBB. Figure 2 shows the number of water quality meetings per catchement. Figure 3 shows the number of farmers per catchement who got fertilisation advice.

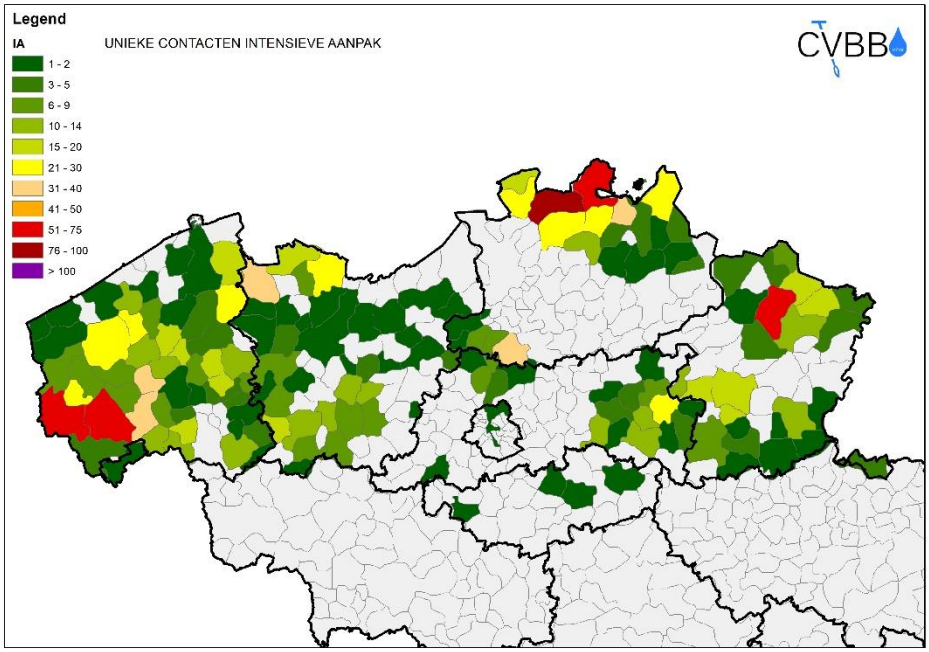

Fig. 1: Number of farmers in the catchment, who got fertilisation coaching of CVBB

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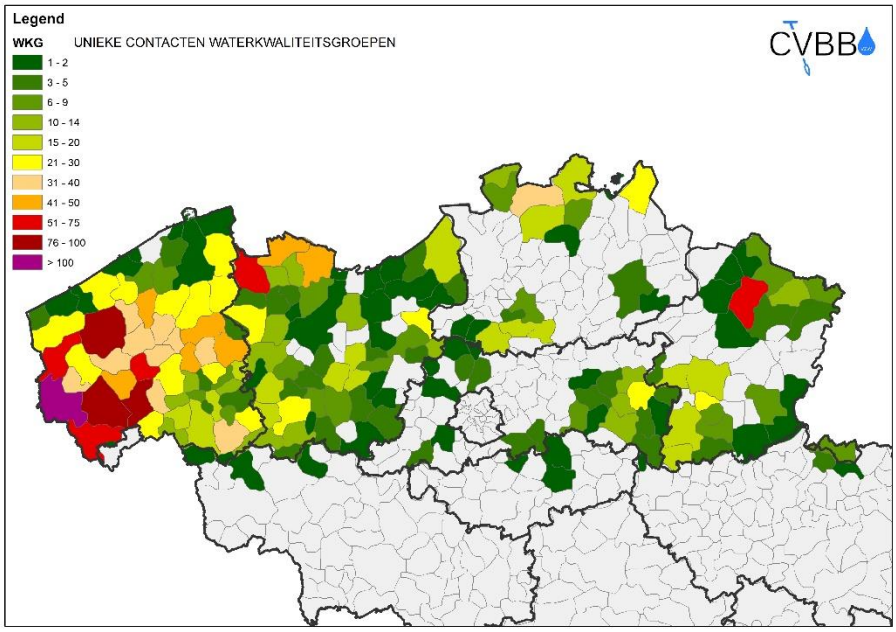

Fig. 2: The number of water quality meetings of CVBB per catchement

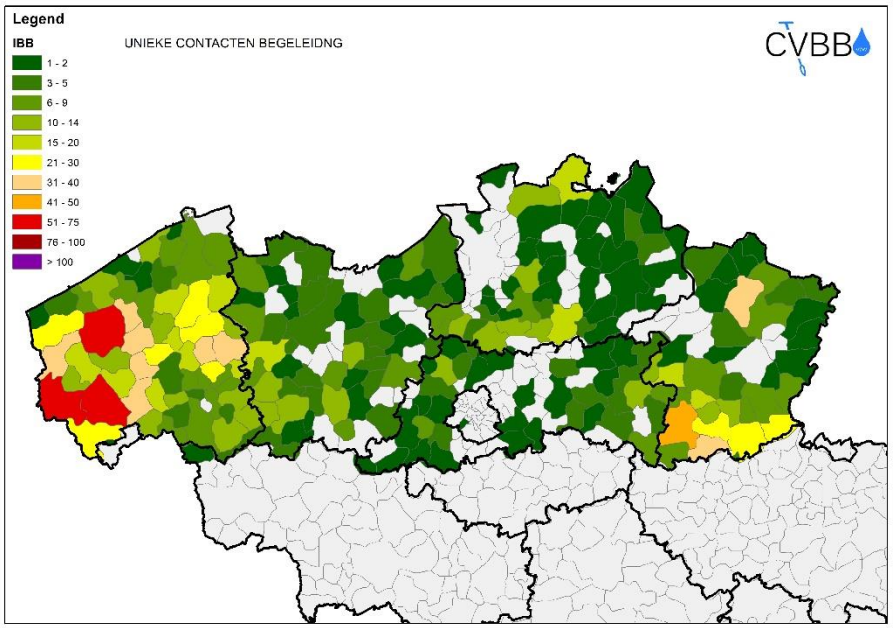

Fig. 2: The number of farmers per catchement who got fertilisation advice of CVBB.

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7.2 Objectives, actions and results:

CVBB focuses on impact of agriculture on water quality. All their nitrate-monitoring locations were evaluated on the influence of non-agriculture. If the monitoring location was too much influenced by non-agriculture, another measuring point was selected in consultation with the different actors in order to be sure to measure mainly agricultural influence. Objectives, actions and results:

The aim of CVBB is to improve water quality with regard to nitrates in Flanders. An improvement in water quality can mean both a decrease in the average NO3- concentration and a decrease in the number of exceedances. CVBB also wants to investigate and address the cause of the pollution and to create a change in mentality among farmers towards fertilization.

With the establishment of CVBB in 2012, 26% of the nitrate monitoring points in the watercourses in Flanders exceeded the threshold of 50 mg NO3- per litre. In 2016, the percentage of nitrate monitoring locations exceeding the threshold was decreased by 5%.

Actions to obtain the goal of the CVBB:

- Monitoring of the NO3- concentrations in the watercourses through intensive sampling upstream the monitoring point exceeding the threshold level.
- Organisation of 'water quality groups' (information meetings for local farmers on the results of the monitoring point in their region).
- Investigating the cause of the exceedance of the threshold level and tackling the cause.
- Personal farmer advice and guidance with the aim of improving the fertilisation strategy of farmers.

Independence (of governance and controle agencies) and transparancy are very important to gain trust by the farmers.

7.3 Multi-actor approach:

Farmers, farmers associations, agricultural advice and research centres, government, provinces, municipalities, VLM, VMM (Flemich environment agencies), bioforum.

CVBB gives information and advice to farmers and works together with the farmers to obtain a better water quality. Flemish government (through the VLM) finances. The other actors have an advisory role.

Conflicts are discussed and resolved in consultation with the partners involved. CVBB takes the lead.

There are both formal (f.e. with the government/VLM) or informal (bv. With farmers) agreements in place.

7.4 Innovations in water governance:

Transparency is a very important key for the success of CVBB. CVBB tries to be very open on their goals, the results of the measurements, the measurements, because of this, the farmers gave CVBB already a lot of information.

CVBB is independent from the government and control agencies, which creates trust of the farmers in them.

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CVBB tries to work out solutions together with the farmers and tries to propose very practical solutions and feasible techniques in function of the needs and possibilities of the farm/farmer. The participation of farmers is completely voluntary and there are minimal costs for the farmers. Government pays for the sampling. CVBB give advice to the farmers and farmers can select the measures, which are beneficial and feasible for them. Therefore, many farmers are willing to participate.

CVBB was the first who searched for the cause why a monitoring point exceeded the threshold and tried to address the source of pollution together with the local actors and taking into account the characteristics of the area.

7.5 Agricultural Best Management Practices employed:
Some examples of BMPs:

- Tackling of direct discharges .
- Improve fertilization strategy by making fertilization plan for farmers based on soil analyzes on crop/parcel level and farmer advice and guidance.
- Adaptation of the application techniques, such as in row application of fertilisation, fertilisation with drag hoses.
- Fractional fertilisation.

It is important to propose practical and feasible techniques and measures in function of the needs and possibilities of the farm/farmer to ensure the uptake of the farmers.

7.6 Participatory monitoring:
Nitrate concentration in water and soil is monitored in the problem areas. Nitrate concentration in water is monitored every 3-4 weeks and the results are sent by mail to the farmers, who have indicated to be interested in receiving the results of the catchment. The results are also presented in meetings. Soil samples are taken if needed to determine the fertilisation strategy. The results of the soil samples are mailed to the farmers and discussed during telephone conversations and/or farm visits.

7.7 Collaborative management tools:
N/A

7.8 Other best practices from the case study:
N/A

7.9 Lessons learned:

- The intensive monitoring is very interesting to create awareness among farmers and to find and to be able to tackle the cause of polution
- Robust measurement network is essential to minimize fluctuations.
- Gain trust of the farmers and work with farmers towards a common goal are very important.
- It is important to propose practical and feasible techniques and measures in function of the needs and possibilities of the farm/farmer to ensure the uptake of the farmers.

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7.10 Funding and long-term strategy for the case study:
The government funds CVBB. The operation of CVBB is evaluated and extended every 4 year with a new legislation.

7.11 Contact person / reference document:
Coordinator CVBB West-Vlaanderen: Brecht Catteeuw
Telephone: +32 (0)51 27 33 60
Email: brecht.catteeuw@inagro.be
Website: www.cvbb.be (in Dutch)

7.12 Is there anything else about the case study:
External factors, such as weather conditions and processes in the soil, have a major influence. You can not do anything about these external factors. This should be taken into account.

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8 Water Monitoring Project Grote Kemmelbeek (GKB) – Bayer CropScience, Belgium

HIGH-RESOLUTION WATER MONITORING PROGRAM GIVES FURTHER INSIGHTS ON SOURCES OF CONTAMINATION FROM HERBICIDES IN SURFACE WATER

Name of the project : Water Monitoring Project Grote Kemmelbeek (GKB) – Bayer CropScience.

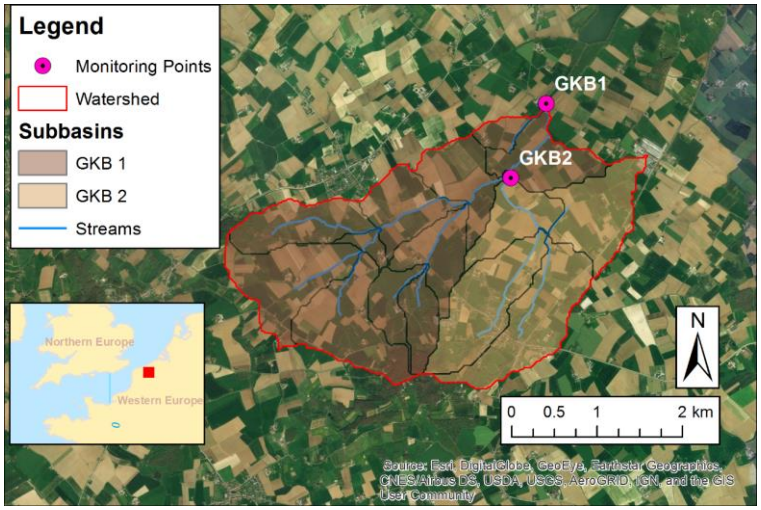
Country : Belgium, Province of West-Flanders, Heuvelland, catchment area of Grote Kemmelbeek.

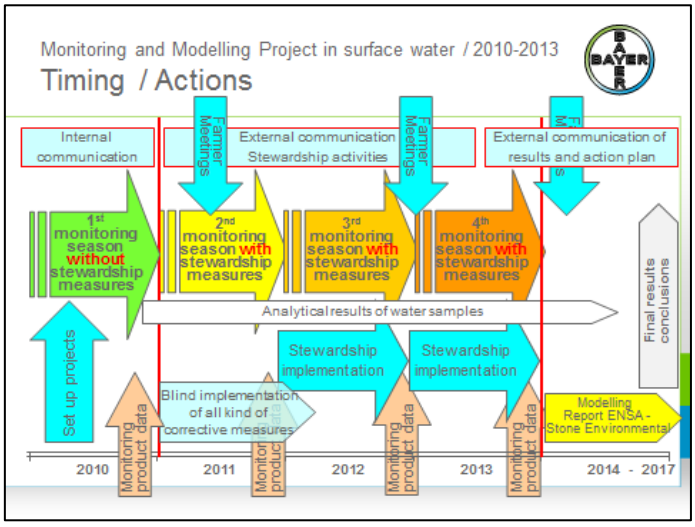
Monitoring period : 2010-2013.

Analytical results and SWAT modelling phase : 2014-2017

Study area figure of the GKB catchment with two-water quality monitoring points identified:

There are two primary stream systems within the catchment, the eastern part which drains through the GKB2 monitoring point. GKB1 is the watershed outlet, thus all areas in the watershed drain through this monitoring point. Based on the years from 2009 – 2013, the average annual precipitation for the GKB catchment is 797 mm/year.



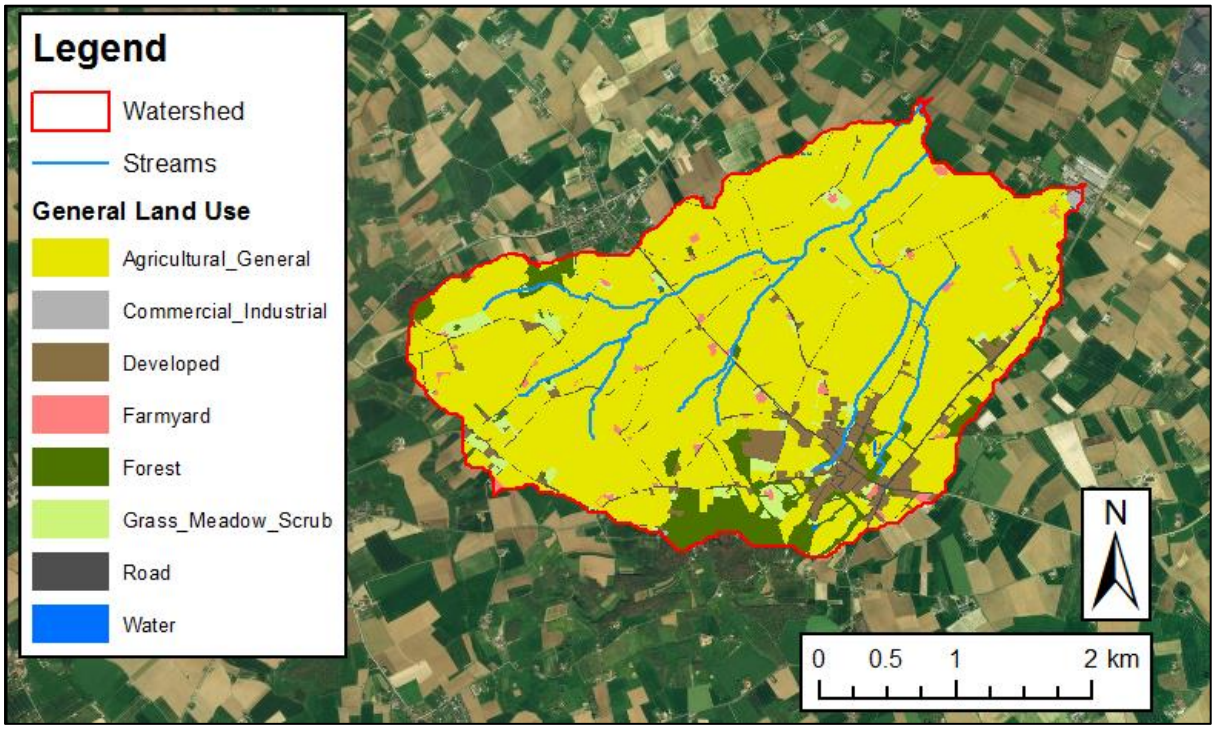


Grote Kemmelbeek :

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 727450

8.1 Description of the context:
Study Area Description :

The Grote Kemmelbeek (GKB) catchment in Belgium is a 992 ha catchment located in the Flanders region of Belgium. The catchment is predominantly agricultural (>90%), with some forest, farmsteads, and non-cultivated grassland. Limited influence of industry or urban activities.



The mean elevation of the catchment is 53 m, and ranges from a minimum of 24 m to a maximum of 159 m. The hilly region is characterized by a typical “sandy loam” soil.

The water body of the Grote Kemmelbeek is connected with the lake of “Dikkebus”, which is a production source for drinking water. Therefore, pollution of surface water by nutrients and especially by plant protection products has to be avoided.

8.2 Objectives, actions and results:
The EU Water Framework Directive has set environmental quality standards for pesticides, which are the benchmarks for the on-going EU wide water monitoring and the evaluation of water quality. In addition, national water standards may deviate or include different compounds.

The explicit understanding of the exposure routes to a specific water body is crucial in taking the appropriate mitigating measures to avoid exceedances of these standards in surface water.

In the agricultural catchment area of the Grote Kemmelbeek in the West of Flanders in Belgium, Bayer set up a high-resolution water monitoring program by taking one or more mixed water samples daily in the period 2010-2013 at two different measuring points. During sampling, high intensive flow data from the river were registered by ISCO automated samplers. Concurrently, a survey was carried out among the involved farmers within the catchment area. Agronomic data from the applied herbicides, application rate and dates were collected for each field along with soil data, tile drainage situation in the field and weather data.

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Samples in the first year were taken without informing the farmers in the concerned area as a reference year (base line). During the following three years farmers were asked to implement mitigating measures such as the use of low drift nozzles, vegetative filter strips, micro-dam technology in potatoes and conservation tillage. The objective of this research was to reach an intrinsically better ecological quality in surface water after an awareness campaign at farmer's level and the establishment of these agronomic Best Management Practices (BMPs).

The water samples were analysed by LC-MS/MS for residues from 11 different active ingredients of herbicides. The analytical results displayed a high correlation with the precipitation data. Intensive rainfall results in high concentration values. The highest concentrations were specifically measured during the application season. Surface water exposure occurred quickly, within a few hours, and usually disappeared significantly slower through dilution, dispersion and degradation. The impact of the weather conditions and the quantity of applied herbicides as well as their specific properties show an important role in the contamination level of surface water. The main objective of this project was the quantification of the different pollution pathways in order to take pragmatically mitigation measures and to implement an optimal stewardship program. This quantification was done by running the SWAT modelling for the collected data of analytical results, water flow and weather data, soil and drainage information of the fields, detailed information on land use and the applied herbicides at field level during the monitoring period. Next to diffuse sources, point source entries were also found as the most important and significant exposure route rendering a consequent reduction of these contributions necessary.

Out of the diffuse sources, run-off was often the predominant exposure pathway into surface water. Applying agronomic Best Management Practices focusing on run-off mitigation (conservation tillage, micro-dams, vegetative filter strips, green cover crops) would therefore be most effective in combination with an intensive stewardship program at the farmer's level to help reducing pesticide concentrations in surface water in order to meet the standards of the EU Water Framework Directive.

Success factors:

The most important factor for the success of the strategy was "trust" of the involved stakeholders in this monitoring project. The good relationship with the local farmers, with contract sprayers, with the distributors/advisors of plant protection products, with the local and regional authorities was the key to success. Transparency, involvement and openness of the farmers was needed for creating awareness, for the implementation of the proposed mitigation measures and especially for the information survey of the applied plant protection products at field level. Secondly, this project required a large financial budget and the necessary manpower and expertise.

8.3 Multi-actor approach:

Bayer CropScience was the owner of this project and took the lead for the set-up and coordination, execution of the monitoring, survey of the farmers, analysis of the samples and modelling phase of the project and final reporting of the results.

Involved stakeholders:

1) Farmers / contract sprayers: create awareness on surface water contamination, inventory/survey of the fields, crops and applied plant protection products, implementation of mitigation measures as from the second agricultural season.

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2) Distributors / advisors of plant protection products: the good relationship between Bayer and its distributors and their advisors contributed to the trust of the farmers. This group of influencers was multiplying the message of Good Agricultural Practices to the farmers.

3) Local and regional authorities (Municipalities, Provincial authorities, Flemish Regional authorities, and water boards): Positive attitude to give the authorization for taking samples and the installation of samplers in the field. In addition, the local municipalities have a positive influence at farmer's level and they provided interesting details on local common practices of farmers and important information of the specific river network parameters.

4) Research institutes and Universities: input of expertise and knowledge on water monitoring and modelling. Leadership role within de Bayer CropScience organization.

8.4 Innovations in water governance:
No real innovations in water governance were implemented. Only conventional mitigation measures were applied. A description of the conducted process and success elements are mentioned in point 3 and 4. Idem ditto for trust and transparency. Important to know is that the high-resolution monitoring data and survey of the farmers have led to an accurate, high quality end result of the model. This final result gives better insights in the sources of contamination and is helpful to take the right practical mitigation measures in order to result in a better ecological status of surface water.

8.5 Agricultural Best Management Practices employed:
Agricultural Best Management Practices. The following Agricultural BMP have been applied as from the second season :

1. Against erosion and run-off:

- Vegetative grass filter strips alongside the watercourses (financial compensastion)
- Conservation tillage.
- Micro-dam technology between the furrows of potatoes.
- Green cover crops.

2. Against drift:

- Minimum 50 % drift reduction nozzles everywhere (for free).
- Buffer zones.

3. Against point source pollution:

- Installation of a filling area with a biobed – Leader Project / INAGRO
- Create awareness on point source pollution, promotion of the use of bioremediation systems such as Phytobac® and Biofilter.
- Stimulating rinsing principle of the sprayer in the field.

8.6 Participatory monitoring:
See also point 3.

In the catchment area of the Grote Kemmelbeek high-resolution water samples were taken by ISCO automate samplers at two monitoring locations.

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- In the first period (from week 19/2010 untill week 29/2010) grab samples of 20 ml each 30' and 12 samples in 1 mixed bottle during 6 hours. This results in 4 mixed samples per day.
- In the second period (from week 29/2010 untill week 32/2012) grab samples of 20 ml each 60' and 12 samples in 1 mixed bottle during 12 hours. This results in 2 mixed samples per day.
- In the third period (from week 32/2012 untill week 52/2013) grab samples of 20 ml each 120' and 12 samples in 1 mixed bottle during 24 hours. This results in 1 mixed sample per day.

8.7 Collaborative management tools:
See also point 3.

The quantification of the different pollution pathways was done by calculating a SWAT model for the collected high-resolution data.

8.8 Other best practices from the case study:
After the first season as a base line or reference year, open discussion and communication with all involved stakeholders was very crucial and the basis of success. Especially the trust and transparancy with the involved farmers was very important.

8.9 Lessons learned:
See point 3.

8.10 Funding and long-term strategy for the case study:
Actions were funded by Bayer CropScience.

The quantification of the different pollution pathways gives Bayer the possibility to develop practical and effective mitigation measures and to implement an optimized stewardship program as part of a long term sustainable agriculture strategy in order to reduce contamination of surface water. Specific fundings were used for the implementation of vegetative grass buffer strips and the use of low drift nozzels.

8.11 Contact person / reference document:
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Reference documents on request.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 727450

9 Cicindria catchment, Sint-Truiden, Belgium

Cicindria catchment, Sint-Truiden, Belgium (2014-2018; ongoing)

9.1 Description of the context:

The Cicindria study catchment (1075 ha) is a small agricultural catchment located in the east of Belgium in a fruit growing region. It is characterised by mainly agricultural land-use with some residential land-use and in the surface water frequently high concentrations of pesticides have been detected. The area has a high potential erosion causing pesticides entering the river as a result of fast overland (runoff and erosion, direct losses) processes, directly connecting surfaces and/or agricultural fields where pesticides are applied, to the receiving river.

9.2 Objectives, actions and results:

The objective of the study was to increase the uptake of mitigation measures by communicating to the farmers and monitor the effect in a long-term monitoring campaign before and after implementation of measures.

A targeted approach was developed where first a map was derived with priority zones for applying mitigation measures. This information in combination with information from a pesticide monitoring campaign was used to communicate to local farmers with focus on those farmers with potentially a significant impact on the pesticide load to the river.

A risk map representing the risk of pesticide runoff to the river was derived based on information about the topography, crop cover, the estimated pesticide use, the potential erosion risk, and the connectivity of the agricultural parcels to the river. Subsequently, the theoretical risk map was validated in the field using field observations of runoff during stormflow events, and using observations of roads short-circuiting the runoff to the river. The risk map in combination with monitoring results of pesticide concentrations in the river was further used to communicate to the local farmers.

From the validated risk map priority zones were defined for measures related to erosion control. The information was used to target farmers that may have a significant impact on the pesticide load to surface water. Those farmers were encouraged to participate in a voluntary erosion control program supported by the local government, starting from 2016 on.

Communication was done in two steps: (1) general information meetings to the local community of farmers and (2) visits to farmers with fields located in the identified priority zones. During the first year of active communication and involvement of farmers, 11 grass buffer strips have been installed in the catchment with a width of 9 m or 21 m covering a total area of 8,46 ha. The effect of the mitigation measures on water quality is further assessed in a monitoring campaign.

9.3 Multi-actor approach:

The actors involved were the farmers, the agricultural research centre pcfruit (knowledge on measures and communication to farmers), VITO as research institution (knowledge; set-up monitoring, generating maps, interpretation of results), VLM (Flanders Land Agency; responsible for management contracts with farmers for instance for erosion mitigation), Watering Sint-Truiden (local water board; local water management with also a focus on erosion mitigation).

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Communication to the farmers was done in two steps: (1) general information meetings to the local community of farmers by pcfruit and (2) visits to farmers with fields located in the identified priority zones by the VLM.

9.4 Innovations in water governance:
Information meetings were organised discussing the results with the farmers and also with the residents (non-agricultural use of the product); addressing the residents was also important to have the trust of farmers. By including VLM in the process (who have an interest in erosion mitigation but not in water quality) alternative financing for the implementation of measures was found.

9.5 Agricultural Best Management Practices employed:
Mainly grass buffer strips that could be subsidized under a management contract with VLM; pcfruit also has a lot of on-going activities to sensitize about point losses and measures to avoid those.

9.6 Participatory monitoring:
Glyphosate concentrations were monitored at two locations on the Cicindria and the loads of pesticide entering the river between these two locations were calculated. Automatic samplers were installed for two types of sampling: time-paced sampling (every 4 hours collected in one bottle for 24h) and event-paced sampling triggered by the river level going over a threshold (every 15 min collected in one bottle per 90 minutes). Event-paced sampling provides higher resolution data after a rainfall event. Also water velocity and river level was recorded every 5 min. The monitoring results are shared with the farmers at the information meetings.

9.7 Collaborative management tools:
No app was developed but the risk map (at the agricultural parcel level) and the map with the priority zones were used as communication tools to the farmers at the information meetings.

9.8 Other best practices from the case study:
Sharing information (monitoring results and catchment maps) to increase awareness and explain the problem; direct communication to the farmers.

9.9 Lessons learned:
Direct communication to those farmers having potentially a large impact; sharing results to increase awareness; finding alternative funding to implement measures.

9.10 Funding and long-term strategy for the case study:
The actions were funded by a stewardship group from the pesticide producing industry for five years. Further continuation is under discussion.

9.11 Contact persons / reference document:
Ingeborg Joris (VITO), Kim Koopmans (pcfruit)

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10 High natural value farming in Maramures, Romania

The project "High Natural Value Farming – sustainable livelihood in Maramures", was implemented in a mountain area in the North West Carpathians in Romania, the Oas Gutai Plateau (Maramures County) which is considered to be representative for significant concentrations of High Nature Value (HNV) farmland; targeted communes: Desesti, Ocna Sugatag (includes village Hoteni), Sisesti, Giulesti; project implementation period 2007-2009.

10.1 Description of the context:

The Oaş-Gutâi Plateau is located in the North Western part of the Carpathians, Romania, on the edge of Transylvania near Ukrainian and Hungarian borders, and it is representative for its influence on the regime of the upper Tisza river basin, covering a surface of 147,000 ha. It is home of ecosystems with abundant biodiversity, rich in history and cultural heritage. The open parkland landscape is a mix of forests, semi-natural pastures and hay meadows - a vital support for communities living around the plateau. This mosaic landscape is shaped by traditional farming systems characterised by low use of chemical inputs, low labour, and pastoralism with low stocking densities. Land abandonment became a problem in the region, being mainly the result of the socio-economic conditions faced by farmers and land fragmentation (low incomes, hard working conditions and a lack of social services in many areas make farming a less attractive option for young people), causing considerable damage to the biodiversity of semi-natural habitats, especially for alpine grasslands by grazing abandon. At the same time, in lower land, intensification and specialisation are the concepts to achieve profitability, resulting in environmental problems such as pollution of water by nutrients and pesticides and loss of habitat and associated biodiversity. Project mainly focused on surface water quality in Mara River. Agricultural production is likely to be intensified with negative consequences on the environment and rural traditions, but conditions like good farming practices, management requirements for acceding rural development funds present a good chance to change "bad" agricultural practices into good and best practices. Lack of initiative, financial and human resources, but also a passive life attitude are frequently the main problems of rural areas, and efforts are made for animating local society in order to keep the traditional farming.

10.2 Objectives, actions and results:

The aim of the project was to establish a simple and easily replicable model for explaining and demonstrating the nature conservation value of traditional HNV agricultural systems to a range of stakeholders in Romania. Detailed understanding of a) the concept of HNV farming and b) the complex needs of the farming systems in these areas are essential prerequisites for the formulation of effective

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policies (in accordance with EU policy objectives) for conserving the biodiversity of large areas of semi-natural habitat and complex mosaic-type agricultural landscapes in Romania. This required complex and multi-directional awareness-raising activities targeted at policy makers, the public and farmers. Authorities, policy makers, environmentalists, farmers and advisors learnt together on how to guide agricultural change in an ecologically-sound manner.

Integrated awareness raising ensured that the public is more appreciative of its farmers' role in biodiversity conservation; policy makers are more sensitive to the farmer-wildlife link in their deliberations; farmers are able to take pride in routes of development that do not result in massive biodiversity loss.

***Objectives* of the project were:**

1. Capacity building of local self-governments and promoters – that will enhance trust and community participation.

2. Establishing demonstration areas, where good farming practices are applied – included selection of the two most representatives farms. Structure and size of farms, as well as the vocational training of farmers will represent the criteria for farms selection.

3. Influence national policy - advocacy at national decision makers will promote sustainable development at national level which requires political vision and commitment

4. Dissemination of the project findings and results at local and national level.

***Project results* included:**

- Enhanced knowledge for applying good agricultural practices for 30 participants (decision makers at local level - local councils members and farmers).
- 1500 leaflets printed and distributed among participants, but also in communities and involved institutions.
- 2 demonstration area's where good farming practices are applied: Sugatag village and Hoteni village.
- Round table organised in Bucharest – forum of discussion between local stakeholders and promoters (environmental and agricultural NGO) and national level decision makers (Ministry of Agriculture, Forestry and Rural Development, Ministry of Environment and Water Management, National Agency for Agricultural Advisory).
- 2000 brochures printed and distributed - summarising and disseminating the project results in Romanian and in English.
- Project materials and outcomes publicised on the NGO networks websites.

Long term outcomes and impacts:

- Improved judgment of local farmers in choosing their farming practices,
- Biodiversity protective practices applied,
- Improved attitudes toward nature and valuable grassland habitats and species,

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- Better conservation status of the grassland.

The project also contributed to the building up of civil society and the encouragement of continuing social transformation in the target areas. By promoting the HNV farming systems the project contributed to the decrease of land abandonment and agricultural intensification.

Communication strategy aimed at guiding farmers to reduce pressure on biodiversity, water, air, soil by:

- Preventing overuse of fertilisers and pesticides (or inappropriate use),
- Preventing increase livestock density and overgrazing
- Preventing drainage of wetlands, irrigation, field enlargement, conversion of semi-natural grassland to arable lands,
- Preventing monoculture and removal of landscape elements like hedgerows, stonewalls, ditches

10.3 Multi-actor approach:

During project implementation, the SH platform included: farmers, decision makers at local level/national level, (Local Councils representatives, Local Directorate for Agriculture and Rural Development, Agency for Environment Protection, County Agency for Agriculture Consultancy), mayors technical consultants, civil society. Platform was coordinated by EcoLogic and project partner WWF. There were no formal agreements, but the project opened the opportunity to work on HNV landscape in Maramures area, and projects followed (focusing on maintaining traditional agriculture, reducing water pollution in target area-eg Integrated management and conservation of the Mara basin reversing the water degradation in the Romanian transbourdary region of the Upper Tisa http://www.ecologic.org.ro/proiect/managementul-si-conservarea-integrata-a-bazinului-hidrografic-mara-pentru-reducerea-degradarii-calitatii-apei-in-zona-transfrontaliera-romana-a-tisei-superioare/

10.4 Innovations in water governance:

At the time of project implementation, (2007) there were little or no partnerships between decision makers and farmers. It was a time when environmentalists and policy makers needed to discover how to consider the needs and aspirations of farmers. Farmers, advisors and policy makers needed to learn how to guide agricultural change in an ecologically sound manner. The government needed to learn about the realities on the ground when developing its policies and overtake the opportunities, which exist in its measures. Accession to EU provided a wider framework for participation, discussion and exchange of information and realities. The project placed one of the first bricks for the realistic design of the agro-environmental measures in Romania (via meetings with relevant SH from the Ministry of Agriculture, Forests and Rural Development, and via sharing good practices from farm level).

10.5 Agricultural Best Management Practices employed:

During project implementation 2 BMP were applied: 2 farmers Liliala Hotea (Hoteni village) and Vraja Gavrila (Sugatag village) were selected as demonstration farms where project purchased equipments that facilitates farm development.

Hoteni farm: Hotea Liliana family, milk and auxiliary milk products, 8 cows (out of which 4 are kept in the stabbles for maximizing milk production and thus not being involved in physical effort); The household is composed of: the orchard, 7 hectares of hayfield, 1 hectar of arable land, small park for

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agricultural machines; project purchased milking machine for the farm and a betonated concrete platform was built to prevent leakages of animal manure from the stables.

Sugatag village: Vraja Gavril family, sheep breeding, 400 sheep (250 belonging to Vraja family, the rest taken into custody from Sugatag village); family owns 7 ha of land; the sheep are taken up to the Tataru Plateau on an altitude of 1000 m, far from the village of Sugatag; project purchased mowing machine.

10.6 Participatory monitoring:
Project included advice and guidance on how to apply good farming practices taking into account the real features over the 2 demonstration farms (3 months); monitoring of the demonstration farms continued via external consultant for 3 more months. After end of the project, EcoLogic Association representatives frequently visited the farms, and today they are are still managing the same farm activities.

10.7 Collaborative management tools:
Project included gathering of data on agricultural practices in target area and the data were included into project reports.

10.8 Other best practices from the case study:
Communication and dissemination strategy included an informational package regarding HNV farming guidelines – this was the first step in the region regarding dissemination of HNV related information; (1500 leaflets were dissemintaed among farmers, agricultural advisories, economic entrepreneurs, local authorities offices).

10.9 Lessons learned:
The most important is the fact that via the project participatory approach the voice of the farmers in Maramures has been heard by the representatives of the most important decision making institutions in rural environment in Romania and that the project multistakeholder approach has been opened a path for encouraging this type of agriculture which is so very important for maintainance of biodiversity in the rural areas.

10.10 Funding and long-term strategy for the case study:
The BMP implementation in the demonstration farms were funded through the project. The long term strategy to ensure further exploration/development on the subject (maintainance of agricultural practices for ensuring good quality of environment, landscape and traditional communities) included other initiatives and projects targeting the area and implemented by EcoLogic Association with various partners (seminars on good agricultural practices, assessment of agricultural practices and pollutants in the area of Mara Hidrographic Basin, biological evaluation of Mara River, development of management plan for Mara River).

10.11 Contact person / reference document:
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10.12 Is there anything else about the case study?
EcoLogic Association started working in the area in 2001. Since then, EcoLogic and local partners were actively involved in developing the area into a model of good practices in the field of nature conservation and sustainable development. Starting with 2014, the area is part of Mara-Cosau-Creasta Cocosului ecotourism destination, an initiative at national level for supporting traditional landscape,

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nature conservation and development of local communities based on sustainable use of natural and cultural resources (destination is managed by EcoLogic Association, alongside with other members of the destination partnership).

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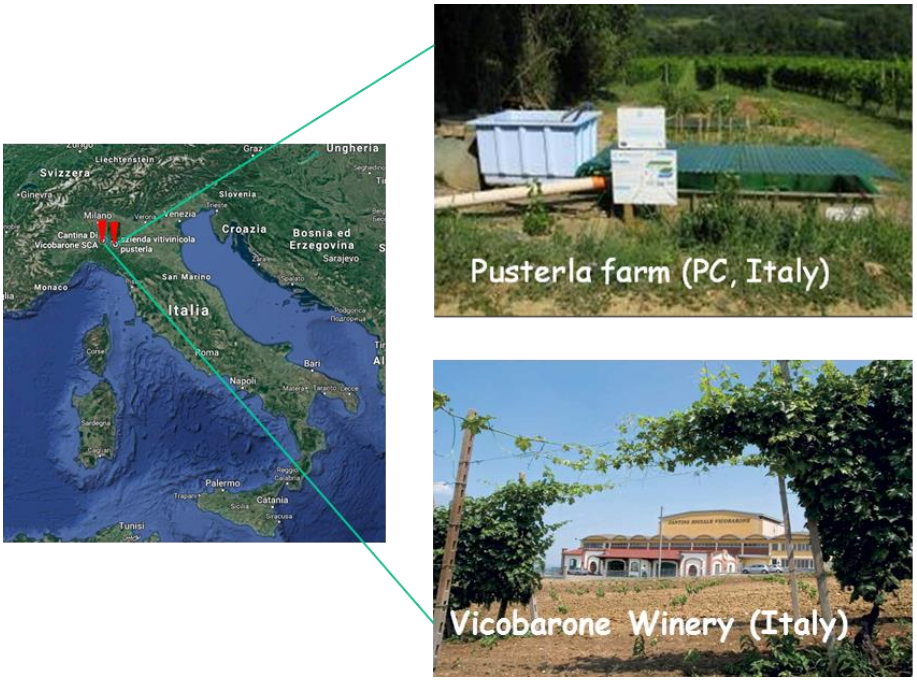
11 Life ArtWet Project, Italy

Mitigation of agricultural nonpoint-source pesticide pollution and phytoremediation in artificial wetland ecosystems, Pusterla Farm, PC, Italy - 01-OCT-2006 to 30-SEP -2010.



11.1 Description of the context

Pusterla Farm is located on a rural area in the catchement of Trebia River, Province of Piacenza, North of Italy. The predominant culture in the area is the grapevine. The grapevine cultivation needs 10 to 15 pesticides treatments during the year. Nutrients are also used. Therefore the main possible contaminants for water bodies are pesticides and nitrates. In the artwet project the reserach was focused on the development of mitigation misures and best management practices to avoid water contamination by pesticides.

11.2 Objectives, actions and results:

The main objective of the ARTWET LIFE project was to demonstrate low-cost natural treatment systems to effectively reduce the risk of agricultural non-point-source (NPS) pesticide pollution in surface water. The project aimed to prove the value and feasibility of bioremediation treatment systems based on vegetation in artificial wetland ecosystems. However, for Italy the research focuses on point-source pollution. In particular, at Pusterla Farm, a biomass bed prototype was installed and its performance for pesticides degradation was assessed. This prototype consists of a biological active matrix, which retains the Plant Protection Products (PPPs) into organic matter or soil particles, where enhanced or rapid microbial degradation of the PPPs occurs. The system was developed for treating spray leftovers and PPP spillages during and after the field treatments. The use of such a system show the reduction near to 98% of PPPs in water and was considered a valid solution to avoid water bodies contamination by point sources in a vineyard. However, at that moment and at the present this system has a limited use in farms as it is considered by the national legislation a system for the storage and treatment of dangerous waste. Therefore, a specific authorisation is needed for its installation and use.

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11.3 Multi-actor approach

In the ARTWET Project, for the Italian case study, the actors involved were Catholic University as partner of the project, developer of the byopurification system and incharged with adsorption and dissipation study, and Pusterla Farm as location for the application of the biopurification system and provider of the information regarding the pesticides handling and application. There were no conflicts between the actors and the activities were lead by the partner of the project, Catholic University. No formal agreements were developed.

11.4 Innovations in water governance:

In the Italian case study of the ARTWET Project the development of a bio purification system as the "biomass bed" represents an innovation to avoid the contamination of water body by pesticides trough point sources. This mainly due to the low cost for the development, use of in-house material for the biological matrix that has the role of adsorbing and degrading the pesticides, easy way of use by the farmers, etc. The several studies developed in Italy demonstrated its efficiency in decreasing the PPPs concentration in water that can be then discharged in adjacent water bodies or drainage systems. Biomass bed is part of the big family of the bio beds systems, developed all over the world, as for example biofilter in Belgium, Phytobac and biobac in France, adapted to climatic conditions bio beds in Peru, Guatemala and Ecuador.

11.5 Agricultural Best Management Practices employed:

The use of bio-purification systems, which are directly linked with Sustainable Use Directive (SUD) implementation requirements, should be part of Good Agricultural Practices (GAPs). GAPs are defined to ensure farmers to know what needs to be done to comply with the legislative requirements, whereas Best Management Practices (BMPs) help define farmers how they can meet legal requirements, particularly if they need to be brought into compliance quickly, or even go beyond them. Hence, with time and evolution of practices on the farm, the BMPs often become the standard for new Good Agricultural Practices. To help reach these very stringent targets for water legislation, specific local risk mitigation measures as well as general and widespread adoption of BMPs will be necessary. Although GAPs are taken into account during the registration of PPPs not all general recommendations can be placed on labels and therefore one of the most important elements in prevention of unwanted effects of chemical contamination in water bodies is farmer education. However, as already specified these systems have a limited use in farms as considered by the national legislation systems for the storage and treatment of dangerous waste. Therefore, a specific authorisation is needed for installation and use.

11.6 Participatory monitoring:

No participatory monitoring was/is developed.

11.7 Collaborative management tools

No collaborative management tools were developed.

11.8 Other best practices from the case study

Together with a scientific committee, a list of good practices will be constituted and approved subsequently to Guidelines adoption. Good practices will be identified as useful tools to employ in order to guarantee results (as regards products and services quality) and minimize impacts, improving firms' sustainability. Good practices will have to be integrated into models and technical specification so that their accordance with Guidelines could be recognized. The list of good practices will be updated

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over time, on the strength available knowledge and innovative technologies in the wine sectors, of chiming in with the idea of "sustainability path" aiming at continuous improvement.

11.9 Lessons learned:

The achievement of the results was/is quaranteed by applying a comprehensive and integrated approach to all stakeholders and developing tools/outputs based on them needs. Furthermore, comunication of the results and the formation of end users (farmers), using a basic and comprensible language is mandatory.

11.10 Funding and long-term strategy for the case study:

Life Artwet project was partialy funded by the European Comission. Indeed the total budget was 3,878,621.00 € and eu contribution was € 1,916,993.00,-.

11.11 Contact person / reference document:

Nicoleta Suciu (nicoleta.suciu@unicatt.it);
http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3099

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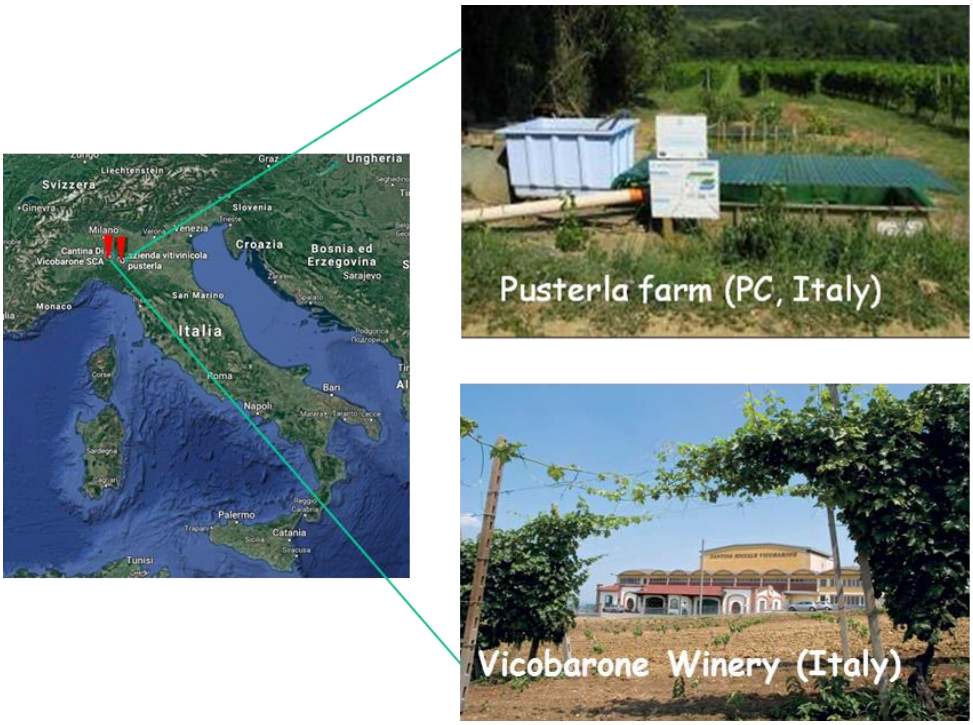
12 V.I.V.A. Project – VIVA "Sustainability and Culture", Italy

Vicobarone Winery, PC, Italy – 2011 – on going.



12.1 Description of the context

Vicobarone Winery is located on a rural area in the Catchment of Tidone River, Province of Piacenza, North of Italy. Also in this case the predominant culture is the grapewine. The winery is part of the project due to its interest to asses its sustainability and of its products. The main objective of the project is 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. One of the 4 indicators used to assess the sustainability is the water indicator, which reveals the total volume of fresh water consumed and polluted water both referred to company activities or to the production of a wine bottle (0, 75 l). It is an explicit indicator of the fresh water consumption in the vineyard and in the cellar related to the wine production.

12.2 Objectives, actions and results

The main objective of VIVA Project is 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. Vicobarone Winery is the testiomonial for the Tidone Catchment as the only winery of the catchement partecipating,in a voluntary way, in the project. 56 wineries/company are part of the project. Partecipating in this project means that Vicobarone Winery is collecting data to calculate its sustainability performance in vineyards and wine production, through the four indicators: Air, Water, Territory and Vineyard. The obtained results are then verified by a certification bodies that finnaly gives the sustainability certification.

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The Vicobarone Winery joining VIVA "Sustainable Wine" take the following advantages:

i. **Marketing and competitiveness**: environmental values associated to a product are an important driver of competitiveness both in domestic and international markets;
ii. **Money-saving:** measures to reduce greenhouse gas emissions and water consumption, linked to a good technological renewal strategy, can reduce not only the company's impact on the environment, but also the production costs, preventing the waste of resources;
iii. **Audit: t**he analysis audit of a third part certification body ensures retailers and consumers recognition on the national and international market, enabling also the competition on international tenders;
iv. **Relationship with the consumers:** the disclosure of sustainability data helps to raise consumer awareness and to guide their choices in a transparent and responsible way.

12.3 Multi-actor approach

In the VIVA Project, an considering just the Vicobarone Winery case study, the actors involved are the Italian Ministry for the Environment, Land and Sea, the OPERA Research Center of Catholic University, the Emilia Romagna Region, the Vicobarone Winery and the Certification Body.

The procedure for joining the VIVA Project by a company comprise: **i)** to sign a voluntary agreement with the Italian Ministry for the Environment, Land and Sea; **ii)** the request, together with a brief description of the company and the products, has to be sent to the Director General for "Sustainable Development, Environmental Damage, European Union and International Affairs" (DG SVI); **iii)** the Italian Ministry for the Environment will provide institutional collaboration, by monitoring and coordinating the indicators' analysis and the evaluation of technical choices to improve their sustainability performances; **iv)** wine companies should perform the sustainability analysis at their own expenses, following the technical specification provided by the Italian Ministry for the Environment, Land and Sea; **v)** the results of the analysis should be validated by an independent third-part verification body; **vi)** the Italian Ministry for the Environment will issue the VIVA label within 30 days from the presentation of the validation document and the company analysis report.

12.4 Innovations in water governance

The adoption of a sustainability program, through the calculation of the water footprint, as the Vicobarone Winery did, offers a better and wider perspective on how the activities of a winery affects the use of water resources. This can help in adopting measurements to reduce water consumption, to decrease its impact on the environment, production costs and prevent the waste of water resources. The water footprint is the sum of three components:

Blue Water: refers to the volume of surface or groundwater, directly consumed in the vineyard and in the cellar, that does not return back to the same source where it was taken from or it returns but not at the same time; **Green Water**: it is the volume of the rainwater, evapotranspiration during the grapevine crop cycle; **Grey Water:** represents the volume of polluted water, quantified as the amount of the required water needed to dilute pollutants so that the water quality remains above defined quality standards (legal and/or ecotoxicology).

12.6 Participatory monitoring

No participatory monitoring was/is developed

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12.7 Collaborative management tools

No collaborative management tools were developed.

12.8 Other best practices from the case study

In the VIVA Project specific Guidelines will be developed in order to clearly define, as regards wine sector, a univocal concept of sustainability and to promote a common vision related to impacts measurement methods and results communication. They result from the stakeholders' active involvement, at national and international level, between 2011 and 2016 and the institution of the Wine Observatory on Sustainability (the first international observatory on sustainability in the wine sector), promotes cooperation among the operators of this sector on a topic of strategic importance. These Guidelines should become a point of reference to recognize and define sustainability models and schemes, providing operators with directions about those elements (good practices included) essential to properly assess impacts and useful to set out benchmarks as regards products guaranteed as "sustainable".

Together with a scientific committee, a list of good practices will be constituted and approved subsequently to Guidelines adoption. Good practices will be identified as useful tools to employ in order to guarantee results (as regards products and services quality) and minimize impacts, improving firms' sustainability. Good practices will have to be integrated into models and technical specification so that their accordance with Guidelines could be recognized. The list of good practices will be updated over time, on the strength available knowledge and innovative technologies in the wine sectors, of chiming in with the idea of "sustainability path" aiming at continuous improvement.

12.9 Lessons learned:

The achievement of the results was/is quaranteed by applying a comprehensive and integrated approach to all stakeholders and developing tools/outputs based on them needs. Furthermore, comunication of the results and the formation of end users (farmers), using a basic and comprensible language is mandatory.

12.10 Funding and long-term strategy for the case study:

Since 2011 the Italian Ministry for the Environment promotes the National Program for the Environmental Footprint which targets the diffusion of sustainable production and consumption models, involving more than 200 entities such as firms, municipalities and universities. In 2011, within the Program and through a bottom-up approach, the Ministry for the Environment launched VIVA, a sectoral experimental project. VIVA is the result of a successful synergy between ministry, wine-growing firms, research institutes, universities and certification bodies. The Ministry for the Environment takes an active part in the *EU Program for the Environmental Footprint (PEF–Product Environmental Footprint and OEF-Organization Environmental Footprint)*, playing both an institutional and technical role, bringing national experiences to European round tables in order to update its programs according to the EU achievements. It is exemplified by the regulations "Made Green in Italy", a national voluntary agreement to assess and communicate the products environmental footprint (as established by art. 21 Law n. 221/2015 on green economy and resources efficiency).

12.11 Contact person / reference document:

Ettore Capri (ettore.capri@unicatt.it); http://www.viticolturasostenibile.org/EN/Home.aspx

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13. Action plan 'Soil & Water' – Flevoland, The Netherlands

This 'Action Plan Soil & Water' is an initiative of the farmer's organisation 'LTO Flevoland', the Dutch Water Board 'Zuiderzeeland' and the province 'Flevoland' in the Netherlands. The action plan has started in 2014 and will end in 2020.

13.1 Description of the context:

The 'Action Plan Soil & Water' is mainly focusing on the surface water and the soil in Flevoland the Netherlands, to make sure there will be a good agricultural yield in the future and improve water quality. The action plan is motivating agricultural entrepeneurs to apply the newest knowledge and information, to develop new practical information, and spread and inform others. In the period of 2014 until 2022 the farmers organisation 'LTO Noord Flevoland', the Water Board Zuiderzeeland and the Province Flevoland are organising different activities. One of these activities is the project 'BioMass'. This project will focus on the research of how many grass clippings are released at the regular management and maintanance work of the Water Board, and which opportunities there are to use these grass clippings as valuable materials instead of waste materials in the water. Other water related activities are also developed, to fight diffuse pollution.

13.2 Objectives, actions and results:

A healthy and sustainable agriculture is important for the economy and the liveability of the countryside. The agriculture of Flevoland has always been appreciated because of its beautiful products, not only national but also international. The goals of the water quality and the water quantity are mainly accomplished by the sustainability and the use of the soil. The agriculture of Flevoland can stay this successful if there is a lasting attention for the soil. They have been working on the following actions to maintain the success of the agriculture of Flevoland:

- **Soil quality**
  In order to make sure the soil will function as it should, it is important to maintain the sufficient high levels of the organic matter in the soil. Furthermore there is biomass available that can be used strenghting the organic matter in the soil. This can be sourced from the water authorities, nature organisations and municipalities.
- **Clean properties**
  Good houskeeping in and around the farm is a major factor influencing surface water quality. There are possibillities regarding the sit management to prevent the surfacewater from these emisions. With small investments, attention and specific knowledge it will be possible to reduce/avoid these emissions. This action plan stimulates these pre-cautions in order to do so with for instance the introduction of a bio-filter, combined with bufferring facilities on the farm.

13.3 Multi-actor approach:

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Farmers and local authorities form the core participants of the project. Actually, the project is a regional interpretation of a national approach in the Netherlands, to fight diffuse pollution, maintain soil quality and discuss ways to avoid soil shrinking. In the polder area that is particularly important, as the polders are below sea level, and the water table is set by the authorities. The platform once established has gained more dynamic over time. Networking events are well visited, and other organisations are often invited to contribute with their perspectives. Nevertheless, there is an ownership issue, which delays actual project implementation. While the farmers say they are doing a lot already - why do more, and who will pay - the Water Board takes a supporting role, as the Water Framework Directive is only requiring monitoring and participation. The project has the formal relationship established, and sometimes additional MoU's are highlighting additional initiatives.

13.4 Innovations in water governance:

Since this is an on-going project there are not many big changes in the water quality yet observed. However, the results are: business cases with a pilot, where the costs of the collection of the grass clippers, the technical possibilities to get these grass clippers in the ground have been calculated. The measurements, the availability, the composition will be known after the end of this project. In short, this project will be all about:

- Removed and deposited quantities grass clippers
- Yield of the dikes
- Yield of the water plants.

There will be a pilot in the end of this 2018.

13.5 Agricultural Best Management Practices employed:

A very successful recent initiative requested the farmers to test the water situation at their farm. Samples were taken and analysed, practices evaluated and scored. Measures were offered and considered. Certificated were issued to participants. Most striking was the very high level of participion in the region, indicating the readyness level at farmer's side is very large, but logically, they require a form of compensation for their extra efforts.

13.6 Participatory monitoring:

All events are registered and reported via a dedicated website, but also shared at the highest Board level of the Water authorities, and within the farmer's communities. There are active exchanges between regional initiatives alike, sometimes resulting in joint national events.

13.7 Collaborative management tools:

No collaborative management tools have been used, other than the management procedures in the participating organisations, and the implicit –moral- expectations of partners towards each other.

13.8 Other best practices from the case study

The areas of focus will probably be expanded in the near future, to also address antibiotics, run-off, and other problem areas. New methods have been developed to give the farmer full insight of the no-regret measures he can take on his far, Websites help him to understand the options and their investment requirement. This way, it is more likely than before that action is actually taken.

13.9 Lessons learned:

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Education is an extremey importan element, to learn the farmers and others involved how watermanagement can be an integral part of the farmer's daily work, and that his impact on water quality is actually very large. Actually a dedicated curriculum on watermanagement is added to the farmers education in the region. Water Authorities experience that the cooperation with farmers is better than just enforcing regulation.

13.10 Funding and long-term strategy for the case study:

There was no significant dedicated budget to the cooperation. Each party takes their own costs, and sometimes the Water Board adds a limited supporting budget to initiatives taken, on a case by case basis.

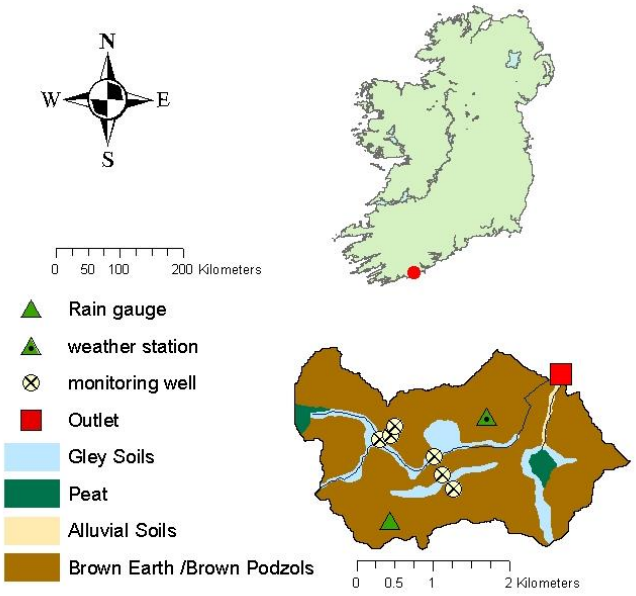
13.11 Contact person / reference document:

For more information: https://bodemenwaterflevoland.nl e: Info@bodemenwaterflevoland.nl

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 727450

14 West Cork, Ireland

Water quality is monitored since 2009 in the Timoleague catchment in west County Corc, south-west of Ireland as a part of the Irish Agricultural Catchments Programme.



14.1 Description of the context:

The catchment is 8 km^2 and located in a region of Ireland known for its extensive dairy production. 90% of the land total is used for agriculture, dominated by grassland used for dairy production. The average livestock density is 1.94 livestock units ha^{-1} (equivalent to 165 kg organic N ha^{-1}) with an average plant available P loading (12% chemical and 88% organic manure and/or cattle slurry) of 30 kg ha^{-1} during growing seasons (predominantly applied during March to April).

The soils are mostly well-drained brown earths (87%), with 13% poorly drained gley soils, and alluvial and peat soils near the river. The geology is old red sandstone and mudstone with an unconfined aquifer classified as productive with a secondary permeability flow. The catchment hydrology is dominated by belowground pathways (77%). The mean annual rainfall is 1228 mm (1981–2010) at the nearest synoptic station (Met Éireann).

14.2 Objectives, actions and results:

The catchment is a part of the Agricultural Catchments Programme aiming for better water quality and at the same time support the production of high-quality food. Knowledge transfer have improved the nutrient use efficiency of the grass production and current BMPs under the GAP regulations have redused loss of nutrients to water, allthough not throughout the nutrient transfer continnuum due to associated timelags and nutrient legasy. Research is focusing on understanding processes behind nutrient loss to water for a more targeted and efficient mitigation strategie. Dedicated farm advisors are promoting the research outputs for a better uptake of mitigation measures.

14.3 Multi-actor approach:

The project is a collaboration between researchers within the Agricultural Catchments Programme, Teagasc advisors and farmers. There are on-going meetings, advise and information exchange with the actors.

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14.4 Innovations in water governance:

The researchers, technicians and farm advisors within the Agricultural Catchments Programme (ACP) are collaborating with the farmers since 2009 and have built up a trust for eachother. ACP provide soil sampling and a nutrient management plan and advise for the farmers, and the farmers allow ACP to monitor nutrient management and nutrients in the soils and water on their farms. Research output are presented for the farmers on meetings. Stakeholder groups frequently visit the farms and are briefed by both ACP and farmers.

14.5 Agricultural Best Management Practices employed:

The Irish GAP measures are mandatory since 2006 and include measures to mitigate farm point sources, incidental losses and diffuse losses.

Point sources: Requirements for storage facilities (winter housing, storage for soild water etc.).

Incidental losses: i) Buffer strips for water courses (2m–200m) and ii) "Closed periods" for landspreading (fertiliser: 15th Sep–12th/31st Jan, slurry: 15th Oct–12th/31st Jan, FYM: 1st Nov–12th/31st Jan).

Diffuse losses: i) Restrictions to stocking rates (170kg ON ha^{-1} yr^{-1}), ii) maximum fertilisation rates = crop requirement, and iii) no external nutrient inputs on P index 4 soils.

14.6 Participatory monitoring:

The ACP monitor nutrient management, soil nutrient status and hydrochemometrics (groundwater and surface water) at high temporal resolution. Participatory monitoring has not been applied within the catchment.

14.7 Collaborative management tools:

Teagsc and ACP have developed an online nutrient management tool.

14.8 Other best practices from the case study:

- Knowledge Transfer has prooved to be an important measure for improved water quality.
- The farmers interaction with researchers and advisors.
- Nutreint management plans have a good uptake.

14.9 Lessons learned:

It is required to understand the processes and drivers of nutrient loss for a targeted and efficient mitigation strategie. Win-win situations improve the uptake of measures. Some "easy wins" have been identified that could improve water quality with small resources.

It is a challenge to monitore the efficassy of current measures when the weather patterns are changing. An intensified weather over the catchment has influenced the water quality.

14.10 Funding and long-term strategy for the case study:

The ACP is funded in 4-year periods by the Irish Department of Agriculture Food and the Marine. Period I: 2008-2011, Period II: 2012-2015, Period III: 2016-2019. We are hopeful for a period IV.

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14.11 Contact person / reference document:

Edward Burgess (ACP manager): Edward.Burgess@teagasc.ie
Per-Erik Mellander (lead scientist): Per-Erik.Mellander@teagasc.ie
Webbpage: https://www.teagasc.ie/environment/water-quality/agricultural-catchments/

14.12 Is there anything else about the case:

The cost effectiveness of nutrient mitigation measures will be assessed within the ACP.

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15 Groundwater Collaboration, Aalborg, Denmark

The association for groundwater collaboration in Aalborg, Denmark

The Association operates within the borders of the Municipality of Aalborg as of 2006, now part of the larger Municipality of Aalborg.

15.1 Description of the context:

- As in the rest of Denmark the supply of drinking water in Aalborg comes from groundwater only.
- Supply of drinking water is dominated by a large public supply campany (Aalborg Vand A/S) and 40 smaller private companies. Total sale of drinking water is around 10 mio. M^3 a year.
- Aalborg is located in an area of Denmark with a high risk of nitrate leaching to the groundwater. The groundwater is in chalk aquifers poorly protected by quaternary deposits.
- Dominant land use in the area is agriculture with some larger forest areas and the urban area of Alborg, the 4th largest city of Denmark (app. 120 000 inhabitants).
- Farming in the area are intensive with both dairy, pig and crop production systems.
- Both nitrate pollution and pollution from pesticides are considered as treaths to the quality of the drinking water in the area.
- Note that the collaboration covers the area of the old Aalborg Municipality, since 2007 part of the new larger municipality.

15.2 Objectives, actions and results:

- The overall objective of the Association is to ensure that the supply of drinking water in Aalborg in the future still can be based on un-polluted groundwater.
- Specific actions are:
  - Set priorities
  - Make action plans
  - Survey and map current and future drinking water areas
  - Coordinate with authorities
  - Agreements on land management to protect groundwater
  - Pay for management agreements
  - Control area under agreements
  - Share knowledge on groundwater protection
  - Respond to consultations

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15.3 Multi-actor approach:

- The members of the Association are the water supply companies within the area of the old Municipality of Aalborg, that is Aalborg Vand and the private water supply companies.
- The first collaboration was established on a voluntarily basis in 1998 and became obligatory in 2002. The current set up is formalised in an agreement from 2017.
- Most water supply companies already joined the collaboration in 1998, but one did not join until 2002 when it became obligatory.
- The current set up was formalised as an Association in an agreement from 2017.
- The secretariat is placed at Aalborg Vand.
- The collaboration has a board of Directors with 12 members – 4 from Aalborg Vand and the rest from 8 different waterworks

Other actors are not directly involved in the Association but are involved in other fora that directly or indirectly affect the work of the Association. This includes for example an advisory board on groundwater protection including the municipality.

15.4 Innovations in water governance:

- The collaboration between the water supply companies in Aalborg has been a frontrunner in the protection of groundwater based on land declarations and, attached to these, one-time compensations to the farmers.
- Currently the declarations cover 1 400 ha of agricultural land.
- More than 80% of the area covered is in voluntary declarations.
- The number of non-voluntary agreements is 8 and the number of voluntary agreements more than 60.
- The compensation to the farmer is fixed as the loss of value of farm. Roughly speaking the difference between what the lands are worth without the declaration minus the value of the land with the declaration plus the loss of value of the machines, property etc.

15.5 Agricultural Best Management Practices employed:

- A land declaration is a juridical binding document registrated to the Land Registration Court describing how to manage the particular piece of land (farmland, nature area or garden).
- The specification of land management in the declarations depends on the measures in the action plan and is fitted to the geology.
- The declarations include issues such as plant cover, grazing pressure, use of pasticides, liming etc., landscape elements, type of trees and other detailed retrictions on the management.
- In praxis the farmers have the options of very extensive grazing, set aside or afforestation, but there is no statistics on the actual use of the land under declaration.

15.6 Participatory monitoring:

Not relevant

15.7 Collaborative management tools:

Not relevant

15.8 Other best practices from the case study:

- There is no active promotion of other best practices linked to the declarations.
- There is no information on the uptake of other measures such as management agreements on grazing and afforestation under the Rural Development Programme.

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15.9 Lessons learned:

Assessment by the Association:

- Declarations are an effective measure to ensure future protection of groundwater as compared to management agreements restricted to short term periods.
- Most farmers find that the restrictions are too severe for managing the land for agricultural purposes.
- However, the high number of voluntary declarations shows that the farmers/land owners in general find this option acceptable.

Assessment by WaterProtect partner:

- Fully support the assessment made by the Association.
- Though the declaration approach has been successful in this specific case, the approach is not very flexible if the objectives on for example groundwater quality are not met by the declared land management.
- It should also be noted that expropriation is not authorized by law and that most farmers are not willing to sell land voluntarily.

15.10 Funding and long-term strategy for the case study:

- The actions are funded from a fee on 1.4 DKK per m^3 sold water (2017) (app. 0.19 €)
- It is estimated that the area already covered by declarations needs to be enlarged by one third

15.11 Contact person / reference document:

Website : Vandsamarbejde Aalborg (http://www.vandsamarbejdeaalborg.dk Contact person of the Association: Pernille Stampe Jakobsen (pernille.jakobsen@aalborg.dk)Reporter: Erling Andersen (eran@ign.ku.dk)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 727450

16 Oddderbær Watershed and The Odderbæk Steam Association, Denmark

16.1 Description of the context:

The case study area, Odderbæk Watershed, is situated in central Jutland (western part of Denmark) and is part of the Municipality of Vejle (located in the northernmost part). The watershed is 2,900 hectares and a small watercourse named, Odderbæk ('Otter stream' in Danish), runs through the central part of the area. The area in general can be characterized as rural mainland located between the 'rural periphery', to the west, and the urban fringe to the east (20 minutes by car to the nearest city border). This location makes the area attractive as a living place for hobby farmers and others with off-farm jobs.

There are approximately 100 farm- and forest properties in the area.

The The Odderbæk Steam Association (OSA) was established in 2000 after a local farmer and member of municipal council became aware of the poor physical condition of the stream during a field trip organized by the local municipality and the county. During the field trip the farmers were introduced to the importance of the physical condition of a stream for the aquatic life, specifically fish and that unpolluted water alone does not provide the proper condition for a fish population. This information led the local farmer (and member of municipal council) to ask the biologist from the county (in charge of the field trip) whether he would be interested in presenting and discussing this new perspective on the water course quality with the farmland owners in the Odderbæk watershed. The biologist agreed on one condition: That any initiatives should come from farmland owners in order to ensure local support. That same evening, the farmer phoned 10 farmland owners to pursuade them that they needed to embrace the opportunity at hand. The feedback from the other farmland owners was very positive, ranging from "I will go along if it doesn't cost me anything" to "even if it does cost me some money, I think it should be done".

Shortly after a deal was struck between the farmers and county (later on handed over to the municipality of Vejle) and within one year, the Odderbæk Stream Association (OSA) was established with a board and statute (with help from the county). The association was put in charge of managing the stream and its tributaries and was successful in changing the physical condition of the stream within its first year. Reducing sedimentation was one of the first tasks faced by the OSA, and one of the solutions was to establish so-called 'sand traps' in the stream. However also a re-meandering of the stream, removal of willows etc. was performed. The OSA also quickly became a forum for discussing new initiatives to reduce nitrogen and phosphorus leaching from the surrounding fields - new initiatives, which did not interfere too much with the production, while at the same time added amenity value to the farms were designed, again in collaboration with the municipality. On the basis of the success of two initial projects and a well-functioning OSA board, the OSA, in 2002, decided to broaden their activities to include the wider landscape and they started up a collaborative landscape planning process in collaboration with (amongst others) University of Copenhagen. This planning process took taken place in the period 2002-04 and resulted in strategy for the enhancement of the landscape (a landscape strategy) as a whole including wildlife, farming, outdoor recreation, cultural heritage and aesthetics. In the following years the OSA initiated different projects to implement the strategy and new intiatives (beyond the strategy were) devloped.

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Concerning the OSA:
Membership of the OSA is open for all organizations, households, and persons. In 2014 the OSA had 106 members. 93 % of the riverbank owners and above half of the house holds living within the watershed (the villages excluded) were members of the OSA.

The board of the OSA consists of 6 persons and a treasurer. Members of the board are chosen so that they represent all member groups of the watershed, including the farmers in the hinterland and members without direct ownership of any riverbank.

To be member of the OSA, you have to pay an annual fee of 150 Danish kroner and an additional maintenance fee of 0,25 kroner per meter of riverbank you own (if any).

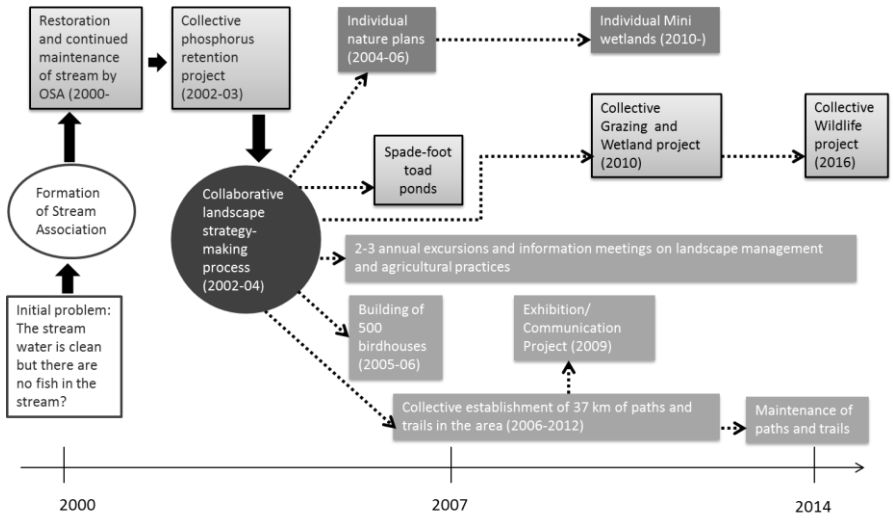

Fig. 1: Summary of activities undertaken by the OSA

16.2 Objectives, actions and results:
The overall objectives of stream association are to maintain and improve the stream and surrounding landscapes.

16.3 Multi-actor approach:
The multi-actor approach was several aspects. The OSA may be seen as a multi-actor plat form were farmland owners and others have shared knowledge and experiences and has initiated collective actions.

However during their lifetime OSA has also had different collaboration with other actors. These collaborations especially the collaboration with local municipality has been of importance. The figure below shows the relationships between OSA and other actors.

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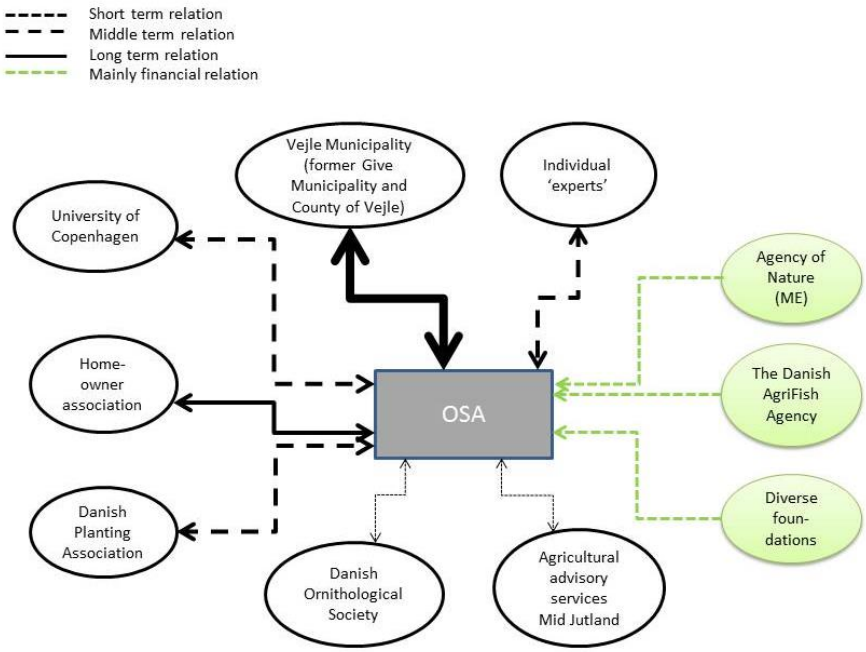

Fig. 2

16.4 Innovations in water governance:

The innovations are related to creation of the OSA as a collaborative forum for collective actions but also the Landscape strategy covering the Landscape as a whole may be seen as an innovation going beyond the individual sector interests

16.5 Agricultural Best Management Practices employed:

- Conversion of arable land to permanent grassland – along the stream
- Establishment of mini wetlands
- Common grazing of permament grassland

16.6 Participatory monitoring:

The farmers and others have for a period reported observations in relation to mamals and birds The effect of the sand traps have been monitored in collaboration with Danmarks Fiskeriundersøgelse

16.7 Collaborative management tools:

- The OSA
- The OSA board
- The landscape strategy

16.8 Other best practices from the case study:

- Improvement of the access to the countryside – establishment 37 km walking paths
- Clearing of unwanted vegetation
- Establishment of ponds for spadefoot
- Education and information events
- Nature plans for all invidiual farmland owners

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16.9 Lessons learned:

Factors of importance for the success in the case study area:

- Strong and committed leadership – in the OSA
- Concerns about the stream problems among farmland owners or at least it was possible to raise the interests
- The farmers were or became awareness of the benefits: for nature and farming . Benefits for farming is related to better reputation and image for farmers and for some farmers also better production condition. The latter counts for farmers which have establish mini wetlands. Their opportunities for enlarging their livestock increased
- The processes were perceived democratic and they included conflict management
- Close relationships between the OSA and the local authorities – both to administration and to the political level
- The administrative level in the municipality has change their working culture – so that they do not any long solely acts as an authority with control functions but also acts as a partner interested in having things done on the ground
- Financial support possibilities – various kind
- Many land use changes were possible because most of them took place on more marginal agricultural land

The landscape strategy including goal and actions for the future land use changes was important in the seeting the agenda for the actions undertaken.

16.10 Funding and long-term strategy for the case study:

As seen in the figure one the many initiatives have been funded my many different courses. The OSA will continue and take new initiaves but is depending on funding

16.11 Contact person / reference document:

Website: Odderbæk landløbslaug (http://www.odderbaek.dk/)
Contact person of the Association: Niels Clemmensen (clemmensen@mvbmail.dk)
Reporter: Lone Kristensen (lokr@ign.ku.dk)

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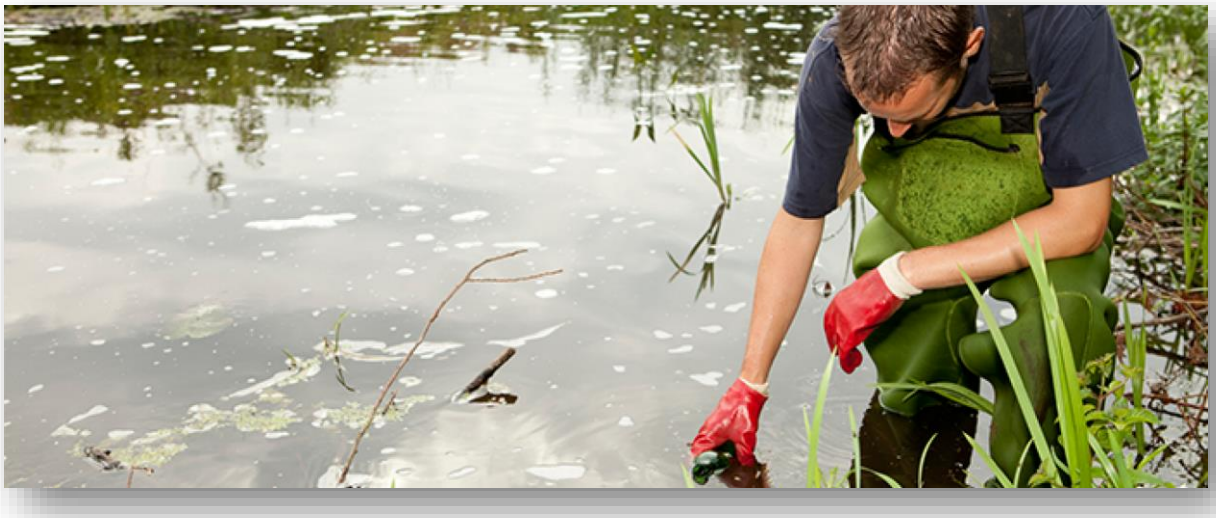
Section 3: General conclusions and recommendations



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This report brings together 16 European Case Studies in Agriculture to build a comparative assessment of the case study findings, and to inspire the seven Action Labs in WaterProtect. The Action Labs are also described. The case studies have the following main targets in common:

- Prevention of the impact of human action in agriculture,
- Definition of impacts and water related risks,
- Development of mitigation measures,
- Emphasis on nitrates, crop protection residuals, water system stability, awareness

All case study descriptions are reported in a similar way, to allow for comparison between the cases.

Due to factors such as the perceived complexity of agriculture as a sector, sustainable agricultural water management being a relatively new discipline, and geographical, resp. cultural differences in Europe, a common successful approach has not been identified from the 16 cases studied. However, recurrent barriers and success factors have been found, which - when appreciated - will contribute to the increased success of implementation measures taken at European, national and local levels to prevent impact of human action in agriculture. The ones found most relevant are described below.

1. ***Barriers for implementation of successful sustainable agricultural water management***
   - A lack of data: a common need to measure and monitor the catchment much more intensively ('data')
   - A lack of time: complex issues will arise that need to be overcome before continuation. The time to address these issues needs to be factored in to avoid frustration ('time').
   - A lack of creativity: be flexible but persistent towards the common goal. Alternate between a focus on the goal and the roads ahead ('creativity').
   - A lack of understanding: the need to act should be supported and understood. Communication and transparency are crucial ('support').

Below table presents an overview of the relevance of these barriers for each of the 16 cases.

	Case Study **Barriers observed as a lack of:**	**Data**	**Time**	**Creativity**	**Support**
1	EWS One year pilot project Cyprus	√	√		
2	Sol et Eau en Segala, France	√	√		
3	UK Freshwater Partnership, Norfolk, UK.		√	√	√
4	Evian Naturel Mineral Water NMW1, France	√	√		√
5	Henniez Natural Mineral Water NMW2, France		√	√	√
6	Waldquelle, Urguelle, Naturquelle NMW3, Austria			√	
7	CVBB, Belgium		√		
8	Water Monitoring Project Grote Kemmelbeek (GKB)				
9	Cicindria catchment, Sint-Truiden Belgium	√			
10	High natural value farming in Maramures, Romania	√		√	√
11	Life ArtWet Project, Italy			√	√
12	VIVA "Sustainability and Culture", Italy			√	√
13	Action plan Soil & Water – Flevoland, The Netherlands	√	√	√	√
14	West Cork, Ireland	√	√		
15	Groundwater collaboration, Aalborg, Denmark			√	√
16	Oddderbær Watershed - Odderbæk Steam Association			√	√

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2. *Success factors for implementation of successful sustainable agricultural water management*

- Impacting case studies have a clear leadership, such as an industrial (chain-) partner ('leadership').
- A knowledge institute participating, building confidence ('R&D')
- Structural and organised knowledge exchange between experienced farmers and new initiative, to explain the added values 'between colleagues' ('exchange')
- Authorities, supporting the action and overseeing progress, gives the necessary status to the activities and opens doors for funding possibilities ('auth.')

Below table presents an overview of the relevance of these success factors for each of the 16 cases.

	Case Study Success factors observed:	Leadership	R&D	Exchange	Auth.
1	EWS One year pilot project Cyprus	√	√	√	√
2	Sol et Eau en Segala, France	√	√	√	√
3	UK Freshwater Partnership, Norfolk, UK.	√		√	√
4	Evian Naturel Mineral Water (NMW1), France	√	√	√	√
5	Henniez Natural Mineral Water NMW2, France	√	√	√	
6	Waldquelle, Urguelle, Naturquelle NMW3, Austria	√			
7	CVBB, Belgium	√	√	√	√
8	Water Monitoring Project Grote Kemmelbeek (GKB)	√	√	√	√
9	Cicindria catchment, Sint-Truiden Belgium	√	√	√	√
10	High natural value farming in Maramures, Romania			√	√
11	Life ArtWet Project, Italy			√	√
12	VIVA "Sustainability and Culture", Italy			√	√
13	Action plan Soil & Water – Flevoland, The Netherlands	√	√	√	√
14	West Cork, Ireland		√	√	
15	Groundwater collaboration, Aalborg, Denmark	√	√	√	√
16	Oddderbær Watershed - Odderbæk Steam Association	√		√	

Recommendations for setting up Action Labs in other regions

Besides the recognised barriers and success factors, 6 areas of recommendations for setting up multi-stakeholder cooperation labs in agriculture were identified:

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1. Civil society - although being a recognised stakeholder - is not usually seen as active participant in the projects. They could be very useful in dissemination and acceptance of results and measures found and so should be involved at an early stage.

2. Important building blocks for a well-functioning governance system should be appreciated and well defined. These building blocks are:
    - Clear roles and responsibilities allocated
    - A leadership role identified
    - Transparency
    - Stakeholder engagement
    - Coherence
    - Appropriate scale of the project

    Reference is made to the publication of WP 2 in WaterProtect (D2.1 Framework for developing and analysing water governance systems).

3. Participatory Monitoring

- For effective participatory monitoring, awareness raising before the monitoring starts is a vital element for success
- Authorities when overseeing the monitoring activities have a very positive effect on the success and impact of the monitoring efforts.
- Data sharing is considered an essential element. Several forms of data sharing have been observed: periodic monitoring and reporting, results published (realtime) on the organization's website, etc.
- Active exchanges between regional initiatives alike increases the value of monitoring results enormously, and their broadened use for policy development, accreditation, reward schemes, investment decisions, etc. becomes more evident
- Frequent visits of independent farmer advisers to the farms are extremely useful, and should be a structural element in the design of new cases

4. Water stewardship schemes with a set of common indicators

- A water stewardship guideline specifically developed for agricultural purposes would be a useful tool.
- The EWS European Water Stewardship Standard is seen as a useful collaborative tool to harmonize the actions of farmers on overall goals set forth by water authorities in the basin
- The use of a set of common indicators should become a common practice in new cases

5. Collaborative management tool

- Real time monitoring to create evidence and responses when water quality issues arise is effective
- (web based) platforms for knowledge exchange created by the group members enhances exchanges of data and information
- effective collaborative management tools exist, and so are online nutrient management tools – we wouldn't recommend a "one that fits all" tool, but work with familiar tools in the region.

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6. Good working cases are extremely important references for promoting and inspiring new initiatives. Farmers know what they currently have, and tend to stick to that. They should be convinced by each other. The power of dissemination is in the exchange between farmers:

- contribution and dedication of a group of farmers to improve water management in the river basin is far more effective than single farmer implementation
- Farmers typically want to receive coherent and exhaustive training on the content, the requirements and overall objectives'
- Farmers can prioritize their actions for water quality protection by identifying vulnerable areas at the farm and estimate the impact on potential destinations
- Wider community involvement contributes to the long-term success of the case study
- Success is achieved by applying a comprehensive and integrated approach to all interests and actions in the catchment linked to water management and protection, and mutual economic and social benefit
- "Water Stewardship is the most effective path for sustainable water management"
- Communication of the results and the formation of end users (farmers), using a basic and comprensible language is mandatory".

In conclusion, the cases presented show that multi stakeholder cooperation for sustainable water management is an extremely effective tool for policy implementation in Europe. The recognition of barriers and success factors can avoid disappointment causing many worthwhile initiatives from stopping too early. When taken into consideration in the operation of the seven WaterProtect' Action Labs these can become fruitful showcases of new policy initiatives.

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Appendix I. Draft template on action labs.

Template to present action lab in the public report
This template will be sent to action lab leader with request to describe the action lab as per proposed headings for the public report. Some information is available from the project proposal but it probably can be updated based on project progress. In a nutshell, it is a presentation of the action lab to external audiences.

Name of the action lab, country:

Description of the context:
Some information is available in project proposal (size and characteristics of the catchment, land use and farming system, focus on which pollutants). Any additional information relevant to describe the action lab context. Add image to illustrate the context of the action lab.

What is action lab trying to achieve within the project timeframe:
Explain specific objectives of the action lab in terms of water quality improvements, testing specific management practices etc.

Actors involved in multi-actor platform in the action lab:
Some information on actors is available from project proposal, including stakeholders who signed letters of support.

Exisiting governance model:
Description of exisiting governance model, based on responses to governance framework currently being prepared by action labs.

How is action lab using multi-actor platform/approach to achieve the objectives:
Describe intention and progress with organising multi actor platform and multi actor groups (large group and smaller groups etc).

Best Management Practices:
Describe intentions and progress in testing and evaluating targeted mitigation measures.

Participatory monitoring:
Describe intentions and progress in using exisiting monitoring data, getting additional data and involving framers and local stakeholders in participatory monitoring.

Collaborative management tool:
Describe intentions and progress in establishing and using collaborative management tools and apps

Other innovative tools used in the action lab:
Explain if there are other useful tools / innovations in the action lab that go beyond project themes.

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Appendix II. Outline of Public Report

Setup of the report

As part of the work package to upscale the project results to other potential end users and other regions in the EU, the public report is to be published based on desk-study assessment of collected case studies (projects, tools and initiatives) to identify emerging themes and similarities with Water Protect action labs.

This document presents the proposed outline for such public report, draft work plan as well as template that will be used to collect information on Water Protect action labs and additional case studies to be included in the public report.

Type of publication: Public report (30+ pages) in English with photos/images available to download on project website.
Target audience: WaterProtect action labs and project partners, other projects tackling water and agriculture, local/national stakeholders of the action labs, interested stakeholders working on water and agriculture.
Dissemination: Project website and newsletter, dissiminate at relevant events, partner websites.

General Description

The aim of the Water Protect project is to drive uptake and realization of management practices and mitigation measures to protect drinking water resources in action labs across the EU (BE, IE, DK, IT, ES, PL, RO) through multi-actor approaches with focus on 4 project themes (i) governance models; (ii) participatory monitoring; (iii) collaborative tools; (iv) best management practices (BMPs) in agriculture.

Executive Summary
Introduce Water Protect project, explain the challenges it is trying to solve and its context, explain the action oriented labs, and the need to look for additional case studies with potential best practice of multi-actor platforms as per project proposal.

Water Protect Action Labs
Provide description for each action lab and how project themes are beeing implemented in them.

Case studies
Provide description of 15+ additional case studies, and how project themes have been addressed. Highlight additional relevant elements in the case studies.

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