

TOPSOIL Roadmap Nutrient Management: “Improving local implementation of groundwater protection in the regulatory context of European Directives”

Version of 4th December 2019

Background of roadmap.....	2
Introduction.....	2
Responsibilities: Intertwining regulatory approaches and local implementation	3
<i>Is there a need to improve compliance with the European regulatory framework?.....</i>	3
<i>Is nutrient management integrated across environmental issues?</i>	4
Monitoring: Knowledge and Control for improving understanding and better adapting measures.....	4
<i>Is the monitoring data sufficient to identify causes for the status of the groundwater body?.....</i>	5
<i>Can monitoring data improve the understanding about the complexity of soil and groundwater interactions and contribute to building trust between land users, water users and regulators?</i>	5
Motivating local measures by cooperation and design: Identification of benefits as a driver for local implementation.....	7
<i>What is the main driver for change in management practice in this area?.....</i>	7
<i>How can measures be integrated into daily management practices?</i>	7
<i>How can beneficial cooperation between water managers and farmers be established?</i>	8

Background of roadmap

TOPSOIL has committed to provide roadmaps focused on TOPSOIL related challenges, in order to make the lessons learnt from the project available to a wider audience. This document provides a draft for the roadmap for challenges 4 and 5. It aims to serve as guidance to groundwater experts who see the need to address governance issues related to;

- Better knowledge and management of [soil conditions](#), which will provide resilience to extreme rainfall events, improve water quality and improve crop yields (TOPSOIL challenge 4); and
- Better understanding of the [capacity to break down](#) nutrients and other environmentally hazardous pollutants in the uppermost layers of the ground.

The roadmap is based on the results of the WP6 workshop “Working with farmers and regulators to minimise nutrient loss to water”, and the results of the workshop series on German-Dutch exchange on groundwater-protecting maize cultivation as well as the lessons learnt as presented at the TOPSOIL policy day (March 2019 in Brussels).

This roadmap was developed as part of WP6. It has been finalized with the support of Peter Nailon (WRT), Ralf Eppinger (VMM), Louise Bracken (DU), Rinke van Veen (PD), Silke Mollenhauer (OOWV), and Ilke Borowski-Maaser (IIF).

Introduction

The condition of the top layers of soil are central for providing resilience to extreme rainfall events, improving water quality, improving crop yields and increasing soil capacity to break down nutrients and pollutants such as pesticides to limit transmission into groundwater. How the soil is shaped and managed has been a major focus of TOPSOIL pilots. In particular, the cooperation between agriculture, water provision, and regulators has been focused on in terms of how to improve local soil management to better protect groundwater.

The importance of the TOPSOIL project is underlined by the latest European Environmental Review which found that whilst there is much improvement in terms of nutrient management, major problem remains: *“Water pollution from nitrates caused by intensive agricultural practices has decreased in Europe in the last two decades. However, despite this positive overall trend, nitrates pollution and eutrophication continue to cause problems in many Member States as agricultural pressures on water quality are still increasing in some areas. Member States should step up their efforts to address diffuse pollution from nitrates and phosphates.”* (p. 11, EIR 2019)¹. Further, COWI and Eunomia (2019) reported that the minimum costs of the foregone benefits of providing “purified” drinking water due to the gaps in implementation of Groundwater Directive and Environmental Standards Directive meets the sum of 986 Mio Euros in all over the European Union.² Discussion in both the European Environmental Review and Cowi and Eunomia (2019) demonstrated the need for strong legal framing, action against non-compliance and the need for a cooperative development of voluntary engagement delivering additional benefits to the farm business.

¹ EIR 2019: Environmental Implementation Review 2019: A Europe that protects its citizens and enhances their quality of life. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. 4.4.2019.

² COWI and Eunomia (2019): Study: The costs of not implementing EU environmental law. Final Report. March 2019. Online available.

The dominant focus in TOPSOIL challenges 4 and 5 has been limiting nutrient leaching into groundwater through sustainable management as defined in European directives. In times of climate change, these challenges are likely to increase as extreme weather events (e.g. storm water and heat wave) increase agricultural vulnerability and limit the openness towards experiments for reducing nitrate leaching.

During at least four transnational TOPSOIL events³, and many more national and regional discussions in the pilots, the following issues related to the governance aspects of nutrient management were central:

- Responsibilities: Intertwining regulatory approaches and local implementation;
- Monitoring: Knowledge and Control for improving understanding and better adapting measures;
- Local Measures: Motivating local action by cooperation and design: Identification of benefits as main driver for local implementation.

In each section the theme is introduced and then a range of steps are presented to guiding questions and reflections on the challenge. The questions are – if possible – answered with examples from the different countries involved in TOPSOIL.

The steps proposed do not need to be worked through in a particular order. It must be noted that the governance themes need different levels of attention in different management situations because in some countries they are completely predefined by regulation, whilst in others they have to be adapted to the local context.

Responsibilities: Intertwining regulatory approaches and local implementation

Sustainable management of environmental resources demands top-down regulatory approaches, supported by bottom-up management approaches. A range of stakeholders are involved in managing water resources and even though they may feel that they have limited ways to support European regulations, it is important to value all contributions. The following questions might help to identify areas for action in a catchment.

Is there a need to improve compliance with the European regulatory framework?

Discussing nutrient management in TOPSOIL it became clear that European regulations provide the strongest lever to implement national and regional regulations requiring a reduction of nutrients in surface and groundwater. A strong, harmonized legal framework sets a minimum standard for nutrient management, and might act as a driver for additional action to prevent further restrictions. For example, in Denmark a relatively stringent nutrient management approach has been applied for the last 30 years, which has led to a substantial reduction in nitrate concentration and provided many insights into the impact on agricultural business, such as the need to adapt crop selection or business chains due to changes in the crops produced. Given the scale of necessary change in land management and agricultural practice throughout the NSR, the regulatory frame is only strong and

³ WP6 Workshop Durham (November 2018), and three Dutch-German workshop on improving maize production for groundwater protection (2017, 2018, September 2019)

effective if compliance on all regional and local levels is ensured. The countries in the NSR take different approaches. For instance, in Lower Saxony strong nitrate surplus remains linked to high concentrations of nitrate in the shallow groundwater bodies. Only recently have requests for nutrient balancing at the farm scale been slowly implemented. In The Netherlands, more emphasis is given to the farmers; their “licence to produce” is at risk if the European Commission punishes The Netherlands because of the Nitrates Directive. This demonstrates that prioritizing compliance with EU requirements can provide support for adaptation to sustainable nutrient management, but also fosters the need for resolving regional conflict between users’ interests, such as farmers and water providers. In the UK Farming Rules for Water, detailing farmers’ responsibilities to protect water resources have been fully in place since April 2018. UK1 is facilitating a North East England regional awareness-raising campaign, although regulator enforcement capacity remains extremely limited.

Is nutrient management integrated across environmental issues?

Nutrients and agriculture are mentioned in the EIR 2019, not only in the context of water management, but also with regard to air pollution. Experiments of the UK1/2 pilots demonstrated to the farmers that soil health is closely linked to its capacity to retain and break down nutrients, protecting groundwater. Thus a joined up framework for delivering sustainable soil and water management, based on principles of ecosystem services and public goods, should be promoted more strongly, including considerations of the review of the EU soil directive. In regional practice, discussions confirm that the need to manage different legal requirements with different reporting structures and funding programmes in the same area (e.g. WFD, FFH, Nitrate Directive, Flood Directive) can pose a challenge towards integrated management. However, with regard to compliance, land users as well as authorities, highlight best practice examples which combine structures and programmes, thus raising awareness of multiple benefits linked to changes in land management. Because of the relation between groundwater and surface water on a local scale in The Netherlands regulations concerning the Nitrate Directive cannot be seen apart from the WFD. Another aspect which is often ignored in the context of nutrient management is that changing soil structure e.g. by including catch-crop leads to increased application of pesticides. This can only be avoided if mechanical management options – including more person hours than pesticides usage, are applied. Still, trade-offs between minimising physical cultivation to improve soil health and structure and the use of herbicides point also towards the benefits of looking further for alternatives. From Belgian perspective, land management (more specific nutrient management) should be, in optimal case, adapted to natural background conditions, e.g. in relation to vulnerability of soils to nutrient losses and the vulnerability of surface and groundwater bodies due to the level of natural attenuation. Local and regional regulatory approaches (management and measures) could be related to vulnerability mapping, and thus protect potential zones/bodies with nutrient problems rather than already affected ones.

Monitoring: Knowledge and Control for improving understanding and better adapting measures

In most areas, soil and groundwater interaction is complex due to the heterogenic characteristics of soil, water bodies (groundwater and surface) and their uses, and in UK1 may be influenced by widespread historic mining activity. As a response to this, public authorities implementing environmental law promote the integration of monitoring data into strategical planning as the

“relatively innovative” approach necessary to complement the traditional approach of inspection and promotion⁴.

The status of groundwater is invisible to public or experts. Data from monitoring therefore plays a central role, both in terms of communicating the status of a groundwater body and for assessing the impact of specific management options. Modelling support is a valued tool of visualisation and assessment. However, while models may provide a sound and scientific knowledge to support decision making, they may also include uncertainty due to simplifications, conceptual choices and limited empirical data. Further, most monitoring activities focus on regional scales. For area-wide implementation of locally adapted measures, monitoring activities need to be intensified, although subject to infrastructure and budget constraints. In the context of nutrient management the following questions may also be considered.

Is the monitoring data sufficient to identify causes for the status of the groundwater body?

With the WFD /GW rule of “one-out-all-out”, monitoring data plays a central role in strategic planning. However, there is a gap between monitoring compliance due to regulations or regulatory capacity and monitoring the success / impact of measures on nutrient leaching. The authorities’ resources are limited and often strictly focused on reporting requirements such as documenting failures. From the perspective of groundwater, users who have direct economic and public interest in good water quality, such as water providers, would benefit from increased monitoring and protection. In UK and D, for example, water providers monitor groundwater quality to meet their legal requirements. In NL, UK, and D, water providers set up voluntary contracts to achieve additional nutrient reduction. In Belgium, voluntary contracts are organized by the regional authority.

UKTAG UK Technical Advisory Group on the Water Framework Directive) provides the monitoring requirements to assess WFD status, but this does not make provision for identifying pollution in terms of Source-Pathway-Receptor or cause-impact-relations. Given the often complex hydro-geological context, monitoring the groundwater quality needs to be different if insights on cause-impact-relations are requested: for example a single measurement point in the Wear Magnesian Limestone groundwater body can lead to a poor Water Framework Directive (WFD) status due to agricultural (livestock and arable) pressures. The current monitoring provision makes it difficult to identify specific pollution sources and subsequent detailed mitigation. However groundwater vulnerability maps, equating shallow superficial drift with surface-ground permeability have been developed. This approach reinforces the surface water, groundwater and farm business benefits available through the implementation of low impact soil management techniques, precision-targeted inputs and the use of cover crops. At local scale, combining and harmonizing monitoring activities can provide a much better accepted basis for the local identification and implementation of measures. For example, in the Province of Drenthe, farmers using a nutrient balance tool which integrate soil type, in and exported nutrients on farm level and the impact on nitrate leaching.

Can monitoring data improve the understanding about the complexity of soil and groundwater interactions and contribute to building trust between land users, water users and regulators?

Consequences of monitoring results may be severe, for example limiting compensations payments, inducing fines, requiring changes in land management practices or water treatment. Monitoring data

⁴ IMPEL- European Union Network for the Implementation and Enforcement of Environmental Law. Topic: Water & Land, <https://www.impel.eu/topics/water-land/>, accessed 15th Aug. 2019

may be highly sensitive to public discussion and supporting “blaming & shaming” communications. Data ownership plays a role here. For instance, in Germany land owners check carefully which type of data they let be generated, such as boreholes on their land. Agreeing on the data to be generated and its usages played a crucial role in some of the German pilots, and needed to be clarified in the cooperation agreements between TOPSOIL partners and involved farmers. In contrast in the Danish pilots, all monitoring data is publically accessible. The issue of communication of data in public was not an issue in the pilots. In The Netherlands all the monitoring data for the Nitrates Directive, investigated within agricultural parcels, is only available on an aggregated level.

In addition, to identify and deal with localized impacts of failing WFD requirements in GW bodies may need higher resolution of soil data and new approaches to modelling than is routinely undertaken.

This has been the case in the Wear River Catchment: the (limited) representativeness of monitoring data, given the naturally fractured geology and widespread historic mining activity, needed to be acknowledged by all stakeholders (regulators, water providers and land users). A joint approach on how best to manage around localised data gaps and anthropogenic and geological complexity is being developed. This approach involves the regional promotion of soil management best practice within the context of Farming Rules for Water, which puts the responsibility on the farmer to avoid pollution of water resources. .

In The Netherlands, monitoring data generated by the regions (e.g. Province Drenthe) is used for reporting. In addition, farm based agreements on improving the N-balance, required a few additional measuring points. This data is also directly fed back to the farmers. Here, as well as in other countries, the feedback mechanism of data collected at individual farms as well as its interpretation is highly appreciated and proved to be central for building trust, especially if the feedback was combined with the options to discuss the implications of specific concentration values, and find a reasonable connection to farm practice.

If data is generated *and* discussed with land owners / users they can connect this with their land management practice and better understand the mechanisms between soil, water and nutrients on their land. This data contributes to building trust and to rationalize measures. Farmers from pilots in The Netherlands, UK and Germany emphasized that learning about the impacts of their management is considered a major benefit for engaging in pilots. In contrast, if different monitoring approaches for different directives take place on the same farm and in worse case result in contradicting or not comparable results, expertise and action of public authorities can be discredited. However, often such discussions took place in an atmosphere of hands-on excursions on the field or within groups. For example, in The Netherlands, farmers were invited to form a study group together with neighbouring farmers. They were supported by an external consultant, and discussed nutrient management and options for their farms. While these activities were mainly financed as part of projects, the farmers also pay about 250€ for their participation in the project.

It must be remembered that building trust with stakeholders takes time and whilst (new) monitoring data may be helpful, time is still required. Farmers are experts on their own land. If their experience has led to approaches explaining the interaction of soil and water which differ from the results of monitoring data, the process to link experience to data is difficult and also requires openness from the monitoring body to add local assessments and to embed and check on hypothesis linked to them.

Motivating local measures by cooperation and design: Identification of benefits as a driver for local implementation

Objectives for reducing nutrients leaching into surface and groundwater require local action by farmers. They have to adapt management practices previously selected for the economic benefits due to high yield in comparison to the production efforts.

What is the main driver for change in management practice in this area?

Having to consider longer-term impact of their activities such as quality of groundwater bodies requires a fundamental shift in approach towards agriculture. These changes do not come easily. For example, in Denmark, farmers do not want to raise costs to establish catch crop or extra applications of nitrogen, or to set areas out of productions.

At the same time, many farmers see the need for changes in soil management, also because climate change decreases its resilience and contributes to the challenges. Further, they see their role in shaping the landscape and our regional identities, and they would like the public to perceive this role as a positive one. Improving public perception and also maintaining the landscape for the next generations may be a strong incentive to start reflection on possible or necessary changes in nutrient managements. An example from the UK demonstrates that the impact may also be a driver for large scale businesses as they can profit from positive environmental impacts as part of their management strategy.

How can measures be integrated into daily management practices?

Most examples showed, unsurprisingly, that farmers are most likely to engage in voluntary contracts for reducing nitrate leaching if the management and control structures can easily be included in the daily farming business **and** if the farmers perceive relevant financial, social or personal benefits for changing their practice. This may be, in some of the outcome based approaches, the reward for less leaching, or in the case of the Dutch study groups the easier access to knowledge. In Germany, economic benefits are the main driver. In the UK good environmental practice, delivering financial benefits coupled with reduced risk of non-compliance with environmental rules is gaining attention from farmers as individuals and their representatives.

From the farmers' perspective, the lack of payment and control is a strong barrier to apply more nutrient management. On the other hand, farmers using reduced soil management (e.g. minimum or zero tillage) are more keen on using catch crops for optimizing root growth in next year crop. Cultural tradition in land management practice also provides a potential barrier to change.

The more practical efforts that are required by the farmers and the higher the economic uncertainty is in terms of outcome, the more direct benefits (e.g. financial compensation) are necessary. Such approaches need to be combined with a solid scientific basis to reduce management uncertainty.

In summary, complex processes require open and transparent collaboration to achieve shared understanding. This might sound trivial but experience shows that it is one of the largest challenges which are essential for finding further solutions. As a consequence, time and resources have to be invested to further develop the understanding of soil-groundwater - farming interaction, and to build trust so that innovative measures are trialled. At local scale, many different approaches and

measures were tested in the TOPSOIL countries⁵. Credible regulator enforcement, incentivising farmers to take actions to minimise risks to their businesses, could be a strong motivator.

How can beneficial cooperation between water managers and farmers be established?

Water management depends on consistently low impact of land management on groundwater, both directly and indirectly via “leaky” surface water channels. Often, infrastructure of water providers is established with a perspective of 30 years and longer and depends on large investments. These investments are publicly funded, and public water providers consider themselves as providing a service to society. Providing a central service to society, such as food, is often not as prominent anymore when talking about agriculture. Highly specialized agricultural business needs decisions which combine short time economic return and long term business strategy.

Thus, forms of cooperation for further groundwater protection often include individual contracts between farmers and water managers. These provide additional financial benefits to testing or implementation of local measures (either results or practice based).

However, these individual contracts often miss out the involvement of large scale farmers. Good experience with close stakeholder involvement in the UK and in The Netherlands confirms that there is a need for robust economic cases. To increase the benefits and to reduce the uncertainty if the market readily accepts environmentally damaging products, such business cases need to involve retailers and the supply chain. Again, long-term working relationships, and local trusted, impartial advice is important.

⁵ See also the overview on measures provided in the annex of “Working with farmers and regulators to minimise nutrient loss to water”, Summary of WP6 workshop in Durham (November 2018).