SOILS2SEA DELIVERABLE NO. 6.2

BONUS
SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

Proposals for new governance concepts and policy options

SOILS2SEA

Reducing nutrient loadings from agricultural soils to the Baltic Sea via groundwater and streams

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Reducing nutrient loadings from agricultural soils to the Baltic Sea via groundwater and streams

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Executive summary

Although nutrient loads (N and P) to the Baltic Sea have decreased considerably in the last 30 years, the Baltic Sea Action Plan[1] requires substantial further reductions. The goal of BONUS SOILS2SEA project is to find new and innovative approaches to further reduce nutrient loads to the Baltic Sea. It is common practice to use nationally applied, one-size-fits-all regulations to manage nutrient loads. However, this uniform approach does not account for the significant spatial variation in the retention (removal by biogeochemical processes or sedimentation) of nutrients in groundwater and surface water systems. By using local data on nutrient transport and retention, **measures can be spatially differentiated** to target 'hotspot' areas where the natural retention is low. The BONUS SOILS2SEA project considers the potential of spatially differentiated approaches for achieving further reductions in nutrient loads to the Baltic in three case study areas: the Norsminde Fjord catchment in Denmark; Tullstorp Brook in Sweden and the Kocinka catchment area in Poland.

Such spatially differentiated measures require foremost new data and methods, which are presented in the reports of the BONUS SOILS2SEA project (see project webpage or the second newsletter[2]). However, of equal importance is the governance context in which to situate these measures which strongly influences the way in which spatially differentiated approaches can be applied. In this report, existing patterns of government-society interaction, the requirements of relevant EU-level policies as well as influencing factors such as culture, history and society are analysed on the basis of stakeholder consultations, ethnographic studies and desk-based research. On this basis, and in close collaboration with stakeholders (above all from the farming community) we discuss governance scenarios in which spatially differentiated **approaches** could be applied. This is then concluded with an outlook for each case study area and variables to consider in the implementation phase.

For the **Danish** case, there is a strong interest in spatial differentiation. Here, stakeholders are highly informed, engaged and motivated to move towards a co-governance approach to the management of nutrient loading. This could be supported by the use of specialised maps to demonstrate differences in nutrient retention in groundwater and surface water systems. Experiences in Denmark have shown that although low resolution maps (15km^2 or greater) provide a reliable large scale picture of retention, they are not specific enough to inform top-down regulations to determine measures at farm level or at 1ha scale.

Sweden already has a long national history of cooperative governance and top-down systems of governance are not seen as a particularly appropriate way to reduce N loads in Tullstorp. The Tullstorp Stream Economic Association (TSEA) is an example of a group built up through a bottom-up process and provides a good basis for experimenting with more innovative solutions such as spatial differentiation. Furthermore, the factors leading to the success of this initiative could potentially be used to inform the design of co-governance approaches to implement differentiated regulation in other contexts.

In **Poland**, a differentiated approach could be envisaged, but stakeholders from the Kocinka catchment demonstrated a lack of support for bottom-up processes. The suggestion was

[1] HELCOM (2007)
[2] List of project deliverables: http://soils2sea.eu/publications_uk/deliverables/index.html. Link to the second newsletter: http://soils2sea.eu/xpdf/soils2sea-newsletter-2.pdf)

rather to work with the existing governance system, favouring a top-down approach with clear and fair regulation. Given the current issues of uncertainty (in highly detailed maps) or usefulness (of low resolution maps), a top-down approach to spatial differentiation is not currently a preferable option for Kocinka. In order to nevertheless reduce N loads in the context of the existing governance system, alternative policy options that involve less of a regime shift could be implemented (e.g. awareness raising, financial support and incentives for environmentally friendly agriculture).

The three case study examples show that a differentiated approach can, in theory, be applied in different governance settings. The most promising application of spatial differentiation however is to be expected within a co-governance approach. Here farmers (and other stakeholders) in a defined area (catchment or sub-catchment level) can determine differentiated mitigation measures using local knowledge of the area and using retention maps as supporting (rather than regulatory) tools. In comparison with the traditional top-down approach, the co-governance approach shifts a large amount of responsibility to local farmers or to catchment councils. While the responsibility would not include the definition of the reduction targets, it does include the responsibility for fulfilling the reduction targets. This includes defining and implementing mitigation measures (placing of wetlands, change of land-use, etc.), collaboration among the farmers within the catchment, as well as the monitoring of the different measures. Crucial to the success of such collective action is trust, which is highly influenced by repetition of the situation, the reputation of others past actions and a reciprocial linkage structure of the community network.

How to read this report

This report is structured into a main report with four Annexes. The main report is intended to provide a summary and comparative overview of the information contained in the annexes and can be read as a standalone document. For those who have a particular interest in the detailed findings for any of the three country case studies, please refer to Annex 1 for Norsminde, Denmark; Annex 2 for Tullstorp, Sweden; and Annex 3 for Kocinka, Poland. Annex 4 presents an overview of policy options that can be applied to reduce N loads to the Baltic and integrated into different governance regimes.

1. Background and scope

Nutrient loads (N and P) to the Baltic Sea have been decreasing since around 1980, particularly from phosphorus, resulting in some notable local improvements in the coastal zone.[3] This has been possible through nationally uniform agricultural regulations and standards for sewage treatment, which have led to substantial reductions in pollution from both non-point and point sources. Assessments show, however, that the obtained abatements are insufficient, and the Baltic Sea Action Plan[4] requires substantial further reductions of N and P loads. In some areas, the necessary abatements may be even greater in order to cope with the additional pressure of climate change[5] and to protect coastal and transitional water ecosystems and comply with the good status objectives of the EU Water Framework Directive.[6] Achieving additional reductions is, however, not an easy task. In many cases, the 'low hanging fruits' (i.e. the most straight-forward measures) have already been implemented.[7] It is the goal of BONUS Soils2Sea project to find new and innovative approaches to further reduce nutrient loads to the Baltic Sea.

Until now, the dominant form of regulating nutrient loads has been through nationally applied, one-size-fits-all regulation. Yet this approach does not account for the fact that there is a significant spatial variation in the retention (removal by biogeochemical processes or sedimentation) of nutrients in groundwater and surface water systems, depending on the local hydrogeological and riverine regime. Recognising these spatial differences could lead to a much more effective and efficient management of nutrient loads. By using local data on nutrient transport and retention, measures can be spatially differentiated to target 'hotspot' areas where the natural retention is low. These spatially differentiated measures require not only new policies, but innovative approaches to governance in general.

In a European setting, governance primarily describes the fact that while the state may retain overarching control (e.g. through legislative and executive power) governments are increasingly reliant on other societal actors to co-govern in order to harness adequate resources as well as establish its legitimacy.[8] These processes of governance and co-governance are also affected by certain practices which are not only on an explicit 'surface' but also on a 'hidden' immanent level which are commonly referred to as cultural factors or cultures.[9] Culture sheds light on organizational or institutional structure of engaging in governance and co-governance processes. It also illustrates the influence of deeper cultural values of institutional stakeholders and layers on planning and implementation processes of policies and frameworks. When exploring new approaches to governance, it is thus important to take into consideration that existing systems have a range of 'constants' that will not change. This means that innovative governance concepts still need to be aligned with existing patterns of government-society interaction, the requirements of relevant EU-level policies (see Table 1-1: Overview of EU level Directives of relevance to management of nitrate loadsTable 1-1) as well as influencing factors such as culture, history and society.

[3] Elmgren et al. (2015)
[4] HELCOM (2007)
[5] Refsgaard et al. (2013)
[6] e.g. Hinsby et al. (2012)
[7] Natur- og Landbrugskommission (2012)
[8] Pierre and Peters (2000)
[9] Knieling and Otengrafen (2009)

Table 1-1: Overview of EU level Directives of relevance to management of nitrate loads

Water Framework Directive (WFD) (2000/60/EC)	Common European framework to protect and restore aquatic ecosystems, and to guarantee long-term, sustainable water use. Nitrate and phosphate are identified as main contributors to eutrophication. Member States must establish national River Basin Management Plans (RBMP) and concrete Programs of Measures (PoM) with the aim of reaching good ecological and good chemical status for surface waters as well as good quantitative and good chemical status for groundwater. Polluter pays principle applies to water use from households, industry and agriculture.
Nitrates Directive (ND) (91/676/EEC)	Aims to reduce and prevent water pollution from nitrates (50 mg/l threshold). Focus is placed on agricultural sources such as livestock manure and other potentially polluting fertilizers. Member States must identify surface or groundwater that is polluted or vulnerable to pollution and designate nitrate vulnerable zones (NVZ) where stricter monitoring is implemented. Mandatory measures include the implementation of national rules for fertilizer application in accordance with Good Agricultural Practices. Furthermore, each farm or livestock unit has a maximum fertilizer allowance of 170 kg/ha/yr of N. This indirectly regulates phosphorus inputs to 25 kg/ha/yr.
Marine Strategy Framework Directive (MSFD) (2008/56/EC)	Aims to protect and preserve the marine environment in Europe, attaining good environmental status of EU waters by 2020. Member States are to define and assess the environmental status of their waters, develop policies and monitoring programs, and implement measures. Overlap with the Water Framework Directive in coastal zones is coordinated through a Common Implementation Strategy (CIS).
Groundwater Directive (GD) (2006/118/EC)	Sets groundwater quality standards and and introduces measures to prevent or limit inputs of pollutants into groundwater. It establishes quality criteria that takes account local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge. It supports the WFD with assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations. Member States must establish standards at the most appropriate level and take into account local or regional conditions.

The BONUS SOILS2SEA project considers the potential of spatially differentiated approaches for reducing nutrient loads to the Baltic in three case study areas: the Norsminde Fjord catchment in Denmark; Tullstorp Brook in Sweden and the Kocinka catchment area in Poland. In the following section we outline the governance systems in each country.

Sweden is a unitary and decentralised State. It can be classified as having a corporatist or *state*-centric[10] form of governance, wherein the state is still the most dominant actor, but where there are institutionalised relationships with powerful societal actors and where there is a high degree of consensual decision-making. While the basic elements of this approach remain, there has been a process of decorporatisation since the late 1980s creating a change in the relationship between the government and major interest organizations.[11] The institutionalized interactions with established organizations have now become more ad hoc and strategic, replaced by a new tendency towards consultation with broader society.[12] The Swedish Constitution recognises local co-government, although at times the strength of local autonomy can lead to a fragmentation in governance and coordination.[13]

Denmark is a unitary and decentralised State that can be classified as having a *liberal-democratic* or state-*centric* system of governance.[14] Here, the state plays a preeminent role, but has strong institutionalised relationships with important societal actors such as trade unions, employers and NGOs as well as heads of major companies.[15] There is a long tradition of involving economic and social actors at all stages of the policy cycle and is a way for the government to get information and create legitimacy for adopted policies.[16] The Danish Constitution recognises local co-government although the Regions and the Municipalities do not hold legislative powers and must act within the confines of the applicable law.[17]

Like Denmark and Sweden, **Poland** is a unitary and decentralised State. However, governance takes more of an 'étatist' form in relation to the definition of Pierre and Peters (2005). Here, the government is the principal actor in governance which can take action unilaterally and also decide whether some actors are permitted to exert influence.[18] The Polish Constitution recognises the principle of decentralisation and bestows local co-government units (municipalities) with legal personality and property rights and legislative powers for areas of local interest (CoR, 2012b).

In addition to their differing approaches to governance, the BONUS SOILS2SEA case study areas each demonstrate a different cultural, historical and societal context which must also be taken into account when proposing new governance approaches.

Tullstorp Brook in Sweden is a 30 km long stream located in the south of Sweden. The stream drains a 63 sqkm large area and discharges into the Baltic Sea close to the small town Skateholm. The area is intensively farmed with around 85% of the catchment area being agricultural land. The soil in this region is one of the most productive in Sweden and

[10] Pierre and Peters (2005)
[11] Lindvall and Sebring (2005)
[12] Pierre et al. (2015)
[13] Pierre et al. (2015)
[14] Pierre and Peters (2005)
[15] Jørgensen (2002)
[16] Jørgensen (2002)
[17] CoR (2012a)
[18] Pierre and Peters (2005)

it has led to maximum usage of the land. The catchment has therefore been intensely managed during the last century which has led to high nutrient loads to the Baltic Sea. The construction of extensive tile drainage systems, dredging, excavation and straightening of the stream channel and removal of in-stream vegetation and riparian zones have altered the local hydrological cycle of the Tullstorp Brook catchment. Due to the management of the catchment, the residence times of both water and nutrients have decreased significantly during the last century, which together with intensified agricultural activities have led to a high load of nutrients to the Baltic Sea.

In 2009 local farmers and landowner founded the Tullstorp Stream Economic Association (TSEA), with the goal to reduce the outflow of nutrients to the Baltic Sea. This is undertaken by creating wetlands and restoring the stream with different measures. Formal decisions are taken by the Board of representatives and a project manager is in charge of all administrative burdens. For the landowner it is voluntary to participate. The association developed a process, where landowners are asked to participate and sign an agreement, giving the association the right to carry out activities connected to the restoration and future management on their land. The landowner still owns the land and can use it according to the agreement and receives financial compensation. For the first part of the restoration project, a stretch of the river was selected and all 45 landowner signed the agreement.[19] In the Tullstorp project, 35 wetlands with 105 hectares have been constructed and 10km river has been restored between 2009 and 2016.[20]

Norsminde Fjord catchment in Denmark is located on the east coast of Jutland in Denmark. Norsminde is intensively farmed with more than 70% of the catchment area being agricultural land. According to the General Farming Register (GLR), 7389 ha are registered with intensive agriculture and fertilizer application up to the allowed norms[21]. These can be considered as professional, full-time farming businesses. Agriculture is considered the main source of nitrate and phosphorous leaching in Norsminde: today the nutrient load to the fjord mainly consists of nitrogen from agriculture and needs to be reduced further. The total nitrate load is at 142 tN/year and the target is 62 tN/year. The reduction target of 70 t N/year is divided into 37 t N/y before 2021 and 33 tN/y postponed to after 2021.[22] The farmers in the Norsminde area are organised in the local farmers union “Landboforeningen Odder-Skanderborg” (DLØ, http://www.lbfos.dk/) and A “Catchment Council for Norsminde Fjord” was established (http://oplandsråd-norsminde-fjord.dk/) with the aims to work for identifying smart and innovative measures and solutions that can contribute to a good ecological status in Norsminde Fjord and at the same time enable a continuous development of the agriculture in the catchment.

The **Kocinka catchment in Poland** is located in the south of Poland in the Oder river basin. The catchment is mostly agricultural with pine forests dominating in the lower reach. The Kocinka region is considered fairly representative of Poland with regard to soil types, land use and agricultural practices. Crops are generally rain-fed and do not require irrigation, though areas with light soil may be irrigated during dry spells, and raising the soil wa-

[19] Sørensen (2016)
[20] Sørensen (2016)
[21] GLR (2013): http://nitrat.dk/xpdf/technicalnote---nitrate-leaching_chrthirup.pdf, p. 7
[22] Danish Ministry of Environment and Food (2016): Water Area Plan 2015-2021 for River Basin District Jutland and Funen (in Danish) http://svana.dk/media/202856/revideret-jylland-fyn-d-28062016.pdf

ter retention capacity of the soil in these areas is considered highly desirable.[23] The number of part-time farms in the Kocinka region is high at 2.000 supplementing their farm income through off-farm work, in comparison to 3.255 full-time farmers. In the areas surrounding Kocinka – in Lubliniec County in particular – the main crops are rye, wheat, oats, barley and potatoes, and animal husbandry, where present, focuses on pig farming. The use of pesticides and mineral fertilizers is often limited by financial constraints, and the level of mechanization is low. In addition, the Kocinka river is popular for trout fishery. Agricultural land constitutes 71% of the entire Kocinka catchment with 4.656 farms cultivating 13.780.645 ha. The Kocinka catchment is not considered a Nitrate Vulnerable Zone, but it is regarded as eutrophic, or at a high risk of eutrophication, with high concentrations of nitrate and phosphorus in surface waters, especially due to agricultural use of fertilizer.[24]

This chapter has highlighted the challenges relating to the management of nitrate loading in the Baltic Sea region and has outlined the arguments for developing new policy options and governance concepts. It has introduced the broad systems of governance in Sweden, Denmark and Poland as well as the more local contexts of the three case study areas in these countries. In the following chapters, we summarise the results of stakeholder consultations and ethnographic studies conducted in the three case study areas. On this basis, we then propose policy options and new governance approaches that are aligned with the different historical, cultural and political realities of each case study area.

[23] Poland National Committee of International Commission on Irrigation and Drainage (POCID), Polish Factsheet http://www.icid.org/v_poland.pdf

[24] Matysik, M., Absalon, D. and Ruman, M.. "Surface water quality in relation to land cover in agricultural catchments (Liswarta river basin case study)." *Polish Journal of Environmental Studies* 24.1 (2015): 175-184, p180.

2. Methodology

This report on new governance concepts is the result of different interrelated activities (see Refsgaard 2014):

- Ethnographic study
- First round of workshops: setting the scene together with the stakeholders
- Formulating policy options
- Second round of workshops: Scenarios for future emissions reductions

Figure 1 (below) shows the interrelations between the different activities.

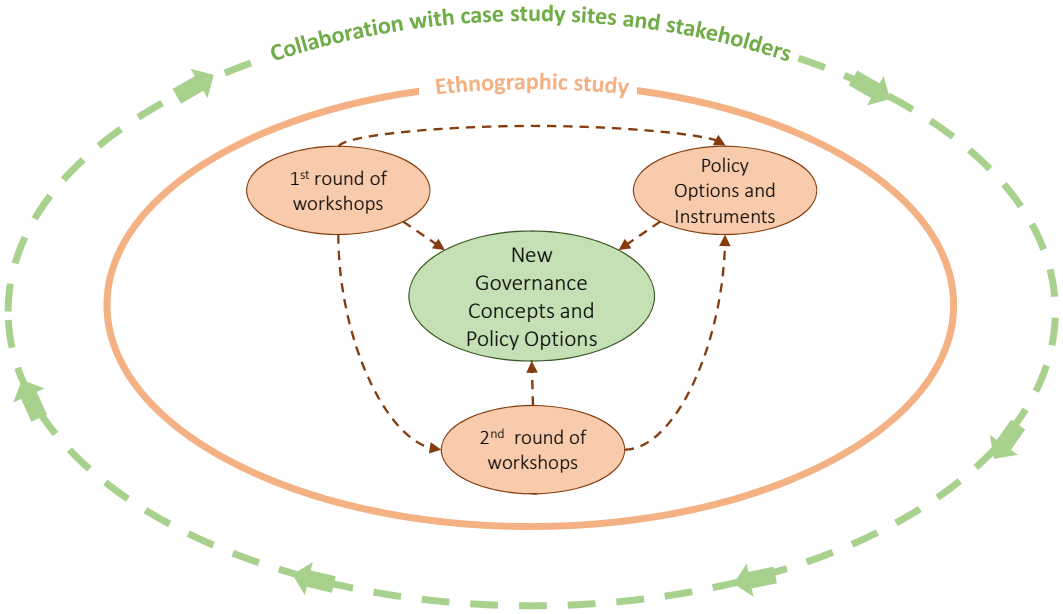

Figure 1: The interrelated activities

The ethnographic study was carried out in parallel to the workshops an formulation of policy options and instruments. It provided place based research backgrounds for the three case study sites. Information was mainly collected through desk-research and narrative qualitative interviews. This information was used to assist the co-development of measures and provide reality checks regarding acceptability and socio-cultural fit of these policy options. For the three case studies, interviews with local experts were conducted and observations of daily practices and routines were undertaken. The consulations were partly undertaken in English or in local language. Methods will be described in more detail in the part 3 Ethnographic studies.

Methodbox Ethnographic study

For the ethnographic study different methods were used:

Desk-research: Academic/grey literature and archival material (maps, photographs, images, letters etc.) was analyzed.

Detailed conversations: Following an interview protocol with local farmers and representatives of farming associations, entrepreneurs, local citizens, political decision makers and representatives of non-governmental organizations.

Observation: Mostly applied in a film documentary for which a script was developed in co-operation with a film maker. The film is focusing on the Polish case study site and the culture of local stakeholders in the catchment Kocinka area (e.g. perceptions, believes and motivations) with regard to their decision making on farming practices/ environmental issues. The film was released in 2016. https://www.youtube.com/watch?v=LUouES4SeJk

Methodbox

For the two workshop rounds, we used different participatory methods:

Disney Method

The Disney Method was only used in the first Swedish workshop and consists of four consecutive elements. Initially the group thought as “outsiders” and reviewed the facts, data and external viewpoints regarding the reduction of N and P loadings from agricultural land running into the Baltic Sea. Next, the participants imagined themselves as “dreamers” and imagined an ideal solution without any constraints. Thirdly, the participants imagined themselves as “realisers” – realists with a practical, constructive mindset. Lastly, the group assumes the role of a “critic” who reviews the plan in order to identify problems, obstacles and risks. In this way, the group departed from the usual way of thinking, started a group discussion, and finally agreed on items for further discussion.

World Café

Drawing on seven integrated design principles, the World Café methodology is a simple, effective and flexible format for hosting a group dialogue. This method was used both in the first and second round of workshops. Questions regarding measures and scenarios were discussed at different coffee tables. Participants were encouraged to write down discussion aspects on tablecloth so that when people change tables they can see what previous members have expressed. Results from each table was collected and summarized at the end of each workshop.

MoSCoW Method

The MoSCoW method is a prioritizing method that was used in the second round of workshops. Participants were asked to prioritise the elements required for the successful functioning of the three governance scenarios. MoSCoW is an acronym derived from the first letter of each of four prioritization categories:

- M - MUST (necessary, essential, and not for discussion)
- S - SHOULD (should be addressed, if all MUST-requirements can still be achieved)
- C - COULD / nice to have (could be implemented/addressed, but only if items above are not hindered)
- W - WON'T (not of interest now/ could be addressed at a later stage)

To start a mutual exchange between the project and other initiatives, presenting the project activities and to ask for feedback on the project approach were the main goals for the first round of workshops in the three case study areas, namely Norsminde (DK), Tullstorp (S) and Kocinka (PL) in 2014. Despite having the same goals, the format and methods were adjusted accordingly depending on the different backgrounds of each case study. For the workshop in Sweden, participants used the Disney Method and for the workshop in Denmark and Poland, the World Café method was used to discuss basic ideas and designed central elements of potential policy instruments.

With first results from the ethnographic study and insights from the first workshops, policy options and corresponding policy instruments were formulated. These options were used to formulate scenarios that were discussed in the second round of workshops. All workshops in this second round followed a similar approach, discussing three different scenarios with the method of a World Café. Although the scenarios discussed were adapted to the local conditions, they allow for a comparative analysis between the three countries. These three scenarios were evaluated with respect to technical feasibility and social acceptance. For prioritizing different aspects of the scenarios, the so-called MoSCoW method was applied. For the last scenario (the co-governance scenario), a questionnaire was handed out to the participants (mostly directed towards farmers) in order to gain more knowledge about their opinion on self-organized management and monitoring. In total 36 stakeholder answered the questionnaire.

3. Ethnographic study

Ethnographic studies were an ongoing activity feeding into the development of governance concepts and policy options. The studies – which consisted of interviews and oberservations - provided insights into the culture of institutional and non-institutional stakeholders in their different societal settings in each of the case study sites. Within the focus of the ethnographic research, culture was applied as an ideational system where culture comprises beliefs and values and is non-material and non-social.[25] It consists of the knowledge that a group of individuals share and that helps define them as a distinct group, although group boundaries are dynamic and change as new knowledge and values become shared. In this definition culture is the intellectual material that influences behavior, particularly social interactions and institutions (e.g. governance), and material exchanges, including those linked to agricultural production and their environment.

3.1 Approach

Information for the ethnographic background studies were mainly collected through desk-research and narrative qualitative interviews with key stakeholders (in English or in local language) which were identified and approached in close collaboration with the case study partners and their contact persons in the regions. Transcriptions of the interviews were conducted, but will not be made publicly available for reasons of interviewee confidentiality. A further method was observation which was applied during the production of a 35-minute film "Soils2Sea: Reducing nutrient loadings into the Baltic Sea" with a main focus on the Polish Case Study site due to various reasons explained in the film and in the section about ethnographic studies in Poland.

Picture 1: Local farmers in Poland showing documents which confirms the acquisition of their farm (Foto: G. Martinez)

[25] Geertz, Clifford, The Interpretation of Cultures, New York: Basic Books, 1973 and Ross, Norbert, Culture and Cognition: Implications for Theory and Method, Thousand Oaks: Sage Publications, 2004.

Picture 2: Local farmer in Poland explaining and demonstrating his farming practices (Foto: G. Martinez)

The collected data focused on understanding the history and culture of the three case study sites in general and in particular in

- culture of perceiving nature/ the environment and the culture of farming practices and decision making
- past and present (development) of farming practices, co-operation amongst farmers, monitoring and governance concepts
- perception/ understanding of environmental policies (agricultural, water) on case study and EU level
- willingness to engage, direction and motivation for engagement
- environmental education

3.2 Overall results

In general it can be stated that - in the same way as the geo-morphological soil conditions differ across the three case study areas - the socio-cultural-political and economic contexts of the people living and working on the different soils are very different and hence lead to diverse decision making with respect to farming practices, nutrient inputs and outputs, collaboration amongst farmers, monitoring and reactions towards measures, regulations and policy options.

In the case study sites in Denmark, Poland and Sweden it was found that the perceptions, values, beliefs, thoughts about nature, the environment and hence needs, acceptance and uptake of measures and regulations are in many ways opposed which in turn demands different approaches.

In Denmark, agriculture has been the dominant sector and the export of agricultural products the backbone of its economy until the 1960's. Over the years, the use of agrochemicals such as fertilizers and pesticides increased dramatically leading to a process of of industrialization, specialization and centralization. Denmark developed into a country of high intensity farming where the regulation of agricultural production is based on elaborated system of monitoring and controlling of inputs such as amounts of fertilizers and crop types.

In the BONUS SOILS2SEA case study site, the Norsminde Fjord catchment, an EU-bird protection area with 70% of the catchment area being agricultural land, in the last 25 years intensive efforts have been made to monitor and reduce nutrient loads. However, nutrient loads are still too high to attest a “good ecological status” of the area.

In the interviews undertaken in the Norsminde catchment area with farmers, chairman of farming organization, political decision makers (mayor) and others it became evident that - in comparison to the case study site in Poland - the environmental knowledge of farmers in general and the knowledge and routines of controlling inputs as well as monitoring of outputs in particular are high and farmers appear very informed. However the level of frustration about approaches which were perceived as an ‘autocratic system of regulations’ was noticeable throughout many conversations. The system of monitoring and controlling inputs was understood as a heavy administrative burden without any flexibility towards allowing the farmers to find local solutions based on local spatial conditions. Hence the farmers did not see much scope of acting within their zone of comfort nor do they feel that they are included in governmental decision making.

As proceeding with the current regulation scheme would seriously impact agricultural production in the case study site, and based on the information gathered during the ethnographic background studies, the BONUS SOILS2SEA approach will be to support measures and solutions which are harvesting the high level of agricultural knowledge and economic standard of farmers and farming associations in coming up with innovative solutions and trigger individual and cooperative activities to help reducing nutrient loads to Norsminde Fjord.

In Poland agriculture land occupies roughly 2/3 of the country with a majority of small self-sufficient farms (mostly under 10 hectar), medium sized farms around 500 ha and large farms of several thousand ha. Most of the land was never collectivized and the structure of farming remains mostly small scale. Farming models are built on strong family traditions and favors solutions learned from parents. Polish agriculture has changed significantly since the collapse of the socialist system in 1989 from socialist regulated and state driven production to unregulated requirements of production of agricultural goods and services . However, the emotional connection towards the land has continued to dominate after 1989. In addition, the collapse of socialism and the introduction of market economy introduced new demands on family farming, which were further expanded in 2004 when Poland joined the EU and new quality standards were introduced to farmers.

The BONUS SOILS2SEA case study site in the Kocinka catchment area contains about 2/3 of agricultural land which is mainly managed by part time farmers, medium and larger private farms and one co-operative farm (a former state-own farms). Currently, slightly more than 55% of the households in the area are connected to sewage treatment plants.

Interviews were undertaken in Kocinka catchment area with farmers, chairman of farming organization, political decision makers (mayor), representative of the water authority and local citizen. When asked about environmental standards and agri practices, interviewees frequently mentioned the need for eductiation, knowledge and EU subsidies. Secondly, informants belived that decision making, especially amongst small and medium sized farmers, are embedded in culture specific networks, family ties and “social consultations”. Furthermore it was found that trust in the capacity and capability of authorities seems to be

very low as well as the willingness to engage in co-operations amongst farmers or with authorities with the slight exception that co-operation amongst smaller scale farmers is being understood as helpful in terms of selling power (products) and buying power (fertilizers, other goods). In addition, it was noticeable that farmers in general believed that the main source of pollution stems from untreated sewage. A strong belief was also noticeable that small scale farming practice does not contribute to pollution as fertilizers are often not affordable or used in environmental friendly quantities.

As the socio-cultural-economic situation in the Kocinka case study site obviously differs significantly from the Danish and Swedish case study, measures and regulations have to acknowledge the specific societal context of the farmers in the Kocinka area, especially the rather low level of environmental awareness of framers and the local population in general. Hence, the BONUS SOILS2SEA approach will support measures which are focusing on the need for increasing awareness about the impact of pollution and of linking subsidies and incentives with environmental standards.

In Sweden cooperative farming - in the sense of sharing information, equipment, storage - has a long tradition and especially in the county of Skåne where the case study of BONUS SOILS2SEA is located. Due to fertility of soil and a governmental policy of ‘kohandeln’ (a term stemming from the agricultural investigation and settlement of the crisis by Swedish policy makers in 1928 when increased international trade with agricultural goods but stagnating of consumption) Swedish farmers enjoyed relatively comfortable conditions producing under the shelter of state subsidies and grants, largely for the local market. A further agricultural reform in 1960 led to specialization of farms and an increase of the size of a farm unit and the liquidation of governmental support for small farmers.

The end of the regulated agriculture in 1989 and the opening of the Swedish agriculture for competition together with the joining of the EU accelerated a couple of changes in the agricultural production in Skåne: (1) significant decline in cereal production; (2) investment in new crops such as sugar beet, wheat, rapeseed and biofuels and (3) reforestation of farmland. Furthermore the requirements of the Water Framework Directive (WWF) triggered a policy of up to 100% subsidies for establishing wetlands and other measures.

In the BONUS SOILS2SEA case study sites in Tullstrops brook (and in many other parts of Sweden) the agricultural development has had a big impact on the transit time of the nutrients in the watershed (from being introduced to being discharged into the Baltic Sea). Tile drainage, removal of wetlands, straightening and dredging of the stream channels are examples of common agricultural actions during the last couple of decades that aim to reclaim more land that are profitable to grow crops and resulting in a quicker diversion of the precipitation. These actions reduce the transport times within the watershed and, hence, reduces the possibilities for retention and attenuation processes. The poor ecological status of the Tulstorp catchment area led the chairman of the agricultural cooperation to believe and discuss with the community that localized level implementation measures (such as meandering streams and wetlands) would provide the most effective solutions, while diminshing the risk of untailored, external, top-down approaches. Given the fact that (1) costs for meandering streams and creating wetlands are covered by state funds and (2) farmers in Skåne and elsewhere in Sweden have a passion for fishing, the Tulstorp project could relatively easy convince farmers to engage by (1) “donating” land next to the Tulstop stream and (2) working hours (which are paid) to carry out the project which aims to re-

arrange a 15 km narrow and straight creek into a wider river bed meandering and surrounded by vegetation and wetland areas. Culturally speaking, cooperation in small and medium sized farming associations instead of isolated activities are very much in line with the socio-historical developments of the country and the case study region. In addition, Swedish farmers enjoyed relatively comfortable conditions producing under the shelter of state subsidies and grants which for example is rather different to the situation in Poland.

4. First workshops

Stakeholders invited to the workshops included local farmers, land owners, land managers and their organisations, NGOs, community members and (local) political decision-makers (see Table 4-1). At these workshops, different policy instruments and options were proposed and discussed, including ones that empower local stakeholders collectively to commit to targets and decide on technical measures for implementation. For details on the first round of workshops, see Annex 9.2.1 for Denmark, Annex 9.3.5.1 for Sweden and Annex 9.4.5.1 for Poland.

This chapter summarises the results of the first three workshops, the goals of which were:

- to initiate a process of exchange between the BONUS SOILS2SEA Project and other initiatives in the region to create synergies.
- to present the project and its planned regional activities.
- to obtain feedback on the approach of the BONUS SOILS2SEA project and potential policy instruments and options.

Table 4-1: Number and group of stakeholder at the first round of workshops

Poland: 12 participants	Sweden: 13 participants	Denmark: 21 participants
Polish Farmer: 3 Authorities (Kłobuck County, Community of Mykanow): 3 Polish Anglers Association: 1 Water Treatment Plant: 1 Research Institutions (Ecologic Institute; AGH): 4	Swedish Farmer:4 NGOs (Naturskydds-föreningen Trelleborg): 2 Authorities (Länsstyreslen Skåne, HaV): 2 Tulstorpsåprojektet: 1 Research Institutions (SMHI, Ecologic Institute, KTH; AGH): 4	Danish Farmers: 10 Agricultural advisor: 2 NGO (Danish Nature Conservations Association and Danish Ornitological Association): 2 Authorities (Municipality and Ministry): 2 Politicians, member of Odder Municipality council: 2 (1 local farmer) Research Institutions (GEUS, Ecologic Institute, Aarhus University): 4 SEGES (Knowledge Centre for Agriculture): 2

4.1 Overview of policy instruments

A range of policy instruments can be used in order to reduce euthrophication problems. For the purposes of our first round of workshops we identified six different types of instruments (see Table 4-2 below, see also Refsgaard 2014) as a frame of orientation for the local discussions.

Table 4-2: Types of Policy instruments

Regulatory instruments	Compulsory regulation, bans, standards, limits
Planning instruments	Regional planning, land-use, urban planning
Market-based instruments or economic instruments	Revenue-generating instruments (taxes, charges) Subsidies (direct payments, tax allowances) Property rights (licenses, tradable permits) Others (user benefits, environmental liability, payments for ecosystem services)
Public investments	Infrastructure investments, procurement, R&D spending
Cooperation-based instruments	Voluntary commitments, negotiations, networks
Information-based instruments	Information campaigns, education, advisory services and capacity building, labelling, environmental reporting, environmental monitoring, access to information and justice rights

4.2 Workshop Norsminde, Denmark

The workshop in Denmark was held at Norsminde Kro on 11 December 2014 with 21 participants. The workshop served to test and uncover stakeholder reactions to the idea of spatially-differentiated solutions towards eutrophication.

Regarding the difference between **regulation on farm or catchment level**, regulations on farm level are more easily linked to individual farmers and are therefore more easily implemented. However, monitoring of actual impacts is more difficult, e.g. because of many factors affecting nitrogen leaching, flow and reduction processes in soils. The advantage of regulations linked to larger areas is that they may facilitate catchment solutions, e.g. where several farmers work together on construction of nitrate-removing wetlands. A second issue discussed was the **use of retention maps**. Stakeholder were concerned that the use of retention maps by the State as a basis for regulation of individual fields may lead to a very rigid and bureaucratic system. Use of detailed retention maps on a voluntary basis by individual farmers to plan implementation of an emission-based regulation is perceived very positively; however, a purely voluntary agreement between farmers in a catchment for the sharing of common commitments to comply with the emission requirements is not seen as very realistic. To reduce the uncertainty of retention maps, farmers expressed the need for supplementary local campaign measurements, e.g. measurements in drain pipes. **Emission trading** was a third topic discussed at the workshop. In general a trading scheme to reduce nitrate emission was seen as realistic; however, a total free trading market was seen as problematic as it may not be an efficient way of ensuring the reduction targets required to achieve WFD goals. Additionally the question of how to distribute permits was discussed and one option could be to associate the permits with the nitrate retention maps, so that an area with low retention receives a high emission permit.

4.3 Workshop Tullstorp, Sweden

BONUS SOILS2SEA researchers teamed up with the Tullstorp Brook project to organise a joint workshop held in Anderslöv, Sweden on 22 November 2014. The thirteen participants at the workshop discussed basic ideas and designed central elements of potential policy instruments (for details see Annex 9.3.5.1). Overall, it was stated that Tullstorp Brook and the regional part of the Baltic Sea are not in very good condition. Participants listed aspects or problems concerning agriculture and environment in the region and discussed how to address these issues. The ideas were clustered and four different themes were identified. Within those themes, relevant measures were discussed and selected as important measures to improve water quality:

- **Measures on farms**: Catch crops and 'between' crops; Optimising fertiliser use using the latest technology
- **Measures in and along streams**: 2 stage water courses; wetlands
- **Differentiated regulation**
- **Nutrient recycling and reuse**

Differentiated regulation was seen with sceptic as more scientific knowledge and technical solutions are needed to apply this. Issues like changes in land prices, some landowners being more affected than others, or who would pay for additional costs, have to be solved first before such an idea could be implemented. These measures will serve as a first result for the project on how these could be implemented and be integrated into governance concepts.

4.4 Workshop Kocinka, Poland

In Poland, the workshop was held in Częstochowa, near the river Kocinka, on 11 December 2014 and provided insights from the participants regarding water quality, agriculture and regulations in the Kocinka region. Stakeholders highlighted **different influential sources** concerning water quality:

- local industries (including the food industry),
- agricultural devices & machines (service and exploitation),
- transport (local and regional),
- atmospheric emissions from individual farms/private houses (inappropriate fires/furnaces, burning/combustion of low quality fuels and waste materials) and illegal dumping sites (landfills).

In general, all activities can have an impact on water quality, the type and size of activity are cruicial variables. One important aspect is the treatment of waste water at household level. Households that are not connected to the community sewage system can build household sewage treatment plants (instead of using septic tanks) or use biodegradable material for the septic tanks to improve water quality. For farmers, there is a lot of information and options already available to improve water quality, but many of these opportunities are not yet fully used. One reason may be a lack of awareness on how sewage and/or manure can negatively impact water quality. Another is the lack of **financial support** for good water quality improvement practices. Also, the laws covering water quality are too

complicated with too much bureaucracy which discourages farmer interest in legal issues. These views toward bureaucracy contributed to participant's **scepticism of new mechanisms like differentiated regulation**. Participants feared that new mechanisms could lead to unnecessary bureaucracy, and that farmers would not understand the ideas (e.g. trading nutrients). Instead of trying to implement new measures, there were suggestions to improve existing mechanisms. Also, **awareness and education** are seen as very important aspects to changing farmers and citizens' attitude and behaviour.

4.5 Conclusions from the first workshops

The first round of workshops provided a first point of exchange between the BONUS SOILS2SEA project and local stakeholders. Measures for improved water quality were discussed differently in each case study region depending on local needs and previous work. In Poland discussions were on a more general level around water quality regulation, Sweden developed water improvement measures in the workshop, while Denmark discussed specific spatially differentiated regulation options. All workshops focussed mostly on practical measures (rather then policy instruments which are used for analytical orientation).

In **Sweden**, technical environmental and agricultural measures (e.g. catch crops, wetlands) with which stakeholders had experience were more feasible than complex measures around differentiated regulations were knowledge gaps exist. This inexperience created space for fear around devaluation of land and injustice. In **Denmark** stakeholders found catchment level regulations helpful to achieve larger scale projects with higher impact. However, an additional, independent institution would need to ensure trust and compliance for such community-based governance concepts as farmers cannot regulate each other. In **Poland**, a major concern was the broad sources of water pollution besides agriculture and a lack of support for farmers.

In all workshops, a general need for **simplicity before bureaucratic complexity** (and economic burdens) was expressed. Stakeholders, especially in Poland, feel already too much of a burocratic burden. Hence, concepts should be easy to understand or old concepts should be improved. Financial compensation and education can help acceptance and implementation. This need for simplicity was also experienced implicitly in the discussions in Denmark around (the complex topic of) emission based trading. Also, Swedish stakeholders expressed concerns of too rigid burocratic regulations.

Furthermore, stakeholders at the workshops tended to visualise eutrophication at a higher level, and **shift the burden away from an individual scale**. Although research, especially in Poland, needs to be conducted to show evidence of the main sources of eutrophication, it should be made clear that the results will help inform and select the best available options. Exchange on good practices, also outside the farming sector, could be beneficial to show that other sectors are also active and inspire with possibilities. Generally, solution-oriented instead of problem-oriented concepts can benefit constructive communication processes.

Results from these workshops were used to develop different policy options tailored to the three case study sites (see chapter 5).

5. Policy options

On the basis of the ethnographic study and the first round of workshops, the following policy options emerged. They all provide possibilities to reduce the nitrogen losses to the aquatic environmentand can be implemented through the six different policy instruments. For each case study, three options are developed. More information like overall description, target group, expected impacts, and types of instruments and examples from practice are described in form of fact-sheets in Annex 4.

5.1 Norsminde, Denmark

5.1.1 Output quota system and emissions trading

Rather than a uniform input quota regime, the regulatory framework could be centered on a transferable quota trading system based on nutrient discharge. Individual farmers in the catchment would hold permits issued by local or regional regulatory agencies that allow discharges into water bodies. The discharges would be determined using retention maps. This way, farms in high-retention areas would receive higher allowances for fertiliser use than low-retention areas. This is also an alternative to a land exchange system, as it is not land, but rather “retention” that can be traded and transferred.

Farmers could purchase discharge credits from a centralised credit bank. The system would require market infrastructure with a credit registry, a documentation flow tool and a secure transaction platform. The nitrate emission permits in the case study area could be registered in the same databases that the Ministry of Environment and Food uses to manage the EU’s Common Agricultural Policy.

An example for this kind of approach is the Water Quality Trading Project in the Ohio River Basin. It exists since 2007 and is the world’s largest water quality trading program. It is entirely voluntary and based on an exchange of water quality credits for nitrogen and phosphorus.

This approach was discussed by the stakeholders during the first round of stakeholder workshops and was perceived as realistic. They were also open to a scenario in which farmers could buy shares of nitrate-reducing wetlands within the catchment, which would then allow them to generate a larger nitrate emission in their own holding. In another possible scenario, a farmer could grow nitrate-reducing catch crops and then sell unneeded emission permits to other farmers in the same catchment.

A concern among stakeholders was the possibility that not enough farmers were willing to purchase permits in the first place, so that the market would not have enough participants to function properly. The benefit for the farmers would have to be made very clear along with possible economic incentives for them to participate.

5.1.2 Self-monitoring through innovative data sampling methods

Stakeholders in Norsminde may choose to take a more bottom-up approach to reducing nutrient loads. This could involve empowering farmers through a training to collect local data from their fields and to adjust their crop choice and fertiliser input according to their land retention capacity. Using innovative passive data sampling methods, which are currently being tested by BONUS SOILS2SEA researchers (see project deliverable 3.3), could represent an opportunity to make self-monitoring technologically feasible. However, there is still considerable challenges on the design of such monitoring programmes for them to be representative.

Self-monitoring assisted by innovative technology represents an opportunity to reduce nutrient loading without a top-down quota system. Based on stakeholder opinions and attitudes, the local information could be uploaded to a collective monitoring system to allow farmers to monitor their individual contribution to reducing the overall catchment nutrient load. This would be different from joint commitments to reduce nutrient emissions, which is a model that stakeholders felt might antagonise neighbors. Instead, monitoring would be individual and data sharing would be optional.

This could have additional benefits. It can help create a sense of ownership and build trust among stakeholders. Visualization of land development beyond the borders of individual plots could increase a sense of embededdness for farmers and hence increase the sense of responsibility. A collective monitoring database can also aid researchers in gathering local data such as topography, soil types and land use in order to create finer-resolution and increasingly precise retention maps.

5.1.3 Creation of a specialised water network

A bottom-up approach in water management in the Norsminde catchment would take into consideration the critique from many stakeholders that legislation is exclusively made by authorities and that the government does not respect farmers' wishes and needs.

In this context, the installation of a Norsminde Fjord Catchment Council, has been positively received by stakeholders according to the interviews. The water network could be incorporated into the local farmers union "Landboforeningen Odder-Skanderborg" and serve as a specialised part of the existing agricultural advisory system. Its role would be to submit proposals for remediation and management plans and agree, in consultation with the water authority, on the measures to be adopted. By actively allowing the farmers and farmers' associations to work on remediation plans approved by the authorities, farmers would be able to make their ideas and concerns heard and a more efficient information network between experts, stakeholders and authorities could be created.

There is a good chance of success with this participatory catchment-based approach in Norsminde as awareness about the importance of improving water quality is already high. The water network would help identify solutions specifically based on retention map data. It is further a chance to involve other actors responsible for nitrogen emissions, e.g. from sewage treatment plants, and hence lower the perceived high burden of famers to have high costs and low benefits for the public good 'water quality'.

5.2 Tullstorp, Sweden

5.2.1 Funding technical measures in and along streams

- Adding more constructed wetlands can help to capture nutrients from agricultural run-off before they enter water bodies.

In Sweden, it is recommended that the catchment area of wetlands (with the focus on nitrogen retention) be large (>100 ha) and comprised of mostly field area (~70%). A calculation was made by the Swedish Environmental Protection Agency in 2009 for a future 2600 hectares of wetlands in Sweden.

By 2012, 21 wetlands had been constructed in the catchment area as part of the Tullstorpsan project, which was initiated by a farmer and a former municipal environmental official. More than 50 farmers and landowners joined the project, which is perceived as a big success and has gained attention for its innovative catchment-based approach. The Stockholm Environmental Institute identified key success factors in the project and found strong leadership with knowledge about how to deal with political interactions and drive complex processes, enthusiastic farmers as well as strong support from politicians.

Planning, digging, lost income and maintenance were included in the costs, which amounted to 33 million SEK (ca. 3.4 million EUR) every year. The average cost for reducing the nitrogen load was 42 SEK (4.36 EUR) per kg nitrogen and for the part reaching the sea 65 SEK (6.75 EUR) per kg nitrogen. The Rural Development Programme allocates financial support for the restoration and construction of wetlands. Other important financial mechanisms include the Marine Environment Grant. In some cases municipalities have supported and invested in wetland projects.

- Creating two stage watercourses, where the stream is broadened and accompanied by plantings along the banks, can also help reduce runoff.

Two-stage ditches can be used to control erosion, flooding and nutrient losses. Bench vegetation reduces erosion in the channel and when erosion is reduced, the loss of particle-bound phosphorus is also reduced. The plants also take up soluble nutrients in the same way as in wetlands. A two-stage ditch is more expensive to construct than a normal ditch. It also takes more area and so the cultivation area is smaller, which can be a critical point for some farmers. At the same time, the risk of crop damage caused by flooding is reduced.

5.2.2 Land bank

A land bank that includes voluntary land exchange and/or land compensation services can help ease the adoption of differentiated regulation. This would be useful for landowners affected by differentiated regulation as those with less potential for natural retention on their land may be forced to fertilize less or install more expensive safety measures. It could furthermore lead to changes in land price, which would require compensation or subsidies for measures. The procedures for land bank use involved would have to be simplified and made less expensive. There has previously been a land swap in Tullstorp for one of the wetland installations as precedent.

5.2.3 Incentives for integrated agriculture

Integrated agriculture practises aims to deliver more sustainable agriculture. It emphasis on the fundamental role and function of agro-ecosystems with focus on nutrient cycles or soilfertility. This concept per se does not lead to reducing N and P loads to the aquatic environment. However, this concept proposes a more conscious and sustainable agricultural approach also for the use of fertilizer. In this way it can lead to reduction in the use of fertilizer.

- Precision farming

This approach is a management concept that allows farmers to adapt fertilizers and manure to specific soil requirements and crop demands. It can lead to an optimized use of fertilizer and therefore reduction of nutrient loss to the aquatic environment. However, the technology is rather expensive and some farmers might think it is too complicated to handle. In order to make it attractive for them, supportive regulations and financial incentives are important policy instruments. For further resource efficiency, these incentives can be designed to be especially attractive to cooperatives where the farmers share this technology. The technology can be also financially beneficial for the farmers in the long run, because it allows them to save fertilizer and therefore money.

- Organic production

Organic production, which involves the use of crop rotations and cover crops, is a measure that was approved by stakeholders as a way of reducing N loads during the first round of workshops. The EU's Council Regulation (EC) No 834/2007 and Commission Regulation (EC) No 889/2008 lay down the basic rules that organic farmers have to apply. The farmers have to consider the natural conditions of their land and if their buildings are fit for organic production. In the current state, organic crop production is more profitable than conventional because the farmers get more revenue for the products in addition to support. There could however be a lower yield. Usually, the workload does not need to be increased. In Sweden, the county governments can help the farmers get in touch with counsellors, find courses and other activities. Sweden has three control institutions to certify products as organic: Kiwa, HS Certification and taste.

5.3 Kocinka, Poland

5.3.1 Incentives for precision agriculture technology

Many farms in the Kocinka region are currently stockless and stakeholders have noted that it is difficult to work the land with neither livestock nor readily or cheaply available equipment. Mechanisation through precise fertiliser application equipment could take into account topographic variables such as water retention and other soil properties. For stockless farms, off-farm organic fertilisers (e.g. urban food waste) can be an alternative to mineral fertilisers. The objective would be to improve nutrient managemnt.

5.3.2 Diversification in the rural economy

Diversification in the rural economy involves diversifying both agriculture and other activities in the rural economy as part of a long-term strategy to reduce nutrient runoff. At present, some 90% of all crops cultivated in the region are grains. If crops and off-farm sources of income are diversified, it will ensure that farms can thrive according to a low-intensity (perhaps organic) model. If this model is linked with an integrated farming approach, it can lead to a more sustainable agricultural practise resulting in fewer pressures on soil and water (i.e. less usage of fertilizer).

- Linking farm and off-farm businesses

The majority of farm households are not able to depend on farming as their main source of income and supplement their income through non-farm work. In order to make farming more relevant to the local economy, measures should aim to integrate small-scale farming with off-farm businesses such as agrotourism. This would allow the region to take advantage of the existing family-scale and low-intensity approach to agriculture rather than adopting a large-scale, intensive cultivation model. This will decrease the pressure on land and water while allowing the region to preserve its (agri-)cultural heritage, as supported by the Acts on National and Regional Land Use Planning.

- Adding value to agricultural products

A goal is to preserve the existing family farm model while increasing profitability through promoting low-tech alternative forms of agriculture such as organic and permaculture. This could be achieved by adding value through food processing and marketing, with a special orientation toward in-demand artisanal products. This would involve building networks and supply chains for the promotion of these products.

The aim would be to introduce/implement a system of control and certification to ensure consistent supply, large-enough batches to process and market higher-end products at a premium price. A potential source of information toward this end could be FertilCrop, which is an EU and national level project (2015-2017) that supports the sustainable management of organic farming systems.

5.3.3 Land bank

The aim of a land bank would be efficient and productive land use planning in the Kocinka region. This would serve agricultural, economic and ecological goals:

- Offering suggestions for land grouping and swapping

One of the main challenges in Kocinka and in Poland more broadly is patchy land use. Family farms are often made up of many small plots with irregular shapes, making efficient management difficult. A policy aim could be supporting land consolidation to foster productivity.

- Using retention maps to determine the most efficient use of land

For land that is infertile or particularly susceptible to erosion and nutrient loading, a land bank programme can facilitate compensation and encourage alternatives to cultivation, such as afforestation, establishing shrubbery and uncultivated biodiversity refuges and the

creation of insulation belts along water streams. The legal basis for this policy recommendation could be found in the 1982 Act on Land Consolidation and Exchange, 2003 Act on Spatial Planning and Development as well as Instruction No. 1 of the Agriculture and Food Minister on land consolidation. Funding opportunities can arise from the EU, which funded up to 75% of consolidation works in the 2007-2013 period under the Rural Areas Development Programme, Axis “Improving the competitiveness of the agricultural and forestry sector”, Scheme I –“Land Consolidation”. [26]

5.3.4 Building communication networks

Creating a communication network can bring stakeholders together for advisory services and awareness raising. Despite existing monitoring mechanisms, target figures for the reduction of nutrient runoff as set by Poland’s environmental authorities have not come close to being met.[27] This body would allow farmers to participate in consultations on measures to reduce nutrient loading. It would raise awareness about manure/fertiliser storage and waste disposal as well as best fertilisation and crop management practices more generally. A model project could be the United Nations Development Programme-Global Environment Facility (UNDP-GEF) Danube Regional Project (DRP), which has trained farmers in the Danube basin in fertiliser planning and other methods.

An objective of the network would be to reach out to all households rather than only farming households and assist in, for example, building household sewage treatment plants to replace septic tanks for households not connected to the community sewage system. It could potentially be integrated into the Agricultural Advisory Centres, which operate with offices in all counties in Poland.

[26] http://www.fao.org/fileadmin/user_upload/Europe/documents/Events_2007/Land2007/Poland.pdf
[27] http://www.balticcompass.org/PDF/Reports/Policy_Brief_Poland.pdf

6. Second round of workshops

In October and November 2016, a second round of workshops in the three case study sites were undertaken. All three workshops followed a similar approach aiming for comparable results. A list of participants is stated in Table 6-1. The Swedish workshop was exceptional, because also Polish stakeholders were in to join this workshop in order to start a first exchange and uptake of project results.

Table 6-1: Number and group of stakeholder at the second round of workshops

Poland	Sweden	Denmark
Polish Farmer: 6 County Administrative Board in Skåne: 1 Czestochowa County, Poland: 2 Polish Anglers Association: 1 Mykanów Community, Poland: 2 Water Treatment Plant: 1 Research Institutions (Ecologic Institute; AGH): 5	Swedish Farmer:3 Swedish Agency for Marin and Water Management: 2 Tulstorpsåprojektet: 4 Polish Farmer: 4 County Administrative Board in Skåne: 1 Czestochowa County, Poland: 1 Polish Anglers Association: 1 Mykanów Community, Poland: 1 Research Institutions (SMHI, Ecologic Institute, KTH; AGH): 10	Farmers: 26 Machine pool (Odder Maskinstation) working for farmers: 3 (local farmers) Agricultural advisor: 1 NGO (Danmarks Jægerforbund – Danish Hunters' Association): 1 Authorities (Odder Municipality): 1 Politicians, member of Odder Municipality council: 1 (local farmer) Research Institutions (GEUS, Ecologic Institute, Aarhus University): 5 SEGES (Knowledge Centre for Agriculture): 1

6.1 Governance scenarios for future emissions reductions

In Chapter 5, we have summarised the main policy options discussed in the first round of workshops and examined their feasibility in light of the ethnographic study. For most of the options, the concept of spatially differentiation (see Box below) can be applied. One crucial element to employ this approach are so called 'retention maps' which show differing levels of nutrient retention across different spatial scales.

Spatially differentiated measures

Spatial targeting of mitigation measures has the potential to produce economic and environmental benefits. Between the root zone of crops and outflow to streams, nitrogen is reduced in the groundwater. This is called groundwater retention. How much reduction oc-

curs in the groundwater varies with factors including the soil-type, soil depth, slope and how much tile drainage there is. If the retention is high, lower amounts of N reach the stream. We could therefore exploit this fact by relocating crops with larger nitrogen leaching losses to fields with higher retention.
In the Norsminde and Odense catchment area (BONUS SOILS2SEA Case Study area in Denmark), 10-20% extra nitrate reduction can be obtained in the subsurface through optimal spatial location of crops. Further gains can be made through optimal location of constructed mini-wetlands, but also of in-stream mitigation measures prolonging the transport times, increasing the uptake in vegetated zones or enhancing filtering in streambed sediments. Altogether there can be substantial economic and environmental gains, because it will be possible to produce the same crop yield with reduced nutrient load or increased crop yield with unchanged nutrient load.
To exploit the full potential of spatially targeted measures, retention maps with a fine spatial resolution (1- 25 ha) are necessary. However, in Denmark for example, the level of uncertainty associated with maps at this resolution is seen to be too high for use in government regulation. For this reason, the Danish government currently uses retention maps at around 1500 km^2 resolution, while expecting to improve this towards 15 km^2 resolution in the future. Although 1500 km^2 resolution maps have a lower level of uncertainty they also cancel out almost all economic and environmental gains of a spatially differentiated approach.

In the first round of workshops, mainly single measures were discussed. However, in order to reduce nutrient loading in the medium to long term, a broader perspective of how to effectively change agricultural practise is necessary. To this end, and to explore the potential of spatially differentiated regulation, we developed a series of scenarios. In principle, the scenarios developed displayed a state of governance in future times with all of them having the same goal: to reduce the nutrient load. To reach the reduction targets, three different ways could be approached. The first one addresses a more centralized (or business as usual) context, the second one uses market instruments and the third one applies a co-governanceapproach to reach the reduction targets. The three scenarios were adapted to the local context. Table 6-2 gives an overview of the management scenarios differing in the degree and approach to centralised/decentralised decision making and monitoring. The following chapters describe the scenarios and discussions in the three case study countries. The governance scenarios were discussed at the workshop in Denmark and Sweden. Polish Stakeholder joined the Swedish Workshop and discussed the scenarios as well. However, at the Polish workshop a different approach was carried out because differentiated regulation was perceived as difficult topic to discuss. At this workshop, scenarios that focused on N-mitigation were discussed and the outcomes are described in more detail chapter 6.2.

Table 6-2: Features of the three scenarios discussed at the workshops

Management Scenario	Centralised/ top-down	Market based/ flexible management'	Co-governance
Approach	Clear N-reduction targets uniformly for the whole catchment at farm or field level.	Cap-and-trade system to reach state set nutrient load target.	Co-organisation of farmers to reach state set nutrient load target.
Monitoring	Authorities are responsible for detailed monitoring and requests	Authorities only monitor the N load at catchment level and requests man-	Authorities monitor the N load at catchment level. More

	management plan from farmers.	agement plan from farmers. More detailed monitoring could be arranged by farmers.	detailed monitoring could be arranged by farmers.
Retention maps	Only low resolution maps at around 15 km^2 are used by government to structure the land use (e.g. catch crops, constructed wetlands).	High resolution maps at 25ha are used by authorities to calculate the exact amount of allowances and their distribution among the catchment.	Could be one tool used by farmers to optimize their fertilizer usage.
Subsidies	Connected with the requirements set by the authorities.	Connected with the precise usage of allowances.	Only given if the reduction target for the whole catchment is reached.

6.1.1 Centralised management scenario

In the 'Centralised' context of spatially differentiated regulation discussed, the State decides on measures such as fertilisation norms at farm or field level. The government uses retention maps at a low resolution (e.g.15 km^2) to produce spatially differentiated regulations for land-use. On this basis, decisions are made e.g. on the location of measures such as catch-crops, constructed wetlands or different fertilisation norms at different locations. To monitor and control implementation, the government requests detailed plans for cropping systems and fertilisation of farmers. The government monitors at large catchment level to evaluate if nutrient reduction targets are met. As an incentive, farmers that fulfil the requirements receive subsidies from the EU CAP.

In both the **Danish** and **Swedish** workshop, this scenario was criticised as being too bureaucratic and rigid with no flexibility and lack of local knowledge. It was perceived as unfair, regarding the distribution of compensation and demotivating additional agri-environmental measures (Denmark) and in affecting certain landowners more negatively than others (Sweden). Danish stakeholders stated that accurate retention maps as well as streamlined, comprehensive and continuous legislation would be the basis for this scenario to work. Swedish stakeholder found that extensive and expensive monitoring and control activities by authorities would be necessary. Furthermore, this approach would not be compatible with current monitoring in the Water Framework Directive and would lack acceptance if enforced.

The **Polish** stakeholders perceived this scenario as positive when clear, fair and comprehensive regulation is given as farmers could concentrate on their work of farming. This scenario is not far from Polish reality as centralization is a trend in Poland. For better local implementation of this scenario, an expert like an agricultural advisor that bridges local needs with national and EU guidelines would be needed. Furthermore, due to low efficiency of farming, subsidies would be need needed to compensate for fertiliser reduction.

6.1.2 Market-based scenario

This 'flexible management' scenario suggests emission reduction through a market-based 'cap and trade' system. Government authorities per catchment would issue permits for N-loading on a field basis. Their decisions are based on 25 ha resolution maps. All farmers would be obliged to participate and can trade N load allowances where necessary. Government authorities can monitor and manage overall N loads allowance and intervene in

the market by buying up or selling permits from the system. Compliance of farmers is monitored through detailed reports provided by farmers on their cropping systems and fertilization (as in Scenario A). Exceeding individual allowance is sanctioned with a deposit that other farmers can use for carrying out mitigation measures. As in scenario A, government performs control monitoring at catchment level to evaluate if the nutrient reduction targets are achieved.

In the **Danish** and **Swedish** workshop this scenario was dismissed. In Denmark it was criticized as it does not “honour sustainability” but legitimizes environmentally-unfriendly behavior of farmers buying permits. Furthermore, past experiences in Denmark with milk quota lead to the fear of potential centralization of farming with larger farms buying most permits. And more so, a cap and trade system could be politically abused. Both Swedish and Danish stakeholders found this scenario as too bureaucratic, inefficient as well as complex to administrate and govern. Swedish stakeholders distrusted the technical implementation and accuracy of the retention maps as a 25ha resolution cannot capture local variations. For this scenario to work, Swedish stakeholders would need trustworthy maps with extensive data. Lack of knowledge is especially seen regarding tile drainage condition on fields but also regarding crop specific fertilization needs and measures tackling both N and P reduction. A solution could be a strong Farm Advisory Services such as the Swedish program ‘Greppa Näringen’.

The **Polish** stakeholders regarded the ‘cap and trade’ scenario more positively, especially the option to trade N-licenses. A streamlined, comprehensive regulation would be required with clear rules on subsidies. A local expert or project manager should be able to adjust regulation to the local circumstances. Monitoring was seen problematic regarding costs and should be undertaken by an authority or third party. Farmers could self-monitor when given compensation. Generally, the Kocinka Catchment consists of over 160 farmers which would hinder an effective cap and trade system

6.1.3 Co-governance scenario

In this scenario, the State government is sparsely involved in the management, monitoring and control of N loading. Rather, farmers in the catchment self-organise, e.g. through a water council, to find local measures that help achieve government targets. Retention maps at 1 ha resolution have higher uncertainty, but can be used by farmers to self-organise spatially differentiated management. Farmers establish a monitoring system to update the retention maps and ensure that the target goals are reached (e.g. monitoring at a field or subcatchment level). Government authorities only monitor on catchment level at the outlet. Their financial and technical support helps farmers’ self-organisation and –monitoring. Subsidies are distributed in a self-organised way when reaching the catchment-level targets. In case no self-organised plan can be implemented, a central regulation (Scenario A) is imposed by the State.

In the **Danish** workshop, this was the preferred scenario as it motivates and empowers the farmer and he or she can influence mitigation measures. For this approach to work, general rules and a central management are still necessary. The voluntary use of retention maps is seen as positive as it can support decision making but farmers could also decide on technology such as precision-size farming to reach nutrient targets. Monitoring preferences were with a third party or authority to provide credible data, although a minority suggested that famers self-monitoring could be interesting. To avoid free riders, clear data collection

requirements and fertilizer accounts would be necessary. A benefit from monitoring could be the improved use of fertilizer. A co-governance approach could also invoke joint agri-environmental measures such as wetland construction etc. by several farmers. Social pressure could help non-cooperative farmers to join. Overall this scheme needs a catchment officer, a catchment council as well as compensation for the probably high administration costs and incentives for (joint) mitigation measures. A water council could meet every three months. Besides greater autonmy of farmers it would be valued for potential information exchange. A misbalance in power and lack of time could prevent farmers in participating in a water council. Lack of time could also prevent farmers in self-monitoring; however, a majority can imagine taking sampling in a 2-4 hour timeframe every 4 to 8 weeks. Gaining compensation and avoiding sanctions is the highest incentive for self-monitoring but also trust in the results and control in the process are valued.

The **Swedish** stakeholders discussed this scenario as fair for individual farmers but with a high level of responsibility on them for implementing and achieving the goals and self-monitoring. Good procedures for communication between and among farmers and authorities as well as comprehensive data management would be key. Authorities would ideally provide data and retention maps, and consult and support the farmer with e.g. incentives for new monitoring technology while considering landowners knowledge. In a joint effort, farmers could further establish and use a machine cooperative to collectively buy and share agricultural machinery. Social dynamics could create a 'positive peer pressure' among the farmers but there is an imminent risk for disagreements between stakeholders if government-set targets are difficult to reach. So far, concerning water management in this area, stakeholders have shown to act cooperatively.

The **Polish** stakeholders found this scenario very unrealistic due to the high cost in time, money and knowledge, the large amount of farmers in the catchment, lack of leadership and the previous experiences with failed cooperatives. Fear of losing power was expressed as group decisions might not represent individual choices. Furthermore, farmers found it unfair that other polluters like households not connected to the sewage system were not helping to solve the problem. Polish stakeholders preferred solutions like the Swedish Tullstorp Span project which managed to collect subsidies for river renaturation work.

6.2 N-mitigation measures in Poland

In Poland, spatially differentiated regulation was not seen as attractive due to high costs and bureaucracy involved. Furthermore, due to Poland's communist history and collectivisation of agriculture, self-organisation is regarded more sceptically and, hence, was not explicitly outlined in the scenarios but discussed in possible and effective monitoring options for all three scenarios. These monitoring options included a *top-down* control approach governed by a national agency, a bottom-up approach with *co-governance* and co-operation by farmers in a water network or a government approach by an *independent body* like a community or regional group. The scenarios outlined are market- and information-based with strong government support.

6.2.1 Rural revival scenario

In this scenario regional development funds are used for information and training on the importance of a healthy environment and on potential goods and services to revitalise and diversify the rural economy (e.g. on agro-tourism, trout fisheries and aquaculture, fruit and vegetable preserving). Establishing a regional label with agri-environmental standards

could reduce N and P inputs and allow actors to obtain a higher price for their products. Furthermore, subsidies or other incentives can be given to “start-up” businesses.

The scenario was perceived as positive by the Polish stakeholders; however, it would require more information on the different options. Farmers could produce regional products in a more ecological way and could be supported by the water company (present at the workshop) by information campaigns and promotion of household connection to the sewage system. Monitoring would need to be supported from the authorities which could be connected to EU funds.

6.2.2 Payments for ecosystem services scenario and awareness raising

This scenario outlines how payments for ecosystem services (PES) can restore the local Kocinka river. Land-owners in the catchment are firstly informed on the range of environmental and societal benefits such as supporting (e.g. nutrient recycling) and regulating (e.g. water purification) services of ecosystems including the increased retention of N and P. They are further supported to identify appropriate ecosystem-based measures and financially rewarded for converting agricultural land (or halting the conversion of non-agricultural land) to protect or restore local ecosystems.

The Polish stakeholders discussed different measures such as buffer zones or constructed wetlands. A meeting for further information, an official information point and compensation would help establishing this scenario. The stakeholders found that an authority, like the Environmental Protection Inspectorate, should be in charge of monitoring. This could be supported by anglers monitoring certain parameters of the river and advising on appropriate measures. Monitoring should take place at the river, as the outflow of the catchment, but also at (sometimes overflowing) wells.

6.2.3 Farm management incentives and awareness raising

This scenario involves economic incentives from State level to farmers to reduce N and P levels and information campaigns to increase awareness on the long-term effect of N and P leaching. Measures include incentives or subsidies for alternative farming methods, e.g. organic agriculture, nutrient recycling, Permaculture, and for technologies that reduce N and P inputs, e.g. precision agriculture.

The Polish stakeholders interpreted that this scenario would lead to a growing agricultural sector with increased usage of fertilizer, and hence, negative environmental impact. These should be considered by high level decision makers (the EU, Agricultural Chamber, other strong representatives of farmers such as farmers’ party). Monitoring should be conducted by an independent body or non-governmental institution. Furthermore, education and raising awareness targeting different age groups was seen as key to reduce environmental degradation in this scenario.

6.3 Conclusions from the 2nd round of workshops

When discussing the **three scenarios** with the stakeholder, clear distinctions between the preferences were obvious. The Polish stakeholders at the workshop in Sweden perceived the ‘Centralised management scenario’ as positive when clear, fair and comprehensive regulation is given. For the Swedish and Danish stakeholders this scenario was criticised

as being too bureaucratic and rigid with no flexibility and lack of local knowledge. For the 'Market-based scenario' the Danish stakeholders were very clear in criticising the scenario, while Swedish stakeholders emphasised the technical difficulties connected with this scenario and the Polish could imagine such a scenario to be implemented with the help of local expertise. The 'Co-governance scenario' was discussed most intensively at the workshops. While the Danish farmers regard this scenario as the only possible out of the three, the Polish stakeholders found this scenario very unrealistic due to the high cost in time, money and knowledge. The Swedish stakeholder saw this scenario as fair for individual farmers but with a high level of responsibility on them for implementing and achieving the goals. For the formulation of governance concepts, it became evident that a 'one size fits all' approach does not seem very viable.

To apply differentiated regulation, the **use of retention maps** is crucial factor. Stakeholder at the workshops saw the maps rather as supporting instrument that can be used as decision support tool when implementing differentiated regulation. Especially in the co-governance scenario, the maps can become an important supporting tool. For the implementation of these maps, it became evident in the workshop, that certain prerequisites would be necessary:

- **Accuracy & Reliability**: It has to be ensured that the retention maps are as accurate as possible with the highest resolution possible. A high resolution of the retention maps ensures the incorporation of local spatial differences. Therefore a resolution of 1 ha would be preferable as stated by the stakeholders. If high resolution retention maps are used in the decision making, it has to be ensured that the best possible knowledge is used and therefore errors in the maps can be excluded.
- **Compensation**: If retention maps are used in combination with regulatory policy instruments, it has to be ensured that compensation schemes can be applied. Especially a change in the land-price due to the usage of retention maps must be compensated in a proper way.
- Clear and strict **regulation**: if retention maps are used with regulatory policy instruments, the policy setting and the rules must be very clear and easy to understand. It also has to be discussed beforehand what happens if the map or part of the map turn out to be 'wrong'.

A second very important issue for all three scenarios is the **monitoring**. Therefore most of the stakeholder in Denmark, Sweden and Poland stated that monitoring activities should be undertaken by an independent 3rd party. In a scenario, where the farmers would take monitoring samples, a majority of participants in Denmark can imagine taking sampling in a 2-4 hour timeframe every 4 to 8 weeks. The preferred intervals for self-monitoring in Sweden by taking samplings for 2-4 hours varied widely from two to eight weeks, and for the Polish farmers intervals of every six weeks are accepted. For the participants of all three workshops, gaining compensation and avoiding sanctions is the highest incentive for self-monitoring but also trust in the results and control in the process are valued.

7. Proposals for new governance concepts, policy options and outlook

As recent studies have shown, the reduction or retention of N and P varies significally at the local scale depending on the hydrological and reverine regimes (see Hansen et al., 2014; Højberg et al., 2015). Therefore a spatially differentiated approach - with measures targeted towards areas where natural reduction or retention is low - is expected to be more cost-effective than traditional uniform measures (Jacobsen and Hansen, 2016). The spatially differentiated approach was also perceived as a useful concept during workshop discussions in the BONUS SOILS2SEA project.

One important issue is that spatial differentiation would affect farmers in a heterogeneous way leading to a potentially rapid change in the value of land that would need to be compensated in some way. Another central issue for the successful application of a spatially differentiated approach is the issue of uncertainty. As discussed in Chapter 6.3, rentention maps can be a valuable decision support tool for undertaking a differentiated approach. A high degree of detail (resolution) is a preequisite for these maps to be useful, but this level of detail is also linked to a high degree of uncertainty. Reducing this uncertainty is a technical issue that can be solved with more data and scientific endeavour. However, the way in which this uncertainty is approached and managed is a decisive factor for the success of a spatially differentiated approach. In a top-down approach to governance, the use of uncertain evidence to inform a regulatory framework can lead to conflict and even legal processes. In a co-governance system stakeholders are not forced to use uncertain evidence to determine measures for reducing N loads. Instead, they can use this evidence as part of a suite of inputs (including local knowledge) to reach a more widely informed view on the best areas to target for N reductions in that locality.

In terms of implementing spatially differentiated approaches, most of the policy options discussed in Chapter 5 (e.g. land banks, mitigation measures in and along streams, building communication networks, or payment for ecosystem services) could be integrated fully or partly into a spatially differentiated governance concept. Also, as discussed in Chapter 1 and Chapter 3, each of the three case study countries has its own specific governance system and socio-cultural-historical setting. Thus, depending on the context, spatial differentiation may be integtrated into existing governance systems or may suggest the need for an entirely new approach to governance.

Chapter 6 explored different governance scenarios for implementing a spatially differentiated approach. The outcomes from **Sweden and Denmark** indicate that differentiated regulation has considerable promise and could be undertaken through a system of co-governance. Self-organised catchment councils or cooperatives could be supported by an independent third-party to whom all parties are accountable (with only a low level of government intervention). Such groups could also support local monitoring activities, help improve the accuracy of retention maps and select and implement technical measures in and along streams. The results from **Poland** on the other hand, suggest that spatially differentiated approaches do not hold as much potential at the present time.

In general, farmers in **Denmark** are professionalized, highly networked, environmentally aware on issues concerning eutrophication and are up-to-date in their knowledge of EU regulations and subsidies. Many are engaged in political processes and lobbying activities. Denmark has some experience with retention maps being used as a tool of top-down governance. However, the resolution available was too low to accurately determine measures at farm level or at 1ha scale. This lack of accuracy and certainty led to a mistrust in government determined spatial differentiation. However, stakeholders in Norsminde were generally open towards spatial differentiation in the context of a co-governance regime, which could build on the positive experiences with the Norsminde Fjord Catchment Council and which could provide the possibility of greater self-determination.

Sweden already has a long national history of cooperative governance and local farmers were not positive about measures from “outside”. In this way, top-down approaches are not appropriate in Tullstorp rather, governance concepts should be rooted in bottom-up processes and local context. The Tullstorp Stream Economic Association (TSEA) is an example of a group built up through self-initiated local processes and provides a good basis for experimenting with more innovative solutions such as spatial differentiation. Furthermore, the factors leading to the success of this initiative could potentially be used to inform the design of co-governance approaches to implement differentiated regulation in other contexts.

In **Poland**, a differentiated approach could be envisaged, but stakeholders from the Kocinka catchment demonstrated a lack of support for bottom-up processes. For many stakeholders, cooperative arrangements are not a viable option and there was said to be a lack of strong leadership to steer such an arrangement. The suggestion was thus rather to work with the existing governance system, favouring a top-down approach with clear and fair regulation. For a government-led approach to work, information would need to be very accurate with regulations that are clear and easy to understand. Thus, issues like data sampling, improving the resolution of retention maps, or supporting decision-making on land exchange would need to be solved before implementing such an approach. Given the current issues of uncertainty (in highly detailed maps) or usefulness (of low resolution maps), a top-down approach to spatial differentiation is not currently a preferable option for Kocinka.

In Poland, the reduction of N loads could be reached through alternative means to spatially differentiated regulation. A market-based approach may suit the expressed need for financial support and top-down management. The focus could be on incentives for environmentally friendly agriculture and diversification of income streams. As there is low level of environmental awareness and opportunities for EU support among the Polish farmers (as many are only part-time farmer or have small farms) information campaigns and training are essential. This could be supported by networks of farmers and other stakeholders to improve communication, explore local (direct) markets and increase awareness and training amongst farmers. Farm structure in Poland is highly fragmented which can cause some problems (longer distance to fields), but has also positive effects (diversification of landscape). As an alternative to spatially differentiated regulation, N loads could be reduced through capitalising on existing widespread low-intensive farming practices by incentivizing and marketing regional agriculture with low pressure on soil and water. As 90% of the crops are grains, there is also potential to diversify to include catch crops.

The three case study examples show that a differentiated approach can, in theory, be applied in different governance settings. The most promising application of spatial differentiation however is to be expected within a co-governance approach. Here farmers (and other stakeholders) in a defined area (catchment or sub-catchment level) can determine differentiated mitigation measures using local knowledge of the area and using retention maps as supporting (rather than regulatory) tools. In comparison with the traditional top-down approach, the co-governance approach shifts a large amount of responsibility to local farmers or to catchment councils. While the responsibility would not include the definition of the reduction targets, it includes the responsibility for fulfilling the reduction targets. This includes defining and implementing mitigation measures (placing of wetlands, change of land-use, etc.), collaboration among the farmers within the catchment, as well as the monitoring of the different measures. Furthermore, co-governance settings can support early conflict resolution through regular meetings and discussion (as well as specific mechanisms to address these issues).

A series of variables (based on Poteete, et al. (2010), Ostrom, E. (2010)) have been identified as being important for effective co-governance of common pool resources:

- **size of the group:** big enough to mobilize necessary resources (e.g. finances, knowledge) but small enough to know each other and meet regularly, ideally in face-to-face **communication,**
- **heterogeneity of participants**: people with a unifying goal and similar background act together more easily but heterogeneous people might mobilize diverse resources,
- **freedom to enter and exit** the group, **long time** horizon,
- effective, transparent and accurate **monitoring and sanctioning** capabilities,
- up-to-date information **about average contributions** in the group,
- **security:** It is safe that individuals' contribution is returned in case that the investment threshold is not reached

Trust is found at the core of collective action, highly influenced by **repetition** of the situation, the **reputation** of others past actions and a **reciprocial** linkage structure of the community network (contributions that go to a generalized pool facilitate freeriding).

These variables are explored in full detail in the BONUS SOILS2SEA report 'Towards co-governance in monitoring of spatially differentiated regulation for good water quality – Common pool resources and EU law' (Deliverable 6.3). In the following report (Deliverable 6.4) we further explore the possibilities of a co-governance approach to spatially differentiated regulation and the potential for upscaling.

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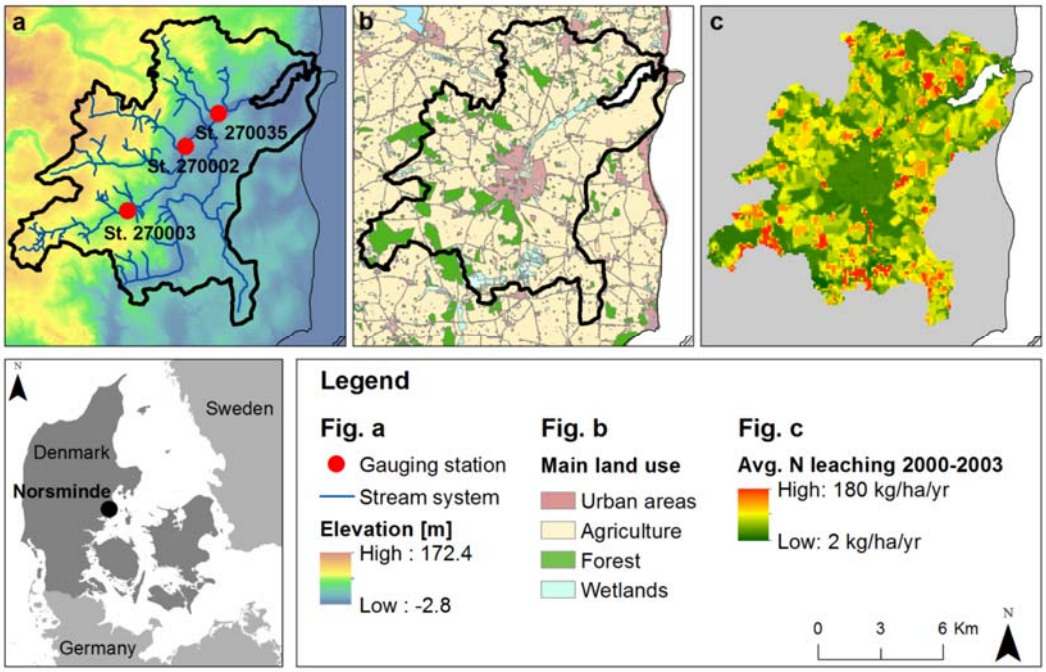
9. Annexes

Annex 1: Case Study Denmark

9.1 Norsminde, DK

The Norsminde Fjord catchment is located on the east coast of Jutland in Denmark. The catchment is dominated by a moraine landscape from Weichsel with mainly clayey soils and some sandy soils in the southern part of the catchment. The topography varies from around 100 m to sea level. An extramarginal stream valley from Weichsel, running from Southwest to Northeast, divides the catchment into a western more elevated and rather hilly part and an eastern part consisting of a flat low lying plain. The climate is temperate with an average precipitation of 773 mm/yr (1995-2003) and an average evapotranspiration estimated to 555 mm/yr. Rævs stream and its tributaries contribute to the main part of the discharge from the catchment to the fjord. The average discharge at the most downstream gauging station (area 86 km^2) was 232 mm/yr (1995-2003).

Figure 2: ***The Norsminde catchment area with a) topography, river network and gauging stations; and b) land use; and c) N leaching***[28]



The stratigraphy in the Norsminde area consists of Paleogene and Neogene sediments covered by a sequence of Pleistocene glacial deposits. The Paleogene layers consist of fine-grained marl and clay, which has low permeability. The Neogene layers above comprise a Miocene sequence of marine origin, typically up to 40 m thick. The formation is clay dominated but with interbedded sand units, which can be more than 10 m thick. The Miocene is only found in the western part of the catchment and the glacial deposits are therefore found directly above the Paleogene clay in the eastern part. In some parts of the area, the Paleogene and Miocene deposits are cut by buried valleys, in particular in the southern

[28] Figure adapted from Hansen AL, Christensen BSB, Ernstsen V, He X, Refsgaard JC (2014) A concept for estimating depth to redox interface in catchment scale nitrate modelling in a till area. Hydrogeology Journal

part of the catchment where the Boulstrup tunnel valley is found. The glacial sequence consists of both sandy and clayey sediments. The clay deposits include a variety of lithologies from glaciolacustrine clay to clay till, whereas the sandy deposits mainly are of glaciofluvial origin. The clayey sediments dominate the sequence with the sandy sediments occurring as small and distributed units within the clay. The glacial sequence is in some areas heavily tectonically deformed with occurrences of rafts of Paleogene clay[29]. The clayey soils in most of the area are typically drained using tile pipe drains. This is believed to highly influence the subsurface flow paths in the catchment.

Figure 3: Typical landscape in the Norsminde catchment (Photo: Vibeke Ernstsen)

9.1.1 Farming

Norsminde is intensively farmed with more than 70% of the catchment area being agricultural land. According to the General Farming Register (GLR), 7389 ha are registered with intensive agriculture and fertilizer application up to the allowed norms[30]. These can be considered as professional, full-time farming businesses. In addition, there are 697 ha of agricultural land not appearing in the GLR and without fertilizer account which probably represent small farms with extensively farmed areas operated by part time farmers.

According to the General Farming Register (GLR) there were 186 farms in 2010 that cultivated 7389 ha distributed among 1586 fields. On average, each farm managed 62 ha including fields outside the catchment. In 2010, winter wheat was the most common crop utilized (50%). Other major crops were winter barley, winter rape, spring barley and grass. The average density of livestock corresponds to 0.85 animal units per ha.

Agriculture is considered the main source of nitrate and phosphorous leaching in Norsminde (see following chapter)

[29] He X, Koch J, Sonnenborg TO, Jorgensen F, Schamper C, Refsgaard JC (2014) Uncertainties in constructing stochastic geological models using transition probability geostatistics and transient AEM data, Water Resources Research, Under revision.
[30] GLR (2013): http://nitrat.dk/xpdf/technicalnote---nitrate-leaching_chrthirup.pdf, p. 7

9.1.2 Specific challenges

The Norsminde Fjord catchment faces two major, somewhat interrelated, water management problems. One issue is related to possible contamination of deep groundwater by nitrate and pesticides potentially threatening drinking water supply in the area. The other issue is related to the ecological status of the coastal water in Norsminde Fjord. BONUS SOILS2SEA will only address the latter issue.

Norsminde Fjord is an important resting and breeding area for birds and is designated as an EU-bird protection area. The nutrient load to the fjord has been reduced during the monitoring period; however, the nutrient load is still too high and Norsminde fjord is classified as having a poor ecological status. Sewage treatment plants in urban areas have been extended to include effective nutrient removals, so today the nutrient load to the fjord mainly consists of nitrogen from agriculture and needs to be reduced further. The total nitrate load is at 142 tN/year and the target is 62 tN/year. The reduction target of 70 t N/year is divided into 37 t N/y before 2021 and 33 tN/y postponed to after 2021.[31]

This situation reflects one of the key problems Denmark is facing with respect to the WFD implementation. Although Denmark has reduced nitrate leaching from the root zone by 50% since 1987, additional reductions will be required to meet the WFD objectives, even when climate change impacts are not considered. Under the current regulation regime, reductions in nutrient inputs of this magnitude would have a serious impacts on agricultural operations[32].

Another specific challenge in Norsminde is the fact that Danish farmers are already over-regulated and perceive national legislation as too strict, according to the stakeholder interviews that have been conducted in the catchment (see Chapter 9.2.3).

9.1.3 Relevant actors

Farmers:

- Agriculture is heavily regulated today. Farmers see the new N reduction targets as potentially economically devastating for individual farmers as well as for the agricultural sector as such. Danish farmers have a 150 year long tradition for being very well organised and using a well developed and scientifically based agricultural advisory service. The farmers in the Norsminde area are organised in the local farmers union “Landboforeningen Odder-Skanderborg” (DLØ, http://www.lbfos.dk/). SEGES (http://www.seges.dk/) is a merger of the former Knowledge Centre for Agriculture and the Danish Pig Research Centre that is the professional arm of the national farmers union Danish Agriculture and Food Council (http://www.agricultureandfood.dk/). SEGES, which is located in Skejby in the Aarhus area about 30 km north of the Norsminde area, is professionally very resource-

[31]Swedish Ministry of Environment and Food (2016): Water Area Plan 2015-2021 for River Basin District Jutland and Funen (in Danish) http://svana.dk/media/202856/revideret-jylland-fyn-d-28062016.pdf

[32] Dalgaard T, Hansen B, Hasler B, Hertel O, Hutchings NJ, Jacobsen BH, Jensen LS, Kronvang B, Olesen JE, Schjørring JK, Kristensen IS, Graversgaard M, Termansen M, Vejre H (2014) Policies for agricultural nitrogen management – trends, challenges and prospects for improved efficiency in Denmark. Environmental Research Letters, 6, 115002.

ful. Both the local union (DLØ) and SEGES follow and participate actively in the many research and demonstration projects in the area.

- A "Catchment Council for Norsminde Fjord" was established (http://oplandsråd-norsminde-fjord.dk/) with the aims to work for identifying smart and innovative measures and solutions that can contribute to a good ecological status in Norsminde Fjord and at the same time enable a continuous development of the agriculture in the catchment.
- Bæredygtigt Landbrug (sustainable agriculture) was founded in 2010 with the purpose to increase farmer's profits and influence and as a competing organisation to the older Danish Agriculture and Food Council.. The goals of the organization are to eliminate taxes and loosen restrictions. As stated on their website, 4000 organic and conventional farmers are members of the organization.
- The Agricultural and Food Council is a representing organization of the farming and food industry in Denmark. It is the result of a merger of five organisations: Danish Agriculture, the Danish Bacon and Meat Council, the Danish Agricultural Council, the Danish Dairy Board and Danish Pig Production. The main goal is to ensure political influence.

Green organizations:

- The Danish Society for Nature Conservation[33] has local branches in the area and resourceful competent local persons as active members.
- The "Dansk Ornitologisk Forening, Lokalafdeling for Østjylland" (http://dofoj.dk/om/) promotes the protection of birds and their habitats in the region.

Authorities:

- The Danish Environmental Protection Agency, Ministry of Environment and Food of Denmark (http://www.naturstyrelsen.dk/) has the responsibility for preparing River Basin Management plans for the WFD. The "Naturstyrelsen – Aarhus" is one of the 21 local branches. (Part of Ministry of Environment and Food)
- The Danish AgriFish Agency, Ministry of Food, Agriculture and Fishery (http://naturerhverv.dk/) has the responsibility for implementing the EU common agricultural policy and for the agricultural regulation decided by the Danish Government.
- Municipalities have the responsibility for implementing the WFD measures. There are two municipalities in the catchment, Aarhus Kommune (www.aarhus.dk) and Odder Kommune (http://www.odder.dk). Odder Kommune decided to become a "Klimakommune" signing a declaration with the Danish Society for Nature Conservation (http://www.dn.dk/Default.aspx?ID=29799) to reduce CO2 emissions by 2% each year.
- Odder Spildevand A/S is a municipally owned enterprise that is responsible for waste water treatment (http://www.odderspildevand.dk/). In the Aarhus Kommune, Aarhus Vand A/S is responsible for the water supply and waste water treatment (http://www.aarhusvand.dk/Om-Arhus-Vand/).

NGOs

- Odder Vandværk a.m.b.a (http://www.ofsis.dk/odder-vandvaerk) is a local water supplier. It is a non-profit organization.

[33] Danish Society for Nature Conservation http://www.dn.dk/Default.aspx?ID=4592 and http://www.dn.dk/Default.aspx?ID=267

9.1.4 Relevant regulatory framework

Denmark's environmental policy, especially around agriculture and nitrogen, has seen rapid updates over the last few years. Hence, this overview of relevant regulatory framework is limited in time up to January 2017.

Common Agricultural Policy (CAP)

Between 2014 and 2020, approximately 7 billion Euros will be invested in the Danish farming sector and in Danish rural areas through the CAP[34]. 6.4 billion Euros of the budget will be made available for direct payments towards farmers. 30 % of the direct payments will be linked to three environmentally-friendly farming practices: crop diversification, maintaining permanent grassland and conserving 5 % of areas of ecological interest, or measures considered to have at least equivalent environmental benefit.

Water Framework Directive and its local implementations

Denmark is divided into 4 river basin districts and 23 main river basins/water catchment areas with individual River Basin Management Plans (RBMPs) to reach good ecological status of groundwater. Norsminde Fjord in the Odder Municipality belongs to the Horsens Fjord river basin district and has a reduction target of 37 t N/year until 2021 for the Norsminde Fjord. The national Danish Program of Measures, developed by the Danish Environmental Protection Agency, is an integrated part of the 23 RBMPs which are developed by the municipalities. The second round of RBMP (2015-2021[35]) and further updates[36] consists of important agricultural measures such as, constructed wetlands, catch crops and targeted measures (such as spatially differentiated measures). Especially catch crops are seen as key measures, since good ecological status of groundwater by 2015 was not met.

Nitrate Directive and its national implementation

Denmark has passed several regulations (e.g. Nitrate Directive Consolidation Act on Manure, Consolidation Act on Agriculture's Utilization of Fertilizer) and updated Action Plans to fullfill the Nitrate Directive and other national goals to reduce N loss over the last 30 years. To reach national and further EU targets (e.g. National Emissions Ceilings from atmospheric pollution, Water Framework Directive) and to counter the imbalance between different regions performance in N reduction, the latest Action Plan (passed in parliament 2016) shifts to locally defined reduction targets (instead of national) and focus on N output (in the environment rather than input to agricultural farms)[37].

Act on Environmental Approval of Husbandry Farms

The Act (1992) aims to ensure that husbandry production develops in a sustainable way by specifying rules for establishing or expanding husbandry production in relation to e.g. urban areas or certain habitats. In Denmark, the Ministry of Environment and Food of Denmark and the Environmental Protection Agency are responsible for the implementation of this policy. Since 2007, the Act gives the frame for approval of projects for livestock holdings

[34] CAP Denmark (2016): http://ec.europa.eu/agriculture/**cap**-in-your-country/pdf/dk_en.pdf

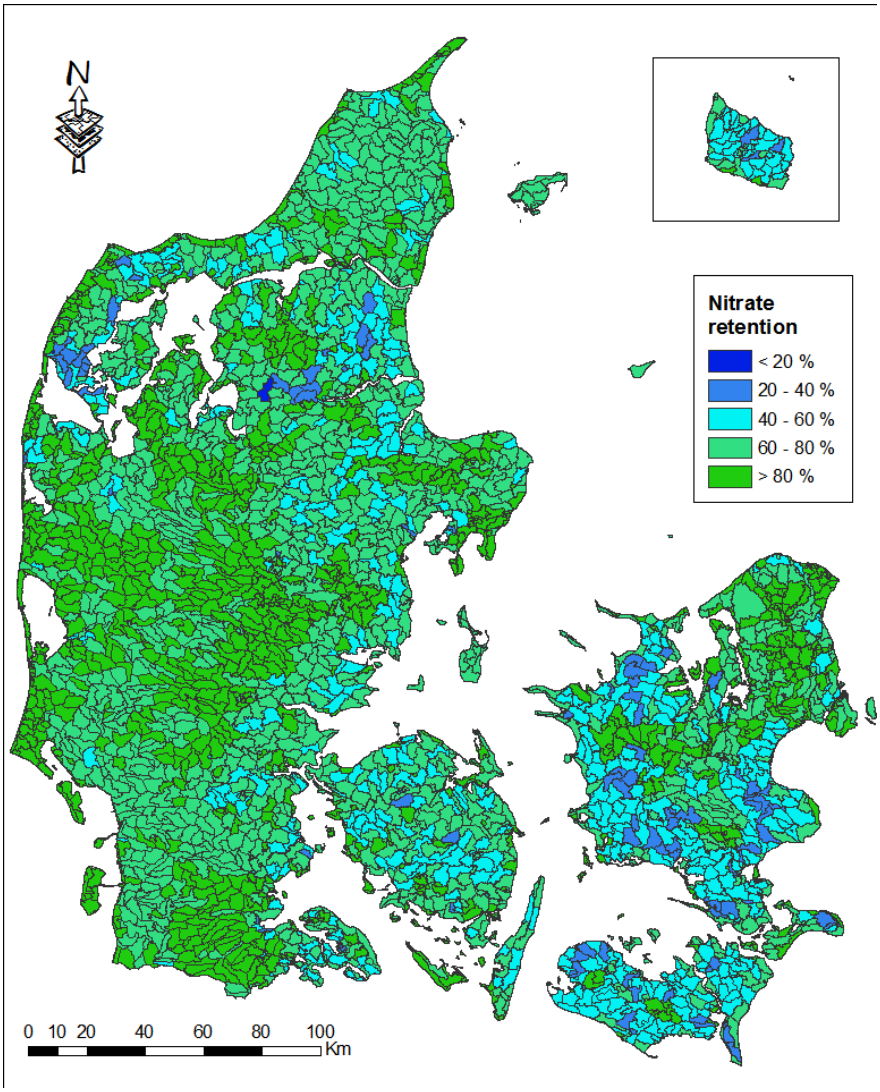
[35] Danish Environment Protection Agency (2015): RBMBs 2015-2021 (in Danish): http://svana.dk/vand/vandomraadeplaner/vandomraadeplaner-2015-2021/vandomraadeplaner-2015-2021/

[36] SEGES (2016): Instrument catalogue of targeted environment action (in Danish) http://trends.nitrat.dk/xpdf/miljoetiltag2016.pdf

[37] Dalgaard T, Hansen B, Hasler B, Hertel O, Hutchings NJ, Jacobsen BH, Jensen LS, Kronvang B, Olesen JE, Schjørring JK, Kristensen IS, Graversgaard M, Termansen M, Vejre H (2014) Policies for agricultural nitrogen management – trends, challenges and prospects for improved efficiency in Denmark. Environmental Research Letters, 6, 115002

and has a national minimum requirement concerning odor, ammonia, nitrates and phosphorus surplus. A map was made to shows the total N-reduction between the root zone and the coastal water. It was intended to be used to design spatially differentiated measures (see figure below).

Figure 4: Nitrate retention/reduction in Denmark[38]



As the map shows, Norsminde Fjord (as part of the Horsens Fjord River Basin) has a high nitrogen-reduction potential (around 60%).

Act on Agricultural Use of Fertilizers and on Plant Cover

This Act regulates the agricultural use of fertilizers and sets requirements for plant cover and other management practices with the aim to reduce nitrate leaching. It sets rules for the total amount of fertilizers to be used at farm level based on crops, type of fertilizer etc. It also enables the Ministry of Environment and Food of Denmark to set rules on catch crops and plant cover. Furthermore, there is a requirement for farmers to carry out fertilizer plan-

[38] Højberg AL, Windolf J, Børgesen CD, Troldborg L, Tornbjerg H, Blicher-Mathiesen G, Kronvang B, Thodsen H & Ernstsen V (2015) National kvælstofmodel, Oplandsmodel til belastning og virkemidler. Metode rapport - Revideret udgave september 2015. GEUS, 111 s

ning and accounting. The policy originates in 1987 and has been revised several times, most recently in 2016.

Larger farms must enter the Register for Fertilizer Account and prepare a fertilizer plan before the growing season (incl. information about the size of the area, soil type, previous crops, planned crops and the standard of the crops) and keep it for five years. They further have to calculate the nitrogen-quota for the farm and submit a fertilizer account at the end of the growing season (incl. information about the calculated nitrogen quota for the crops, nitrogen from livestock and use of fertilizer). There is a benefit for the registered farmers that allows them to buy chemical fertilizer without paying tax on fertilizer (0, 66 EUR per kilo of nitrogen).[39]

Act on Management of Agricultural Land

The Act wants to promote sustainable development of the management of the agricultural land through the combination of protecting the soil as a resource for production and nature, environment and landscape values. There are rules for who can own agricultural land, ceilings of size and number of farm holding that an individual can own, requirements that the owner lives on the farms, etc.[40] Farmers have to furthermore make sure that unfarmed agricultural land is not overgrown by keeping the areas free from bushes and trees. The act also regulates actions to control unwanted plants and animals on agricultural land. The Danish Ministry of Environment and Food and the Danish AgriFish Agency are responsible for the implementation of the policy[41].

Law on Watercourses

The objective of the Act is to guarantee that watercourses can be used to drain off water, especially surface-, waste- and drainage-water with consideration for the natural and environmental quality of the watercourse is not allowed in 2 m wide buffer-zones according to other legislation. The Ministry of Environment and Food of Denmark as well as the Danish Environmental Protection Agency are responsible for the implementation and evaluation of the policy.[42]

Departmental Order on the Use of Sewage Sludge in Agriculture

The Departmental Order is implemented under the Act on Environmental Protection and regulates what kind of waste can be used for agricultural purposes. It also specifies the requirements to the quality of waste in terms of content of heavy metals and other potentially harmful substances. Management requirements are also specified. Denmark uses over 50% of their sludge for agricultural purposes[43].

[39]Ministry of Food Agriculture and Fisheries of Denmark (2015): http://helcom.fi/Documents/HELCOM%20at%20work/Meetings/Events/Workshop%20on%20nutrient%20bookkeeping/01_HELCOM-Workshop_Denmark.pdf

[40]Directorate for Food, Fisheries and Agri Business (2004): http://www.fao.org/fileadmin/user_upload/Europe/documents/Events_2004/Land2004/Denmark_Haldrup_paper.pdf

[41] Ministry of Environment and Food (2008): https://www.retsinformation.dk/Forms/R0710.aspx?id=123419

[42] Ministry of Environment and Food of Denmark http://eng.naturstyrelsen.dk/aquatic-environment/lakes-and-watercourses/ last consulted 06.04.2016

[43] Background reports commissioned by Simon Lundeberg, Klimatbyrån https://www.naturvardsverket.se/upload/stod-i-miljoarbetet/vagledning/avloppsslam/bil2-5-rev-organic-substances-sewage-sludge-intended-agricultural-land.pdf page 1

9.2 Inputs from Stakeholders

9.2.1 1st workshop

The workshop in Denmark was held at Norsminde Kro on 11 December 2014. The workshop was hosted by the Norsminde Fjord Catchment Council, an organisation of local stakeholders within the Norsminde Fjord catchment, with the support of several other local projects. Altogether, 21 people participated in the workshop, representing farmers, agricultural advisors, NGOs, authorities, politicians and research institutions. The group work was organised according to the World Café method with three tables. The key conclusions to the questions from the groups are as follows:

Table 1: Regulation on farm or catchment level

- Regulations linked to individual farmer holdings are easy to implement. However, control monitoring may be difficult for some farms, as water often flows from the fields of one farmer to the fields of another farmer before it is possible to monitor it adequately.
- The advantage of regulations linked to small areas (e.g. 100 ha) compared to large areas (e.g. 1500 ha) is that they are closer to a farmers holding. However, if the regulatory unit happens to include only two farmers and these two farmers are not on good terms, even this may be difficult to manage.
- The advantage of regulations linked to larger areas (e.g. 1500 ha) is that they may facilitate catchment solutions, e.g. where several farmers work together on construction of nitrate-removing wetlands. A disadvantage is that they may incentivise the purchase of land and increasing agricultural holdings.
- It is not realistic for several farmers to make joint commitments to nitrate emissions within a catchment. Farmers cannot police each other and this would likely destroy good relationships.

Table 2: Use of retention maps

- There is a concern that the use of detailed retention maps (ha scale resolution) by the State as a basis for regulation of individual fields may lead to a very rigid and bureaucratic system.
- Use of detailed retention maps on a voluntary basis by individual farmers to plan implementation of an emission-based regulation is perceived very positively. Such use would, however, mainly be utilised to the extent that it benefits individual farmers, while the benefits from considering a catchment perspective would not be achieved.
- Purely voluntary agreements between farmers in a catchment for the sharing of common commitments to comply with the emission requirements are unrealistic. This would require some kind of regulatory framework. A relevant support in this respect could, for instance, be the facilitation of land exchange as typically done in connection with motorway constructions.
- Farmers expressed interest in reducing the uncertainties on the retention maps by supplementary local campaign measurements, e.g. measurements in drain pipes where the maps indicate low retention.

Table 3: Trading with emission permits

- Trading of nitrate emission permits between individual farmers is perceived as realistic. One option could be that farmers buy shares in nitrate-reducing wetlands within the catchment and, in this way, obtain the right to a larger nitrate emission from his/her own holding. Alternatively, a farmer could reduce his/her nitrate load by growing a catch crop and sell unused emission permits to another farmer within the catchment.
- Trading of permits between farmers and the State might be used by the State to regulate the total emission from a catchment, by buying up or selling emission permits. There were no clear conclusions on this issue, but some concern was expressed that such a market system might not be an efficient way of ensuring the reduction targets required to achieve WFD goals.
- Nitrate emission permits would typically be registered in the same databases in the Ministry of Environment and Food that supports the management of EU's Common Agricultural Policy.
- A total free market for the trading of emission permits may be problematic, as there is a risk that permits may be purchased by relatively few farmers. Consequently, the market for permit trading would not function effectively.
- A separate question is how the emission permits shall initially be distributed. One option may be to associate them with the nitrate retention maps, so that an area with low retention receives a high emission permit. This may be used as part of a compensational package to farmers with holdings in low retention areas.

9.2.2 2nd workshop

The second BONUS SOILS2SEA workshop in the Danish case study region was held on 24 November 2016 at Norsminde Kro Hotel. Invitations to the workshop were sent to members of the Norsminde Fjord catchment council and to all farmers within the Norsminde catchment. There was very large interest for the meeting and the registration had to be closed two days before the meeting due to limited space. Altogether, 35 persons participated in the workshop with the majority being farmers (26). Furthermore, there were representatives from a machine pool for farmers, from an NGO, SEGES, agricultural advisory services, research institutions as well as a representative from the local authorities and policy making.

The group work was carried out in a World Cafe format to gather stakeholder views on governance and monitoring issues on the basis of three proposed governance regimes (scenarios see chapter 6). The scenarios and key points from the group discussions are presented in the following section.

Scenario A: Centralised (similar to business as usual)

In the 'Centralised' context, the state makes all decisions on use of measures, including fertilisation norms, at farm or field level. The government uses retention maps with 15 km^2 spatial resolution (ID15 catchments) to improve the effectiveness of the measures through differentiated regulations on land-use (e.g. location of measures such as catch-crops, different fertilisation norms at different *locations). To monitor and control implementation, the government requires farmers to report detailed plans for cropping systems and fertilisation. Government monitoring is focussed on relatively large catchments to evaluate if the reduc-*

tion targets to the coastal waters are achieved. Farmers fulfilling the government requirements receive subsidies from the EU CAP.

Scenario B – Flexible (market-oriented)

Under the 'flexible management' scenario, authorities and farmers work together to reduce N emissions through a market-based 'cap and trade' system. This would be initiated by government authorities per catchment, with all farmers obliged to participate. Based on retention maps with 25 ha resolution, permits for N loading are distributed on a field basis. The community of farmers can trade N load allowances amongst themselves. To document compliance each farmer reports with detailed plans for cropping systems and fertilization (as in Scenario A). Non-compliance with individual allowances is sanctioned by forfeit of a deposit that is then passed onto other farmers for carrying out mitigation measures. Government authorities can intervene in the market by buying up or selling permits from the system to reduce or allow increases to N loads. The government performs control monitoring at catchment level to evaluate if the reduction targets to the coastal waters are achieved.

Scenario C: Co-governance (water boards)

The 'co-governance' approach describes a low level of State involvement in the management, monitoring and control of N loading. This scenario places a focus on the co-governance of farmers within one catchment. Farmers in the catchment self-organize, (e.g. forming a water board) to decide on measures to reach government-set targets. Detailed retention maps - at 1 ha resolution - have higher uncertainty, but can be used by farmers as a tool for spatially differentiated management of the catchment. A system of self-monitoring is established to check and modify the retention maps and ensure that the target goals are reached (e.g. monitoring at a field or sub-catchment level). Authorities support the process of self-monitoring by providing financial and technical support and information (e.g. establishing a water board with a technical support, detailed retention maps, monitoring process support). The authorities will monitor only the entire catchment at the outlet. The allocation of EU CAP subsidies is based on reaching the target loads for the entire catchment and their distribution is negotiated between the farmers. If farmers/water board cannot agree on a plan for implementation, the State will impose a central regulation based on Scenario A.

Scenario A: Centralised (similar to business as usual)

- Stakeholders were not very fond of this scenario. Main critical issues were that this scenario will create less engagement and involvement from farmers and that it leads to a lack of motivation to participate in additional agri-environmental measures. The farmer would aim at only fulfilling the requirements and it could mislead farmers to look for gaps in the legislation to avoid rigid restrictions.
- Very clear, continuous and streamlined regulation that is agreed upon by different authorities is key. For example, the Agency for Water and Nature Management (SVANA) should not have another opinion than the Danish Agri-fish Agency. Regulation should only be changed on the basis of new knowledge and not be based on political changes (e.g. due to change of political parties in power).
- Installment of a catchment water board or a catchment-officer could be a good solution to negotiate with authorities.
- Accurate retention maps would be necessary to have a fair basis of regulation. Inaccurate maps would lead to a lack of confidence and support for the system.

- Overall, this approach is seen as very bureaucratic, not taking into account the local conditions or the motivations of farmers. It would be very difficult to value the land and define a fair compensation scheme.
- The only positive comment was that everyone would be subject to the same rules/restrictions, which make the regulation transparent.

Scenario B – Flexible (market-oriented)

- For this scenario there was absolutely no support from the stakeholders. It would not reward farmers that are very competent in managing crops and fertilization and can produce crops with less leaching than stated in the norms. It would also not honour sustainability. Farmers buying up emission permits do not have to operate farming in an environmentally sustainable manner. This would be a wrong signal to send.
- Bad experiences with the milk and fishing quotas and that these can be capitalised on creates the fear that this approach could lead to faster centralisation of farming, with big farmers buying up permits. And once the permit is sold, it could be difficult to get it back.
- This approach would likely be too bureaucratic, with a lot of planning and management involved. In addition, these permits could be used as a political handle to turn and therefore not serve the purpose anymore.

Scenario C: Co-governance (water boards)

- This scenario was evaluated on all world café tables as the most interesting scenario and it was discussed intensely.
- Many farmers stressed that general rules and a central authority are required, because farmers could not exorcize decisions on other farmers. And even though it will put much burden on single farmers, they liked the ability to interact and have power to select their own measures. It is seen as a more motivating scenario, the farmers have influence what happens and can see the results which could help their farm management also.
- In this scenario the retention maps are seen as a good tool which can provide guidance for implementing differentiated measures. The farmers or the local area consultant representing the water board could contribute to the data generation for the retention maps. It is seen as unrealistic that farmers with high reduction requirements would participate in self-management processes and that agreeable solutions would need to be found.
- In comparison with the previous scenarios it was seen positive that the use of maps is not mandatory and no extensive decisions are based on the maps. With technology enhancement, new tools can be developed that help to choose different measures or crops. For example precision farming can help to reach the goals. Some type of fertilizer information and management tool is seen as necessary for guidance and to reduce free riding.
- It could be a problem, if a farmer is not willing to participate (risk of free-riding). In this case this farmer will be subject to a collective positive social pressure and is likely to eventually join.
- Open conversation in the area is necessary on tools and methods so that no one is excluded or left behind.

- One break-out group suggested that the monitoring should be undertaken by a third party or authorities to ensure credible data, while another group suggested that self-monitoring performed by farmers could be interesting. The use of fertilizer has to be accounted (in fertilizer budgets/accounts), also clear requirements for data collecting are needed, in this way the phenomenon of 'free-riders' could be avoided. Monitoring data could also be used to improve the fertilizer use efficiency.
- It could be a good scheme to implement measures like mini-wetlands or riparian wetland, even in a joint effort with more than one land-owner, this approach could be feasible if compensation schemes are developed.
- The administrative costs (monitoring, meetings, etc.) are seen as rather high, which could affect the scenario negatively. A catchment-officer and a well functioning catchment water board are seen as very important.
- Financing of this scenario was questioned: will it be the polluter or a community or group of people who pay? It would be good that whoever benefits from measures also participates in the financing. Maybe a form of mutual internal compensation can be developed. Or tax rates could be coupled with participation in a water board? And can grants be redirected, e.g. from a national to a local level?
- Overall, this scenario creates a lot more demand on the farmers, but also gives more freedom and self-control. If executed in a smart way, this would be seen as a preferable scenario by the stakeholders.

Following the world café, a multiple choice **survey** was distributed and filled out by 22 farmers specifying what would be necessary for a water board, and hence, scenario C to work (Figure 5 shows the questionnaire and sums up the answers for each question).
According to half the farmers, a water board could meet every three months. The other half voted for meeting every 6 months to once a year. Most farmers see in it a benefit in greater autonomy and several valued the potential information exchange. For some it is important to have their voice heard, have a public recognition of their contribution and have everyone else involved. A misbalance in power and lack of strong leadership and time could prevent many farmers in participating in a water board. Lack of time could also prevent farmers in self-organised monitoring activities; however, a majority can imagine taking sampling in a 2-4 hour timeframe every 4 to 8 weeks. Gaining compensation and avoiding sanctions is the highest incentive for self-monitoring but also trust in the results and control in the process are valued.

Figure 5: Danish answers to Scenario C - Self-organised management in water boards (n = 22)

1.) How often would you be willing to meet as part of a water board?		2.) What would **motivate you** to participate in a water board? (2 choices maximum)		3.) What would **prevent you** from participating in a water board? (2 choices maximum)	
Every month	0	Greater autonomy	16	It is not my responsibility	0
Every 3 months	10	A strong leader	0	Lack of strong leadership/direction	7
Every 6 months	6	Everyone else is involved	4	No one else is involved	3
Every year	3	Financial compensation for your time	0	Lack of time	8
Comments:		Public recognition of your contribution (e.g. through media)	4	Don't want to engage with other farmers	0

In the beginning every month	*2*	Have my voice heard	5	Waste of time, don't see usefulness	2
As required	*2*	Potential for information exchange	8	Lack of voice, others control process	7
		Other	0	Other	1
4.) **Who** would you prefer to conduct monitoring activities?		5.) What would **motivate you** to participate in monitoring activities?		6.) What would **prevent you** from participating in self-organised monitoring?	
Me	0	Have some control in the process	6	It is not my responsibility	0
An alliance of farmers	3	I can trust the results	6	No one else is involved	3
Independent 3rd party employed by water board	18	To avoid sanctions / gain compensation	10	Lack of time	7
Government / Authorities	0	Other	2	Don't trust the analysis of results	5
				Other	4

7.) If you were responsible for monitoring and each round of sampling took 2-4 hours to carry out, how often could you feasibly take measurements?	Once every…			
	… 2 weeks	1	… 6 weeks	1
	… 4 weeks	8	… 8 weeks	7

Comments: 12 weeks (2)

9.2.3 Governance-related findings from ethnographic interviews

In total, eight interviews were conducted in the Danish Case study region in March 2015. Four with farmers and further four with representatives of the municipality, farming advisors and representatives as well as a nature lobbyist:

- **Farmer 1** is a farmer in the catchment area. She stopped having pigs in 2013 due to new regulation and she found herself losing three working places. Nowadays she rents out her pig stall and thinks that pig farming would not be profitable for her anymore because of the investments in environmental rule compliance. Farmer 1 has a bigger variety of crops now and uses crop rotation. Crop rotation also determines what she grows on the fields. She was not involved in the NICA[44]-project.
- **Farmer 2** has been involved in the NICA-project and was happy to cooperate with the scientists. He has pigs and grows wheat, barley and winter barley as feed for them on his fields. He also grows oilseed rape and grass seeds that he sells. He puts all of the manure of the pigs on the field and additionally uses fluid ammonia as fertilizer. He has a constructed wetland as a pilot-project. It was paid for by the project.
- **Farmer 3** is another farmer in the Norsminde catchment who has been farming for 36 years.

[44] Nitrate Reduction in Geologically Heterogenous Catchments (2014) https://www.ncbi.nlm.nih.gov/pubmed/23953482

- **Farmer 4** has been a farmer for several years but stopped because of his back problems. After farming, he was employed by an agricultural association as a cattle assistant. He says that farming was a tough business and he had to work a lot, his wife worked fulltime and he had work next to farming as well to support his three children.
- **Advisor** is a representative of SEGES, a non-profit farmers organization that offers advice to farmers.
- **Farmer lobbyist** is employed by two different agricultural associations and represents farmers' interests.
- **Administrator** is a representative of the Aarhus municipality.
- **Nature lobbyist** is a representative for the Danish Society for Nature Conservation. He is a biologist and used to work for the Danish government.

Farm structure, land use and local cooperation

All interviewees described the trend in farming structure in the Norsminde catchment area as a growing monopoly of fewer farmers having more land. A further trend goes towards fewer cows and more pigs. The Administrator from the Aarhus Municipality thinks that the farmers could not survive without farming pigs because they need to use the manure on the fields. Merely vegetable farming would not work.

The Nature lobbyist stated that the focus has shifted away from local production and that farmers export more. They are not as connected locally anymore and there are fewer farming events taking place in the region. Only some farmers begin to produce products for the local market which he perceived positively as it brings the community back together. One farmer has a really extrovert open-door policy for his farm. He invested a lot of money in new technology (robots) that allows a very high production of milk. His farming practice is very innovative and he invites people to come and look at it and learn about it (e.g. the Minister of Environment and Food has been there) and locals can come and buy his milk. That does not help him gain money but brings the community closer together while it also serves as a marketing strategy for him.

Perception of regulations

Farmer 1 and 2 believe that **yields could gain higher protein and nutrient levels** if more nitrogen could be applied. Instead, Danish farmers have to additionally import soy beans to supplement protein for pig feed. Furthermore, Danish wheat sells for lower prices due to the low protein content (Advisor, Farmer lobbyist). While prices for crops, milk and pigs remain the same, prices for fertilizers, wages and pesticides rise. As farmers face **financial problems** they want to increase fertiliser rates so their yields improve.

Most interviewees criticized that there are **too many regulations** and a **rigid top-down approach without stakeholder participation** in Denmark. E.g. Farmer 1 dislikes the use mandatory catch crops because she feels restricted about what she can and cannot grow. She furthermore feels threatened by regulations and does not dare to invest in new facilities out of fear of new regulations. She wants fewer restrictions and criticizes that Denmark is the only country not allowed to use nitrogen fixing or have legumes as catch crops. Farmer 4 also thinks regulations should be more differentiated as some soils that can use up a lot more fertilizer than others but the restrictions are too rigid and cannot be adapted to the individual soil quality. Farmer 2 criticizes that the requirements for buffer zones are too strict and rigid because they have to be ten meters everywhere. He would like them to

be more flexible ("In some areas we can make them 100 m, in others 2 m is best"). All farmers, the farming advisor and lobbyist demand more flexible regulation. Most of them specify the wish for less documentation requirements and bring Germany as an example for slower and less restrictive EU implementation. Farmer 1 and the Famer lobbyist state that the Danish government "over-implements" EU directives/the WFD and Farmer 3 is in favor of EU-wide regulations as the majority of EU member states have less strict regulations than Denmark. The Advisor describes the problem of overregulation due to the strict top-down Danish legislation (e.g. mandatory catch crops without compensation). The Advisor states that no other country has that much control on the amount of fertilizer used on the fields.

The Nature lobbyist finds that there is strong resistance from agricultural organizations against water plans. Farmers blame environmental restrictions for their financial issues. Furthermore, resistance was high because the society, stakeholders, NGOs and **farmers were not involved in the process**. It was a top-down decision. In his perception, Denmark does not over-implement EU directives: Denmark has been delayed with the implementation of the WFD and did **not achieve its goal of good ecological status for water bodies** in 2015.

Farmer 2 proposed differentiated buffer zone management to the government but feels frustrated that they "don't listen". He likes to cooperate with scientists because he wants to find alternative ways and he feels like the university is more respected by the government. Farmer 3 also experienced **flawed communication** between the interest groups in the catchment and the administration. At a meeting, the Minister of Environment and the farmers and advisors from the catchment talked in different directions and the farmers did not understand what the minister talked about. The Advisor experiences a lot of **mistrust from farmers towards the government**, especially due to the unrealistic targets from the WFD. Rather than saying „nitrogen is the problem“, a more differentiated local approach is necessary. In his perception, a catchment-based approach would also be welcomed by the farmers.

Farmer 3 thinks the situation for agriculture in the area is very bad and he is afraid of the future and **pessimistic about his job as well as the future of agriculture in general**. He feels like he is the enemy of the people and that environmental goals are perceived as more important than agriculture.

Perception of environmental threats

The interviews suggest that farmers do not perceive agriculture as the only cause of environmental problems. Eutrophication is recognized as a big problem for the water quality of the fjord but farmers perceive **phosphorus from waste water also as imprtant pollutant** and cities as the main polluters; and phosphorus already in the soil as big environmental problem in the catchment.

The Advisor demands better and more **differentiated understanding of water pollution** processes. He does not want to accept that nitrogen is the problem (“Maybe the sluice in the fjord has to be regulated differently”). For Farmer 2, knowledge on what is lost in the root zone and if it enters the groundwater or the wetlands is the biggest environmental concern.

The Farmer lobbyist says that the first Danish water plan in 1987 led to problems for the farmers because they were forced to change their way of farming. He understands that the environmental problems were severe and that farming practice needed to change and become more sustainable. But **all the easy measures have been implemented** and change is becoming more difficult for the farmers nowadays.

For Farmer 4, **other EU countries like Poland and Lithuania are far more behind** than Denmark and need to be educated about environmental management.

Opinion on potential policy measures

Opinion on **retention maps** is divided. Farmer 2 who participates in the NICA research project values the resulting groundwater nitrate reduction maps to better understand nutrient uptake and plant distribution on his field. He feels like this is useful for regulations on a catchment level. However, farmer 1 perceives them as unfair ("It's like the lottery on which side you are"). The Farmer lobbyist concerned as there is a lot of uncertainty and mistakes in the maps could negatively affect the farmers.

The Advisor states that if the problem is really too much nitrogen, they are already trying to find **drainage-based solutions in the landscape** (constructed wetlands, buffer zones, restoration of wetlands). Farmer 1 is ok with constructed wetlands on a voluntary basis but criticizes that farmers who established wetlands did not get any benefit from it and still have the same rules as everybody else. This is in line with the experiences of Farmer 2 who is happy that he was a part of a research project that financed his constructed wetland but feels disappointed at the same time. He installed the wetland ten years ago and is frustrated that he still has to follow the same rules as the other farmers and is not allowed to use more nitrogen in his fields. He feels like he was too naïve expecting benefits from the cooperation. According to the Advisor, a new problem is to find new places for river restoration because the good places are already in use. The solutions have to be implemented in a competitive way because right now the farmers are losing money. The Advisor further thinks it is really hard to implement additional measures on the field but more realistic in the “in-between-area”, e.g. a constructed wetland in between the farm field and the river.

Farmer 1 uses Sweden as a positive example: Swedish farmers are allowed to use fertilizer if they can remove it again from the soils and Sweden has a stronger **focus on phosphorus** than nitrogen. She thinks that a change of land use patterns, e.g. installing more grassland, would solve the problem of phosphorus already in the soils.

The administrator describes **land consolidation** (changing the land between the farmers) as a current measure which is working well. The municipality bought one or two farms in the area and then used the land and offered it to farmers for exchange ("2 ha up here for your 2 ha down there").

The Advisor and the administrator speak about the **Norsminde Fjord water council** as a positive example for bottom-up governance. They feel like there has to be a catchment approach when tackling problems. The Nature lobbyist agrees that Water Boards are a very good idea. In his opinion, it is important to cooperate with the farmer's organizations on a local scale so that the farmer's perspective is taken into consideration when developing plans and policy measures and resistance remains low. However, the Advisor is frustrated that if civil society comes up with a good idea, the authorities implement a national plan and “wipe everything away”.

Annex 2: Case Study Sweden

9.3 Tullstorp, SWE

Tullstorp brook is a 30 km long stream located in the south of Sweden. The stream drains a 63 km^2 large area and discharges into the Baltic Sea close to the small town Skateholm. The watershed consists predominantly of glacial clays and till, and is intensively farmed with around 85% of the catchment area being agricultural land. Due to the climatic and geological conditions, a majority of the agricultural land is tile drained to increase the runoff from the soil and provide optimal conditions for agriculture.

Figure 6: Tullstorp Brook river network, gauging station (red point), sampling station for nutrients (yellow point) and land use (Refsgaard 2014)

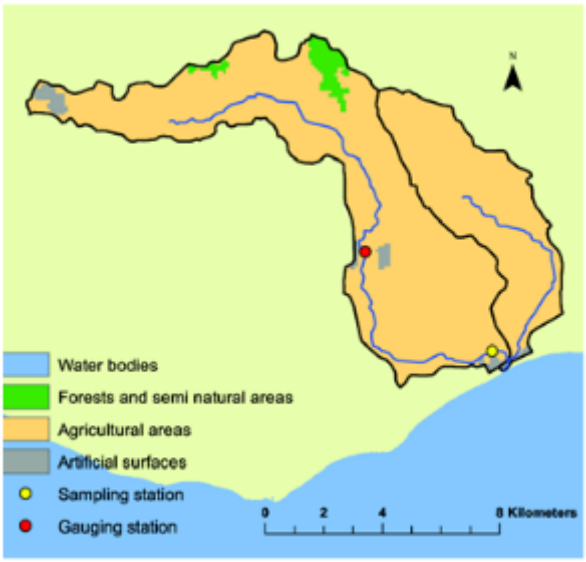


Figure 7: Tullstorp Brook: Typical landscape in the catchment (Photo: KTH)

The catchment of the Tullstorp Brook lies fully within a Nitrate Vulnerable Zone (NVZ) as defined by the Swedish Board of Agriculture[45]. Based on modelled nitrate concentrations in soil water, leakage from the root zone to groundwater bodies exceeded pollution class 5 (> 10 mg/L nitrate-N); however, stream water concentrations of nitrate and nitrite measured at the catchment outlet did not exceed surface water criteria for NVZ designation (50 mg/L) (years 2009-2012). The concentrations at the outlet varied between close to zero and 10 mg/L nitrate-N.

9.3.1 Farming

About half of Sweden is covered by forest. Mountains, marshes and lakes cover approximately one third. The cultivated area is about 6,5 % of Sweden's total land area. Structural change in agriculture has led to a sharp decline in the number of farms in the last 50 years and, since then, the remaining farms have grown larger. Because it is profitable, many old, smaller farms (around 30 ha and less) are retained and the owners either lease out the land or do farming aside from another occupation. Bigger farms from 100 ha up to 1000 ha are farmed fulltime. According to Eurostat (2010), the average farm size is around 50 ha in the region (= 0.5 sqm). The catchment of the Tullstorp Brook has an area of 63 km^2. Dividing the arable area by the average farm size results in around 100 farms in this area.

85 % of the catchment area consists of agricultural land with mostly arable farming. The soil in this region is one of the most productive in Sweden and it has led to maximum usage of the land. The catchment has therefore been intensely managed during the last century which has led to high nutrient loads to the Baltic Sea. In the catchment area of the Tullstorp Brook, most farmers keep a six meter wide protection zone along the brook which is not farmed and for which they receive compensation. Many farmers have also received compensation for constructed wetlands. However, the landowners around Tullstorp Brook have gone further than that. With the aim to keep nutrients at the fields, to prevent eutrophication of the Baltic Sea and to manage problems with flooding, an economical association was started by the Swedish Environmental Department and regional county 2008. The association is open to all farmers in the catchment area and has realised several different measurements in the catchment area and along the Tullstorp Brook. The project started with a few wetlands but has now grown to include a complete restoration of the brook, biogas production and eco-tourism. Undertaken restoration actions included establishing the measurements listed below:

- Wetlands,
- Stony bottom substrate,
- Meandering,
- Increase of vegetation along the brook,
- Improvement of riparian zones (slope, vegetation),
- Sediment traps.

[45] Johansson and Bång (2014), Översyn av känsliga områden 2014, Swedish Board of Agriculture Rapport 2014:11, http://www2.jordbruksverket.se/download/18.37e9ac46144f41921cd14ea2/1401279595790/ra14_11.pdf

In 2001, the project "Greppa Näringen"[46] was launched as a joint venture between the Swedish Board of Agriculture, the County Administration Boards, the Federation of Swedish Farmers and a number of agro-business companies. The project's focus is on the reduction of nutrients, greenhouse gases and nutrient leaching in agriculture as well as the promotion of plant protection products. It operates on a voluntary basis and in 2011, 9,500 farmers participated. The project offers advice on environmentally friendly farming practices and seminars for the advisors.

9.3.2 Specific challenges

The construction of extensive tile drainage systems, dredging, excavation and straightening of the stream channel and removal of in-stream vegetation and riparian zones have altered the local hydrological cycle of the Tullstorp Brook catchment. Due to the management of the catchment, the residence times of both water and nutrients have decreased significantly during the last century, which together with intensified agricultural activities have led to a high load of nutrients to the Baltic Sea. The loads of nitrogen and phosphorous are 250 ton/year and 4 ton/year, and hence exceeds the thresholds to obtain good ecological status. For Tullstorp Brook to reach good ecological status, the local coordinators of the County administrative board of Skåne have set the following targets:

- 30% reduction of nitrogen (75 t/yr)
- 52% phosphorous (2,08 t/yr) reduction for good ecological status.

9.3.3 Governance System

In comparison to Denmark's binding regulations, Sweden's agri-environmental governance consists of non-binding policy.

Relevant actors

Farmers:

- Around 90 property owners in the Tullstorp Brook catchment have organized themselves in an economic association (http://www.tullstorpan.se) in order to coordinate the measures to improve the ecological status of the area.
- The Federation of Swedish Farmers (*Lantbrukarnas Riksförbund*, LRF) has a regional branch for the region and several local groups (http://www.lrf.se/Skane).

Green organizations:

- Swedish Society for Nature Conservation has a local branch in the area (http://nftrelleborg.se) and an interest in the activities occurring in the catchment.
- The Fisheries Secretariat (FISH) is a small non-profit organisation working towards sustainable fisheries in Europe with a strong focus on the Baltic Sea. They were founded by the Swedish Society for Nature Conservation, the WWF Sweden, and the Swedish Anglers' Association. The NGO has an office in Stockholm (http://www.fishsec.org/).

[46] Greppa Näringen (Focus on Nutrients) (2014): http://www.greppa.nu

Fisheries:

- The Swedish Anglers' Association has a regional office in Malmö (http://www.sportfiskarna.se/Omsportfiskarna/RegionSydMalm%C3%B6/tabid/131/Default.aspx).
- Swedish Inland Fishermen's Federation (SIC) (http://www.insjofiskare.se/reserv6.php)
- Svensk Fisk (http://www.svenskfisk.se/om-svensk-fisk.aspx)

Authorities

- The Swedish Ministry of the Environment, (http://www.regeringen.se/sb/d/1471) bears overall responsibility for the environmental quality objectives and for WFD implementation in Sweden.
- The Swedish Environmental Protection Agency (http://www.swedishepa.se) is responsible for national environmental protection and provides the government with expert advice on current status on environmental issues and how to achieve environmental objectives.
- Swedish Agency for Marine and Water Management (https://www.havochvatten.se)
- The South Baltic Water District Authority (www.vattenmyndigheterna.se/Sv/sodra-ostersjon) coordinates the work on preserving and improving the quality of water in accordance with the WFD.
- County administrative board of Skåne (http://www.lansstyrelsen.se/skane) has a coordinating part in work to achieve the Swedish environmental objectives.
- Trelleborg Municipality (http://www.trelleborg.se) translates national and regional objectives into local aims and actions. The department called "Vatten och avlopp VA-avdelningen" is in charge of water supply and waste water treatment. (http://guardian-czestochowa.com/index.php?Lang=en).
- Swedish Agency for Economic and Regional Growth (http://www.tillvaxtverket.se/sidhuvud/englishpages.4.21099e4211fdba8c87b800017332.html)
- The Swedish Board of Agriculture (http://www.jordbruksverket.se/swedishboardofagriculture.4.6621c2fb1231eb917e680002462.html) is the expert authority in agriculture for the Swedish government.

Businesses:

- Green White Space (http://greenwhitespace.org/#mission) is a collection of entrepreneurs with an environmental and social focus located in Malmö. They have an agricultural project in the Skane Region.
- Business Sweden (http://www.business-sweden.se/en/about-us/About-Business-Sweden/) is a platform that is co-owend by the government and the industry. They are an advisory board regarding international trade for Swedish Businesses. They have an office in every Swedish Region.
- Lantmännen Lantbruk (http://www.lantmannenlantbruk.se/en/) is an agriculture supplier (seeds, fetilizers, crop protection etc.) with its Headquarter in Malmö.
- BM Agri (http://www.spannmal.se/om.html) is a consulting and Trading business specialized on everything concerning corn.
- Skånemejerier (http://www.skanemejerier.se/en/About-Us/) is a dairy company that works with farmers mainly from Skåne and emphasises local production.

Science:

- Swedish Agricultural University (http://www.slu.se/en/)

9.3.4 Relevant regulatory framework

Common Agricultural Policy (CAP)

Between 2014 and 2020, the CAP will invest 6, 6 billion Euros in Sweden's farming sector and rural areas to promote jobs, sustainability, modernisation, innovation and quality of the sector[47]. 4.9 billion Euros of the budget will go to farmers directly. 30 % of these direct payments will be linked to environmentally friendly measures: crop diversification, maintaining permanent grassland and conserving 5 % of areas of ecological interest.

Water Framework Directive (WFD)

Sweden is divided into five main River Basin Districts which are administered by the national Authority for Marine and Inland Waters (Havs och Vattenmyndigheten). The measures are implemented by various governmental agencies and municipalities. The Swedish River Basin Management Plans' main focus regarding nutrients is on phosphorus. The reduction of nitrogen is mainly calculated as a side effect. Environmental objectives are established for 2015, 2021 and for certain RBDs and water bodies also for 2027.

The Tullstorp catchment is part of the South Baltic Water District (River Basin District 4) which consists of 10 counties, 91 municipalities, and 2.2 million inhabitants. It is located in the south-east corner of Sweden. Measures for RBD 4 include habitat restoration, building spawning and breeding areas, removal of barriers, weirs and bank reinforcement, operational modifications of hydropeaking, construction of retention basins and re-meandering of formerly straightened watercourses. In the Tullstrop River Basin District, agriculture has been identified as a major pressure for diffuse loading of nutrients [48]. Technical measures for the RBD 4 are the reduction or modification of fertilizer application, hydromorphological measures leading to changes in farming practices and multi-objective measures (for example crop rotation, creation of enhanced buffer zones/wetlands or floodplain management). Non-technical measures include codes of agricultural practice, farm advice and training and measures to increase knowledge for improved decision-making.

Nitrate Directive

Approximately 51% of arable land and 46% of grazing land in Sweden are located within Nitrate Vulnerable Zones. The catchment of the Tullstorp Brook lies fully within a Nitrate Vulnerable Zone (NVZ). Between 1985 and 1995, Sweden reduced N losses to the Baltic Sea by 25% but it is still one of the main contributors of nutrient pollution to the Baltic Sea, responsible for about 19 % of the nitrogen load and 13 % of the phosphorous load in 2012[49]. The country prioritized a strong focus on this issue for many years since 1995. This has been done through requirements and guidelines, use of advisory services and infor-

[47] Sweden CAP (2015): http://ec.europa.eu/agriculture/cap-in-your-country/pdf/se_en.pdf
[48] European Commission (2012): Report from the Commission to the European Parliament and the Council on the implementation of the Water Framework Directive, 2014: 54
http://ec.europa.eu/environment/water/water-framework/pdf/3rd_report/CWD-2012-379_EN-Vol3_SE.pdf
[49] Jensen, Anne-Luise Skov (2013) The Nitrates Directive and the Directive on the Promotion of the Use of Energy from Renewable Sources – Transnational Analysis of Implementation: 15
http://www.balticmanure.eu/download/Reports/bm_implementation_of_the_nitrates_directive_web.pdf

mation, research and development and economic control instruments. The measures which have been required since the mid-nineties are in line with what is defined in the Nitrate Directive.

Sustainable Use of Pesticides Directive

In Sweden, the current National Action Plan's (2013 - 2017) main objectives are the reduction of risks to the environment and to health, reduction of plant protection products in surface water and groundwater, insurance that residues of plant protection products in produce are low in order to protect consumers and the development of a more sustainable cultivation system. In order to ensure that plant protection measures meet the EU requirements, the Swedish Board of Agriculture is carrying out activities such as establishing forecast and warning systems for serious harmful organisms, monitoring and communicating the results of research and trials, etc. Furthermore, the Swedish Government promoted and supported organic production through biological plant protection and alternative approaches financially as part of the Swedish Development Programme for the period 2007-2013.

The Marine Strategy Framework Directive

The Marine Strategy Framework Directive was incorporated into Swedish law in 2010 as part of the Marine Environmental Regulation (Havsmiljöförordningen) which complies with the Directive. Sweden's goal is for the Baltic Sea and the North Sea to reach good environmental status.

Swedish Strategy for Sustainable Development (2003)

In their Strategy for Sustainable Development, the Swedish government names three strategies for environmental topics: Nature conservation and biological diversity, creating a non-toxic environment and the preservation of the sea as well as the target of limiting climate change.

CORINE Land Cover

The Swedish Mapping, Cadastral and Land Registration Authority is responsible for implementing the EU environmental policy. The mapping is divided into 50x50 km map sheets and based on interpretation of satellite data. The vegetation and land types are presented in different classes, for example water bodies, water courses, non-irrigated arable land, complex cultivation patterns, land principally occupied by agriculture (with significant areas of natural vegetation) and natural grassland.

Inventory of Contaminated Sites

The Swedish Inventory of contaminated sites is an inventory from 2016 of about 85.000 old, disused industrial sites and other contaminated areas since 1999. 8.000 of these sites have been classified as of risk class 1 and 2 which means that they are the first priority for remediation. If no land owner can be identified as responsible for the contamination, the Swedish State is financing remediation. The Swedish EPA has coordinated the inventory, and the County Administrative Boards have been responsible for identifying and classifying the different sites.

The Swedish Environmental Code

The Code of 1999 is the most important piece of binding environmental legislation in Sweden. It determines environmental quality standards, establishes substance levels in for example soils and requires an environmental impact assessment to be carried out before any

activity defined as environmentally hazardous can be carried out. As part of the Environmental Code, Sweden adopted 16 environmental quality objectives in 1999 and 2005 that are monitored and assessed by the Swedish Environmental Protection Agency on an annual basis. In 2016, the objectives relating to agriculture and water were assessed as follows[50]:

- **No. 7 Zero Eutrophication:** In some areas, symptoms of eutrophication are abating but Sweden is still heavily affected. The emissions must be further reduced to achieve zero eutrophication. International cooperation is crucial.
- **No. 8 Flourishing Lakes and Streams:** The trend is negative and positive at the same time. Salmon stocks are increasing but euthrophication remains a challenge. Further protection and restoration work as well as follow-up are necessary.
- **No. 9 Good Quality Groundwater:** Monitoring needs improvements and more effective measures are needed within environmental supervision, societal planning, water management and the agricultural sector.
- **No.10 A Balanced Marie Environment, Flourishing Coastal Areas and Archipelagos:** The goal also requires more action to be taken to counteract eutrophication and toxic pollutants that remain major problems.
- **No. 11 Thriving Wetlands:** The trend was assessed negatively because wetlands are still being damaged, partly through nitrogen disposition, and vegetation is changing. The agency demands conservation measures as well as EU and national legislation concerning water operations to be improved.
- **No. 13 A Varied Agricultural Landscape:** The trend is perceived in a negative way. Many habitats and species still do not have a conservation status and sustainable, viable agriculture is needed while adverse impacts on the environment must continue to decrease. Delay in implementing the Rural Development programm is lead to de-motivation in environmental work.

Guidance values for contaminated soils

This policy is a model for calculating guidance values and a risk evaluation for contaminated soils developed by the Swedish Environmental Protection Agency. It is not legally binding but is intended to support municipalities, county administrative boards, operators, consultants and responsible authorities if they want to, for example, assess the need for remediation of soils. The Method for Inventory of Contaminated Soils (MIFO) monitors the topography of sites and how the slope affects the flow of groundwater, drainage of leaching/run-off, in particular for sites where the larger portion of contaminants infiltrates soil and groundwater and run-off water from roofs and ground surfaces[51].

Swedish strategy for sustainable land use

On behalf of the Swedish government, the Swedish All Party Committee on Environmental Objectives has developed a suggestion for a strategy for sustainable land use. This strategy is not published yet, it can be of importance for sustainable land and reduction of emissions. It also proposes an interim target for greater consideration of green infrastructure and for long-term sustainable management of runoff in built environments and in nature.

[50] EPA (2016): The Swedish Environmental Protection Agency's conclusions, http://www.miljomal.se/Environmental-Objectives-Portal/Undre-meny/Publications-and-presentations/

[51] Swedish Environmental Protection Agency (2012): Methods for Inventories of contaminated sites – environmental quality criteria for data collection, http://www.naturvardsverket.se/Documents/publikationer/620-5053-2.pdf?pid=2816, last consulted: 05-04.2016

9.3.5 Inputs from Stakeholders

9.3.5.1 1st workshop

BONUS SOILS2SEA and the Tullstorpå project teamed up to organise a joint workshop held in Anderslöv, Sweden on 22 November 2014. The thirteen participants at the workshop included local farmers involved in the Tullstorpå project, local representatives of the Swedish Society for Nature Conservation, the Swedish Agency for Marine and Water Management, the regional county of Skåne and BONUS SOILS2SEA project members. Workshop participants, using the Disney Method, discussed basic ideas and designed central elements of potential policy instruments. It became evident that the Tullstorpå project could serve as a good example for other communities. Success factors of the Tullstorpå project will be analysed and fed into the work of BONUS SOILS2SEA.

During the first phase of the Disney Method, the participants were asked to list aspects or problems concerning agriculture and environment in the region. Overall, it was stated that Tullstorpån and the regional part of the Baltic Sea are not in very good condition. The ideas of this phase gave the group a starting point for further discussion in the next phases of the workshop on how to address these issues. The ideas were clustered and four different themes were identified:

- Measures on farms
- Measures in streams
- Differentiated regulation
- Nutrient recycling and reuse

Within these themes, participants mentioned and discussed different measures during the workshop. The outcome of this discussion was that more scientific knowledge and technical solutions are needed. Issues like changes in land prices, some landowners being more affected than others, or who would pay for additional costs, have to be solved first before such an idea could be implemented.

From these discussions, the participants agreed upon five measures that should be brought forward in order to improve water quality:

- Catch Crops and ‘between’ crops.
- Optimising fertiliser use using the latest technology
- Measures in and along streams (2 stage water courses and wetlands)
- Differentiated regulation
- Recycling of nutrients

These measures will serve as a first result for the project on how these could be implemented and be integrated into governance concepts.

9.3.5.2 2nd workshop

The second BONUS SOILS2SEA workshop in the Swedish case study region was held on 15-16 November 2016. The workshop took place at Jordberga Gård, within the Tullstorp catchment area. It started in the afternoon of November 15th with the Polish and Swedish stakeholders introducing themselves and getting to know each other. This welcome round was followed by the screening of the documentary film "Soils2Sea: Reducing nutrient load-

ings into the Baltic Sea". On November 16th the workshop continued at Jordberga Gård with a total of 27 people attending. The participants were project partners from BONUS SOILS2SEA, Polish and Swedish farmers, actors from the community Mykanow, a representative from a fishing association, the Länsstyrelsen Skåne (The County Administrative Board Skåne), and Havs- och vattenmyndigheten (Swedish Marine and Water Authority). In a World Café format using the MoSCoW method, three government regime scenarios were discussed as follows.

Scenario A: Centralised (similar to business as usual)

*In the '**Centralised**' context, the State makes all decisions on the use of measures, including fertilisation norms, at farm or field level. The government uses retention maps at a low resolution (e.g.15 km^2) to produce spatially differentiated regulations for land-use. This differentiation can increase the effectiveness of catch-crops, constructed wetlands, and help to define fertilisation norms. Government monitors at large catchment level to evaluate if N reduction targets to coastal* waters *are met. To monitor and control implementation, farmers are required to report detailed plans for cropping systems and fertilisation. Farmers fulfilling the government requirements receive subsidies from the EU CAP.*

- *Approach: top-*down *(clear N-reduction targets uniformly for the whole catchment)*
- *Monitoring: Authorities are responsible for detailed monitoring*
- *Retention maps: only low resolution maps are used to structure the land use*
- *Subsidies: Are connected with the requirements set by the authorities*

Scenario B

*Under the '**flexible management**' scenario, authorities and farmers work together to reduce N emissions through a market-based 'cap and trade' system. This would be initiated by government authorities per catchment, with all farmers obliged to participate. Based on retention maps with relatively high resolution (e.g. 25 ha), permits for N loading are distributed on a field basis. The community of farmers can trade N load allowances amongst themselves. To document compliance each farmer reports with detailed plans for cropping systems and fertilization (as in Scenario A). Non-compliance with individual allowances is sanctioned by forfeit of a deposit that is then passed onto other farmers for carrying out mitigation measures. Government authorities can intervene in the market by buying up or selling permits from the system to reduce or allow increases to N loads. The government performs control monitoring at catchment level to evaluate if the reduction targets to the coastal waters are achieved.*

- *Approach: market based.*
- *Monitoring: Authorities only monitor the N load at catchment level. More detailed monitoring could be arranged by farmers.*
- *Retention maps: Are used by authorities to calculate the exact amount of allowances and their distribution among the catchment.*
- *Subsidies: Are connected with the precise usage of allowances.*

Scenario C

*The '**co-governance**' approach describes a low level of State involvement in the management, monitoring and control of N loading. This scenario places a focus on the co-governance of farmers within one catchment. Farmers in the catchment self-organize, (e.g. forming a water council) to decide on measures to reach government-set targets. Detailed retention maps - at 1 ha resolution - have higher uncertainty, but can be used by farmers as*

a tool for spatially differentiated management of the catchment. A system of self-monitoring is established to check and modify the retention maps and ensure that the target goals are reached (e.g. monitoring at a field or sub-catchment level). Authorities support the process of self-monitoring by providing financial and technical support and information (e.g. establishing a water council with a technical support, detailed retention maps, monitoring process support). The authorities will monitor only the entire catchment at the outlet. The allocation of EU CAP subsidies is based on reaching the target loads for the entire catchment and their distribution is negotiated between the farmers. If farmers/water council cannot agree on a plan for implementation, the State will impose a central regulation based on Scenario A.

- *Approach: co-governance*
- *Monitoring: Authorities only monitor the N load at catchment level. More detailed monitoring could be arranged by farmers.*
- *Retention maps: Could be one tool used by farmers to optimize their fertilizer usage.*
- *Subsidies: Are only given if the reduction target for the whole catchment is reached.*

Scenario A: Centralised (similar to business as usual)

This scenario was rated rather negatively by the Swedish stakeholders. It can be unfair or affect certain landowners more negatively than others. In principle the stakeholders characterized this scenario as a one size fits all approach with no flexibility. Local knowledge and local variations are not acknowledged and will eventually be lost. Enforcing such a scenario would require large and expensive monitoring and control activities by authorities. Stakeholders also stated that this approach would not be compatible with current monitoring in the Water Framework Directive and would be very expensive and lack acceptance if enforced.

Scenario B: Flexible (marked oriented)

Generally, the Swedish farmers were negative towards this scenario. A main issue was that this approach would be very complex to administrate and govern, and the administration could cost more than the gains. Especially the technical implementation based on the retention maps was doubted. The accuracy of the maps was addressed and said that resolution of 25ha does not capture the local variations in some cases. It has to be ensured, that maps can be trusted. Therefore underlying maps and modelling tools would have to be much better than we have available today. It was also mentioned that N and P have to be addressed together. Another problem that was stated was that there is an insufficient data basis available. Especially information of extent and function of tile drainages is missing for many fields. But also knowledge of the effects of changing crops to their allowed loads as well as simply using the best science available for determining fertilisation amounts is needed. This call for strong Farm Advisory Services, the program ‘Greppa Näringen’ was stated as a good example.

Co governance (water boards)

For the Swedish Stakeholder, this scenario would put a high level of responsibility on them. Acceptable goals for all stakeholders and yearly variations of yields should be taken into account. It would require of clear and comprehensive data and retention maps. These should be provided by the authorities (basically the same authorities would be involved as today), which have rather a supportive and consultative role in this scenario. For example,

authorities could provide satellite imagery or incentives to use new technologies for monitoring. It was also strongly recommended to make use of landowners' knowledge and the monitoring technology that is already available on the market. For example, a machine cooperation among farmers could be a good idea. The aspect of differentiated regulation could be of good use for this scenario, implying great responsibility for the farmers for implementing and achieving the goals and self-monitoring. Although the farmers in this specific area have managed to cooperate in questions considering water management and the environment there is an imminent risk for disagreements between stakeholders if government-set targets are difficult to reach. A good and established communication procedure between farmers and authorities and among the farmers themselves was seen as very necessary. Overall, this scenario could be fairer for individual farmers, and as one stakeholder stated, it could create a 'positive peer pressure' among the farmers.

Following the world café, a multiple choice **survey** was distributed and filled out by seven farmers specifying what would be necessary for a water board, and hence, scenario C to work (Figure 8 shows the questionnaire and sums up the answers for each question). The results indicate tendencies but are not representative of farmers in the area. All farmers filling out the questionnaire could imagine meeting in a water board on a regular basis; however, the preferences for meeting intervals differed widely from every month to once a year. Their main motivation to participate is the potential information exchange. Some would like to have their voice heard, receive financial compensation or would be motivated by others being involved. On the other side, it would be demotivating for many if others controlled the process and their voice was not heard. Their lack of time and a lacking leadership in the board could prevent some from participating in a water board. For most farmers, monitoring should be conducted by a third party employed by the water board. Some could imagine an alliance of farmers doing the monitoring. The preferred intervals for self-monitoring by taking samplings for 2-4 hours varied widely from two to eight weeks. The main motivation lies in the avoidance of sanctions or gaining compensation but also in the trust of the results and control in the process. The main reason for what could hinder participation in monitoring was not given but some stated lack of time and distrust in the analysis of the results as reasons.

Figure 8: Swedish answers to Scenario C - Self-organised management in water boards (n = 7)

2.) How often would you be willing to meet as part of a water board?		2.) What would **motivate you** to participate in a water council? (2 choices maximum)		3.) What would **prevent you** from participating in a water council? (2 choices maximum)	
		Greater autonomy	1	It is not my responsibility	0
Every month	1	A strong leader	0	Lack of strong leadership/direction	1
Every 3 months	3	Everyone else is involved	1	No one else is involved	0
Every 6 months	1	Financial compensation for your time	1	Lack of time	2
Every year	2	Public recognition) of your contribution (e.g. through media	0	Don't want to engage with other farmers	0
1 comment: Tull-stoprspan project		Have my voice heard	2	Waste of time, don't see usefulness	0
		Potential for information exchange	4	Lack of voice, others control	4

				process	
		Other	0	Other *(1 Comment:) nothing*	1
4.) **Who** would you prefer to conduct monitoring activities?		5.) What would **motivate you** to participate in monitoring activities?		6.) What would **prevent you** from participating in self-organised monitoring?	
Me	1	Have some control in the process	2	It is not my responsibility	0
An alliance of farmers	2	I can trust the results	2	No one else is involved	0
Independent 3rd party employed by water board	4	To avoid sanctions / gain compensation	4	Lack of time	2
Government / Authorities	0	Other	0	Don't trust the analysis of results	1
				Other	3

7.) If you were responsible for monitoring and each round of sampling took 2-4 hours to carry out, how often could you feasibly take measurements?	Once every…			
	… 2 weeks	2	… 6 weeks	1
	… 4 weeks	1	… 8 weeks	3

9.3.5.3 Governance-related findings from ethnographic interviews

Five interviews were conducted in Sweden with the majority being less focused on the governance but rather looking through a socio-cultural lens. They are used as the foundation for the ethnographic study (see Chapter **Fejl! Henvisningskilde ikke fundet.**). The county authority and NGO representative provided some governance-related information:

- **County Authority** of the County Administrative Board of Skåne with a background in water management and implementation of the WFD
- **NGO representatives**
- Representatives and participants in the **Tullstorp Stream Economic Association (TSEA)**

From the county authority perspective, **water boards** are ideal to transport the WFD and Program of Measures to the local level who implements the measures. Those boards consist of diverse stakeholders such as farmers and industry representatives. At the beginning the water boards were useful to explain stakeholders the relatively new WFD and it was a space for discussion. Now, many water boards are motivated to be more active in participating in development and implementation of measures e.g. by giving general advice to implement protective zones of farm land and/or practical advice on the location.
The county authority states that 90% of Swedish farmers are organised in a national organisation which supports funding opportunities and fosters cooperation. The county authority further reports from the water board of Tullstorpan to be very cooperative and innovative. The head of the water board initiated that farmers pro-actively develop measures that lie within the scope of the WFD such as wetland construction, re-meandering or river restoration and apply for funds from the County Administrative Board. The National Authority spreads funds to the Country Administrative Boards who can then decide on which project applications are supported. Depending on the project, it can be financed by 100% (e.g. wetlands) or 70-80%.

However, farmers are less happy with the **information source** "Water Information System Sweden (WISS)" which shows nitrogen and phosphorous levels on a map and suggests local measures accordingly. Some farmers are upset about this public paternalism.

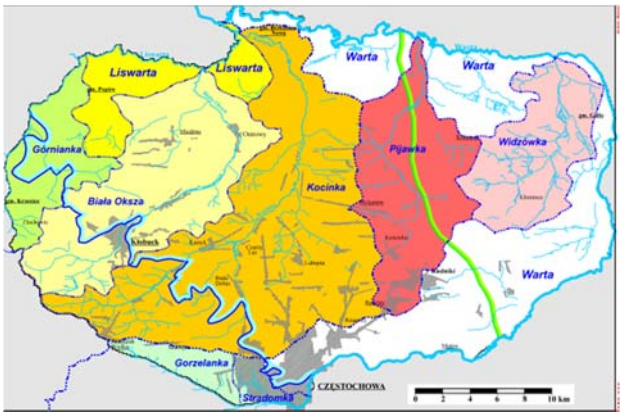
The NGO representative reports of a local association organizing a **visit to wetlands** for local farmers around Tullstorp to increase their understanding and acceptance of wetlands. On a side note, he further reports of former collective action around ditches in cooperatives to keep them in good conditions in the North and South of Tullstorp.

Annex 3: Case Study Poland

9.4 Background

The Kocinka catchment is located in the south of Poland in the Oder river basin (RBD PL6000). The Kocinka river discharges to the Liswarta river, and is its longest tributary at 40.2 km with a drainage basin area of 259.9 km^2. The catchment is covered by 1 - 33 m thick Quaternary deposits[52] of fluvio-glacial and aeolian origin underlain by the Upper Jurassic limestones. The Jurassic strata contain one of the largest groundwater bodies in Poland – the Major Groundwater Basin 326 (MGWB-326).

Figure 9: River network of the Kocinka and the neighbouring catchments (based on Kania et al 2014[53]).



Dominant soils are mainly sandy and clay soils. The topography is slightly undulating with elevations varying between 185 to 317 m a.s.l. The climate is temperate with an average annual precipitation of 600-700 mm/yr and average air temperatures between 7.5 to 8°C. The average discharge and the baseflow discharge at the gauging station were 218 mm/yr and 158 mm/yr, respectively for the period 1974 - 1983. The catchment is mostly agricultural with pine forests dominating in the lower reach. The Kocinka catchment has three sewage treatment plants located in the communities of *Częstochowa, Wręczyca Wielka, and Mykanów* – and these are in addition to ten other professional treatment plants in the larger Liswarta catchment area, most of which are classified as biological mechanical treatment plants.

[52] Paczyński B, Sadurski A (Ed.) (2007) Regional hydrogeology of Poland. Polish Geological Institute, Warszawa, (in Polish).

Figure 10: Regulated stretch of the Kocinka and the riparian forest in the lower part of the river (all photos by P. Wachniew, AGH)..

9.4.1 Farming

Poland has a large Utilised Agricultural Area (UAA) of approximately 16 million ha, which is 50.2% of its total area. The agricultural export sector is economically viable on the whole, and the EU is its largest market. Meanwhile, agriculture as a sector constitutes an ever-smaller percentage of the national GDP, currently standing at 3%. Its importance is thus not so much macroeconomic as socioeconomic, considering that 38% of the population continues to live in rural areas and agricultural production and processing constitute a major source of rural employment.[54] Farming practices on the majority of Polish farms can be characterized as low intensity farming as the majority of farms is small or very small (below 6ha). More than half of the Polish farms produce for self-sufficiency and farming for them is not the main source of income. In the last century, especially small farms are closing down.[55]

Much of Poland's agricultural land has poor and acidified soils managed by extensive, low input and organic farming practices. The Kocinka region is considered fairly representative of Poland with regard to soil types, land use and agricultural practices. Crops are generally rain-fed and do not require irrigation, though areas with light soil may be irrigated during dry spells, and raising the soil water retention capacity of the soil in these areas is considered

[54] IEEP (2008) CAP Reform Profile - Poland http://cap2020.ieep.eu/2009/1/28/cap-reform-profile-poland-2
[55] Jørgensen, L.B. (2013) Policy Recommendations to Save the Baltic Sea - Conversion to Ecological Recycling Agriculture. BERAS implementation http://beras.eu/wp-content/uploads/2013/11/Policy-report-lowres.pdf, p. 87-88

highly desirable.[56] The number of part-time farms in the Kocinka region is high at 2.000 supplementing their farm income through off-farm work, in comparison to 3.255 full-time farmers[57]. In the areas surrounding Kocinka – in Lubliniec County in particular – the main crops are rye, wheat, oats, barley and potatoes, and animal husbandry, where present, focuses on pig farming. The use of pesticides and mineral fertilizers is often limited by financial constraints, and the level of mechanization is low. At the same time, there is still the issue of farm animal management, where the improper management of waste contributes to the contamination of surrounding water bodies (See Chapter 9.4.5.1: 1st workshop). In addition, the Kocinka river is popular for trout fishery. Klobuck County has a relatively large organic farming sector and food-processing industry.[58] Organic farming accounted for 661.687 ha of land in Poland in 2012, which amounts to 3,51% of total agricultural land[59].

In Poland, agriculture is the main source of nitrates entering ground and surface water, and it is estimated that over 50% of the nitrogen load and 40% of the phosphorus compound load in water runoff comes from agriculture.[60] Agricultural land constitutes 71% of the entire Kocinka catchment with 4.656 farms cultivating 13.780.645 ha. The Kocinka catchment is not considered a Nitrate Vulnerable Zone, but it is regarded as eutrophic, or at a high risk of eutrophication, with high surface water levels in nitrate and phosphorus especially due to agricultural use of fertilizer[61].

9.4.2 Specific challenges

The main water management issue in Kocinka is the reduction of nutrient loads associated with agricultural and wastewater effluents that threaten water quality in the Kocinka river and its tributaries as well as the MGWB-326 aquifer underlying the Kocinka catchment. Interaction between the groundwater and surface waters is probably bidirectional as the upwelling groundwater may discharge into the river. The aquifer contains one of the largest groundwater bodies in Poland which supplies good quality drinking water to the inhabitants of the area. The unconfined, karstic fissured aquifer is vulnerable to pollution. Nitrate levels exceeding 50 mg/l have already been detected in the southern part of the groundwater body and water extracted from the polluted wells is subjected to denitrifying treatment. Two plausible sources of this pollution are: (i) inadequate sewage management in the town of Częstochowa and in the municipalities of the catchment and/or (ii) agricultural activities.

[56] Poland National Committee of International Commission on Irrigation and Drainage (POCID), Polish Factsheet http://www.icid.org/v_poland.pdf

[58] Matysik, M., Absalon, D. and Ruman, M.. "Surface water quality in relation to land cover in agricultural catchments (Liswarta river basin case study)." *Polish Journal of Environmental Studies* 24.1 (2015): 175-184

[59] IJHARS (2013): Report of actual state of organic agriculture in Poland 2009-10.

[60] ICID (International Commission on Irrigation and Drainage), Country Profile Poland: http://www.icid.org/cp_country.php?CID=76

[61] Matysik, M., Absalon, D. and Ruman, M.. "Surface water quality in relation to land cover in agricultural catchments (Liswarta river basin case study)." *Polish Journal of Environmental Studies* 24.1 (2015): 175-184, p180.

9.4.3 Governance System

Relevant actors

Farmers:

- *The* Polish *Union of Farmers and Farmers Associations (KZRKIOR) has a regional branch in Czestochowa (http://kolkarolnicze.eu/O-nas/Struktura-KZRKiOR/Regionalny-ZRKiOR-Czestochowa).*
- *Izby* Rolniczej *w Opolu (Chamber of Agriculture in Opole) (http://www.izbarolnicza.opole.pl/izba/public/pages/open/id/12/position/4/?menuu=3)*
- Stowarzyszenia *Ekonomistów Rolnictwa i Agrobiznesu (Verband* Association of Agricultural and Agribusiness Economists) *(http://seria.com.pl/)*

Cross-sectoral knowledge platforms:

- *Agricultural Knowledge and Information System (AKIS) in Poland.* The AKIS is an agricultural advisory service that brings together various actors to provide information, education and research, business and legal assistance and technical/technological advice for stakeholders. Sixteen Provincial Advisory Centres are independent public organisations that fulfil these functions nationwide.

Local Networks:

- *Częstochowa Regional Association of Municipalities for Water and Sewage System (Związek Komunalny Gmin d/s Wodociągów i Kanalizacji w Częstochowie).* Ten municipalities forming this association have a common network of drinking water supply, sewage disposal and wastewater treatment. The association creates a strategy for the development of this network and supervises the integrated system of management and protection of the groundwater resources in the area (Malina et al., 2007).

Authorities:

- *Municipality of Mykanów (Gmina Mykanów – www.mykanow.pl) and three other municipalities of the catchment.* The municipalities are responsible for preparation of the development plans that regulate activities affecting the environment, in particular the quality of surface water and groundwater. For instance, the municipality of *Kłobuck* installed a wastewater system in 2013 that directly affects the water quality in the Kocinka river (http://www.gminaklobuck.pl/samorzad/Opis_projektu.html).
- *National Water Management Authority – KZGW (Krajowy Zarząd Gospodarki Wodnej – www.kzgw.gov.pl)* and *Regional Water Management Board (RZGW) in Poznań* are responsible for implementation of the WFD in Poland and in the Warta river catchment, respectively.
- *Institute of Meteorology and Water Resources Management – IMGW (Instytut Meteorologii i Gospodarki Wodnej – www.imgw.pl)* is responsible for carrying out hydrological and meteorological measurements and observations, their collection, analysis, *processing* and dissemination, as well as assessing the water resources quality. The IMGW cooperates with and supports the public sector and offers various services and expertise in the field of meteorology and hydrology.

- *Chief Inspectorate of Environmental Protection – GIOS (Główny Inspektor Ochrony Środowiska - www.gios.gov.pl)* and its regional branch *WIOS* are responsible for monitoring of the surface water and groundwater quality and for inventorying of point sources of pollution.

Business:

- *Water* and *Sewage System Company of the Częstochowa District - Joint Stock Company (Przedsiębiorstwo Wodociągów i Kanalizacji Okręgu Częstochowskiego Spółka Akcyjna w Częstochowie* - http://www.pwik.czest.pl/en*)*. This enterprise provides drinking water and is responsible for the management of wastewater on the area of the ten municipalities forming the Association.
- *„WARTA" S.A. w Częstochowie* is the sewage plant of Częstochowa for the Warta river (http://www.wartasa.eu/news).
- *SD Huta* Czestochowa *Sp. z o.o*. is one of the largest steel producing companies in Poland (http://huta.isd-poland.com/in-english).
- *The Koksownia Częstochowa Nowa* is a leading manufacturer of coke in Poland (http://www.koksownianowa.pl/).
- *Guardian Częstochowa* is a glass plant that belongs to an American company
- There are also several *automotive* components suppliers, e. g. *TRW Automotive* (security systems)*, CSF Poland* (cables, anti-vibration systems and seals)*, Brembo* (brake system components) *or CGR Polska.*
- *Mykanów Circle of the Polish Angling Association – PZW (Polski Związek Wędkarski - http://www.pzwmykanow.zafriko.pl)* supervises the Kocinka fishery.
- *Razem na wyżyny* is a local action group (LAG) of the European Union LEADER project. A regional development strategy is developed to enhance the quality of life in the region. The LAG already held an environmental workshop, however environment in general is not a main focus of their work (http://www.razemnawyzyny.pl/index.php?option=com_content&view=article&id=90 &Itemid=100.)

Environmental organizations:

- There is a regional branch of the *Polski Klub Ekologiczny* (Friends of the Earth Poland) in Gliwice (http://www.pkegliwice.pl/kontakt/onas.html).
- *Liga Ochrony Przyrody* (http://www.lop.org.pl/) aims for the protection of the environment and the nature in Poland
- *Europejskie Towarzystwo Ekorozwoju* (http://www.ete.org.pl/) is a European environmental organization with a Polish branch.
- *The Salamandra* (http://www.salamandra.org.pl/home.html) society works for the conservation of polish ecosystems.

9.4.4 Relevant regulatory framework

Common Agricultural Policy (CAP)

Since Poland joined the EU in the 2004, it has been a net recipient of CAP financial aid. However, as Poland also co-finances the direct payments and RDPs, the CAP has created

a burden on the state budget.[62] The CAP payments to Poland (2002 – 2011, PLN 113 billion) consisted of several different funding sources, including the Special Accession Program for Agriculture and Rural Development SAPARD (PLN 4.5 billion) to help the Polish agricultural sector prepare for integration into the EU market, e.g. through adjustments to sanitary and environmental protection standards, improving competitiveness, and diversification of the rural economy. However, most payments were channeled to the Rural Development Program (RDP), and the direct payments distributed yearly among 1.4 Mio farmers, (87% of farms with an area over 1 ha). In comparison to other EU countries, Poland receives a large amount of RDP funding (Pillar 2) in comparison with direct payments (Pillar 1). Direct payments accounts to more than 40% of farmers' income.[63] Rural Development funds 2007 - 2013 have encouraged the evolution of a more sustainable model of agriculture, where over 100.000 holdings totaling 2.6 Mio ha have committed to environmentally friendly practices beyond basic requirements and some 865.000 farms cultivated 8.1 Mio ha of land classified as less favored areas (LFA).[64] The 2014-2020 RDP scheme aims to particularly address small and medium-sized farms, diversification towards non-agricultural sectors and support for farmers working together in producer groups.[65]

Water Framework Directive and RBMPs

The Water Framework Directive is in force in Poland since its accession as an EU Member State in May 2004. Poland has 21 water regions located within ten river basin districts (RBDs) with eight of these districts being shared with neighboring countries. The decision-making bodies for the Polish RBDs are split between the National Water Management Board (NWMB) and seven Regional Water Management Boards (RWMB). Each RWMB covers one or more water regions. The National Board is directly subordinate to the Minister of Environment and responsible for the coordination, preparation and production of river basin management plans. Regional Boards are responsible for reporting, public information and consultation. There are six national-level Working Groups aimed at coordinating the work of the various RWMBs, including a working group on Water Management Plan and Programme of Measures, on Agriculture and on Public Participation.

In the implementation of the WFD, several authorities are involved. The Ministry of Environment, for one, is responsible for water management and provides the government with information, amongst others, the state and usage of water resources (quality and quantity), the implementation of RBMPs and the maintenance of surface water and water facilities. The RBMPs are adopted by resolution of the Council of Ministers and are binding for the authorities and bodies subordinated to that Council. The subsidiary bodies to the Ministry are in charge of national water needs and current water resources balance. The subsidiary bodies determine water management for each catchment area, inter alia, water availability for irrigation needs.

[62] IEEP (2008) CAP Reform Profile - Poland http://cap2020.ieep.eu/2009/1/28/cap-reform-profile-poland-2
[63] Wigier, Marek, and Doina Darvasi. "Direct effects of the CAP implementation in Poland–Expectations up to 2020." *Economics of Agriculture* 59.3 (2012). p. 549
[64] EC (2014): Poland Common Agricultural Policy http://ec.europa.eu/agriculture/cap-in-your-country/pdf/pl_en.pdf
[65] EC (2014): Factsheet on 2014-2020 Rural Development Programme for Poland http://ec.europa.eu/agriculture/sites/agriculture/files/rural-development-2014-2020/country-files/pl/factsheet_en.pdf

The WFD is implemented in Poland through a number of acts and supporting legislation, particularly the Water Act, Environmental Protection Law (see below) and the Law on Collective Water Supply and Collective Wastewater Treatment.

The Water Act

The Water Act is the main piece of legislation implementing the EU WFD in Poland. It obliges the President of the NWMB to develop RBMPs and the National Environmental Program and Regional Directors to develop plans for water use in their respective regions and basins and outlines issues that are to be taken into account in RBMPs and the Program. The instrument strives to "increase productivity of soil, facilitate its cultivation, and protect utilised agricultural land from flooding," while protecting water resources from pollution.

Environmental Protection Law

The Environmental Protection Law is a wide-ranging, binding regulatory instrument. It details measures for maintaining the best possible water and soil quality, including through limiting water and wind erosion, creating organic matter, protecting humus and remediation where necessary. The law was introduced in 2001 and is overseen by the General Directorate for Environmental Protection, Regional Directorate for Environmental Protection as well as local authorities. Part of the law creates the State Environmental Monitoring System (§25 (2)), which performs measurements, assessments and forecasts of the environment and disseminates this information.

Nitrate Derivative and its national/local implementation

Poland fulfills the Nitrates Directive through its implementation of several national laws:

- Water Law;
- Regulation on the criteria for designation of waters sensitive to pollution by nitrogen compounds from agricultural sources;
- Regulation on the detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources;
- 11 regulations of Directors of Regional Water Management Boards (RZGW) determining waters sensitive to pollution by nitrogen compounds from agricultural sources, and vulnerable areas from which the outflow of nitrogen from agricultural sources to these waters should be limited;
- Regulation on the detailed method of application of fertilizers and conduct training on their use; and
- 21 Regulations of Directors of RZGW on the introduction of an action program aimed at reducing nitrogen runoff from agricultural sources in vulnerable areas (2% of the country).

Measures along the Nitrate Directive include, e,g,: Organic fertiliser application is allowed only from March 1st to November 30th; No sewage sludge and organic fertiliser on slopes > 10%; No application of fertiliser on flooded, frozen or snow-covered ground; No manure within 20 meters of water courses and water uptake protection zones; Storage facilities for manure and slurry must have a capacity of at least 6 months (although the Act on Fertilisers and Fertilising states 4 months); and Application of organic fertiliser is allowed up to 170 kg N per ha arable land.

Law on Fertilizers and Fertilizing

The Law on Fertilizer and Fertilizing is a binding national level instrument regulating the use of substances meant to enhance agricultural production, including those that affect the chemical, biological and physical characteristics of soils. The objective of this instrument is to enforce requirements for minimum standards of permitted fertilizers and soil-protective planning and zoning with the goal of minimising risks related to the storage and use of fertilisers. The law in its current form was adopted in 2007.

National Spatial Development Plan

The National Spatial Development Plan provides a framework for spatial development in Poland according to sustainable development principles. It establishes a working group of the ministers of rural development, agriculture, fisheries, environment and water management to ensure the preservation of fertile soils for agricultural purposes. Monitoring takes place through a national system that tracks spatial and regional policy and is integrated with an EU monitoring system.

Regional Spatial Development Plan

Regional spatial development plans are an instrument for local authorities to guide sustainable spatial development by establishing local development priorities while taking environmental protection into account. This instrument addresses several land cover classes, including agricultural areas, artificial surfaces, water bodies and semi-natural areas. The plans take nature protection areas into account and implement recommendations from the National Spatial Development Plan. The instrument was adopted in 2003.

The National Fund of Environmental Protection and Water Management (NFOSiGW)

This fund is the largest public finance institution for environmental protection in Poland. The Fund was established in 1989 and sees as a priority in the protection and sustainable management of water resources.

Fertility Building Management Measures in Organic Cropping Systems (“FertilCrop”)

FertilCrop is an EU and national level project that aims to inform and support the sustainable management of organic farming systems, including increases in crop yields and overall productivity. Specific objectives and measures include soil fertility support, improving the understanding of carbon and nitrate stock dynamics in soils and aiding farmers in soil fertility recognition. The project runs from 2015 to 2017.

Code of Good Agricultural Practice

This is a non-binding instrument that serves as a source of public information and a farm advisory service to help implement national, EU and international level environmental legislation in Poland. In terms of the EU, it specifically aims to implement the CAP and LIFE+ Programme policy instruments. One chapter is specifically dedicated to balanced nutrient and soil organic matter management. The code was released jointly by the Ministry of Agricultural and Rural Development and the Ministry of Environment in 2004.

9.4.5 Inputs from Stakeholders

9.4.5.1 1st workshop

In Poland, the first workshop was held in Częstochowa, near the river Kocinka, on 11 December 2014. The workshop was attended by BONUS SOILS2SEA project partners, environmental agency members of Kłobuck County (powiat kłobucki), fisheries-association representatives, as well as Mykanow community actors, who had previously participated in an ethnographic study during the POLEKO Exhibition meetings. Among this latter group were farmers and other stakeholders, including the Water Works in Częstochowa. A total of twelve people attended the workshop.

The World Café method was used to get insights from the participants regarding water quality and agriculture in the Kocinka region. Three tables discussed different issues:

Table 1: Role of agriculture and waste water for water quality

Currently, there is a lot of information and options already available for farmers to improve water quality, but many of these opportunities are not yet fully used. One reason may be a lack of awareness on how sewage and/or manure can negatively impact water quality. At the household level, the treatment of waste water is crucial for water quality. Households that are not connected to the community sewage system can build household sewage treatment plants (instead of using septic tanks) or use biodegradable material for the septic tanks to improve water quality.

Table 2: How can different actors contribute to ameliorate the water quality?

Multiple activities have an impact on water quality, and it depends on the type and size of activity that is undertaken. There were different issues highlighted concerning water quality:

- local industries (including the food industry),
- agricultural devices and machines (service and exploitation),
- transport (local and regional),
- atmospheric emissions from individual farms/private houses (inappropriate fires/furnaces, burning/combustion of low quality fuels and waste materials) and
- illegal dumping sites (landfills).

All these factors can contribute to a certain degree to water quality.

Table 3: How can implementation of regulation be strengthened?

Financial constraints of farmers are a barrier to water quality improvements through the implementation of regulation. Without financial support, good practices are not undertaken. Also, the laws covering water quality are too complicated with too much bureaucracy which discourages farmer interest in legal issues. These views toward bureaucracy contributed to participant's scepticism of new mechanisms like differentiated regulation. Participants feared that new mechanisms could lead to unnecessary bureaucracy, and that farmers would not understand the ideas (e.g. trading nutrients). Instead of trying to implement new measures, there were suggestions to improve existing mechanisms.

The constructive working atmosphere of the workshop led to some insights to conduct further work. For example, awareness and education are seen as very important aspects to changing farmers and citizens' attitude and behaviour.

9.4.5.2 2nd workshop

The second BONUS SOILS2SEA workshop in the Polish case study region was held on 13-14 October 2016. It started on the evening of October 13th with the premiere of the documentary film "Soils2Sea: Reducing nutrient loadings into the Baltic Sea". The film was shown at the school in the community of Mykanów. The movie illustrates the societal story of implementing the EU's Nitrates Directive and regional realities in the EU member states, particularly in the Kocinka catchment area in south central Poland.

On October 14th the workshop continued at the Water Supply and Sewerage Joint Stock Company in Wierzchowisko. In total 18 people attended the workshop. The attendees were project partners from BONUS SOILS2SEA, farmers, actors from the community of Mykanow, a representative from a fisheries-association, a representative of Czestochowa County, and a representative from the Water Treatment Plant.

The group work was organised according to the World Café method with three groups (tables). Due to limited time resources, there was no changing of tables, as it is normally foreseen in a World-Café. Subsequently, the findings were prioritised using the MoSCoW method. The key conclusions to the questions from the groups are given in the following.

Scenario A

"Rural revival*" is based on the revitalisation of the rural economy. The region around the Kocinka is well known for its cultural and environmental heritage, but this is currently not protected nor exploited to its full economic potential. Regional development funds would be mobilised to increase local awareness of the need to protect the natural environment and to provide training on the range of goods and services that already exist but are under-exploited (e.g. agro-tourism, trout fisheries and aquaculture, fruit and vegetable preserving). The creation of a regional label which recognised environmentally sound agricultural practices with low N and P inputs would support a healthy environment while also enabling actors to obtain a higher price for their products. This diversification would not eliminate conventional agriculture from the region but would reduce the reliance on a primary sector for economic security and reduce N and P inputs on those areas that are still farmed.*

Measures *under this scenario include:*

- *Funding to start a regional label for a rural economy based on low N and P inputs.*
- *Information-raising on the importance of a healthy environment as a basis for a strong regional rural economy.*
- *Training on opportunities for economic diversification*
- *Subsidies or other incentives for "start-up" businesses*

Scenario B

*"****Restoring the river****" is an approach that places the health of the Kocinka river and its ecosystems at its centre. Land-owners are informed, supported and financially rewarded for converting agricultural land (or halting the conversion of non-agricultural land) to protect or restore local ecosystems. These ecosystems provide a range of environmental and societal benefits such as supporting (e.g. nutrient recycling), regulating (e.g. water purification) or cultural (e.g. recreational) services including the increased retention of N and P. As a consequence of reducing agricultural land-use, the application of N and P from mineral fertilisers and untreated sewage are also lowered. The potential for leaching of N and P into groundwater and the Kocinka river is thus reduced, thus ensuring the healthy functioning of ecosystems their services.*

***Measures** under this scenario include:*

- *A system of payments for ecosystem services (PES)*
- *Information campaign and technical assistance to help land-owners identify appropriate ecosystem-based measures e.g. leaving wet meadows lie fallow.*

Scenario C

*"**Farm management**" involves a situation with strong State level support for the agricultural sector, with a focus on managing, rather than eliminating N and P inputs. High levels of investment from the national government would underpin economic instruments to stimulate the reduction of N and P from agriculture. Information campaigns increase awareness of the negative effects of N and P leaching for the long-term health of the environment, and consequently, farm businesses. Through improved information and the stimulus of appropriate economic incentives, less N and P will be emitted from agriculture.*

***Measures** under this scenario include:*

- *Market based incentives or subsidies to increase levels of alternative farming methods e.g. organic agriculture, nutrient recycling, permaculture.*
- *Market based incentives or subsidies for technologies that reduce N and P inputs e.g. precision agriculture.*
- *Raising awareness of how existing (agricultural/water treatment/other) practices may be increasing N and P loads to the river.*

Scenario A: Rural revival

The idea of the revitalisation of the rural economy was in general seen in a positive light. Especially for the farmers it could be a good opportunity to produce regional products in a more ecological way. The water company (as part of this group) could support this approach by information campaigns and promotion of household connection to the sewage system. Support from the authorities (connected to funds from the EU), especially in monitoring aspects is needed in order for this scenario to work.

While not every farmer would favour an approach of creating a regional label or exploiting the idea of local agro-tourism, other farmers could certainly be interested. It was stated, that farmers could create regional products (such as spirits), establish agro-tourism schemes, or pursue the idea of regional labels. Information about these possibilities would strengthen this approach.

Scenario B: Restoring the river

The scenario B was more focused on the river, having the goal of ensuring the healthy functioning of the ecosystem. It was stated that the anglers can support this by monitoring certain parameters of the river and also advise where proper measures could be undertaken. Creating buffer zones along the river was discussed in more detail at the table. There are a lot of different fields adjoined to the river with a lot of different owners. It has to be certain that the owners are compensated for turning their land into buffer zones or for preventing their degradation. It was suggested to establish a meeting and information point for the landowners to inform and exchange with other landowner but also with the authorities. Constructed wetlands were a second measure that was discussed. Especially for small farmers, this could be an interesting alternative if this would be compensated well.

Concerning monitoring, the stakeholders on this table stated they rather see an authority, like the Environmental Protection Inspectorate, to be in charge. The river could be a good

place for carrying out the monitoring, as it can be seen as the outflow of the catchment. In this way, the overall monitoring could be reduced. An unsolved issue is wells (both new and old) in the area, for which little information exists. Monitoring attempts could also include these wells, because they sometimes can cause overflowing.

Overall, it was stated that for this scenario to work, considerable financial support would be required.

Scenario C: Farm management
The scenario C implies strong State level support for the agricultural sector, which in the view of the stakeholder would lead to a growing agricultural sector with usage of more fertilizer. In general this would have a negative impact on the environment.

In order to have this emphasis in agriculture, a shift in politics would be necessary. The Agricultural Chamber together with other representatives of farmers, the EU, and maybe a strong farmers' party have a strong influence on the decision making in this scenario. These decision, especially if driven by the EU, are seen as outside of the local decision making process. Therefore solutions for the negative impact on the environment should also be sought at these higher levels.

Education, awareness and information were seen to be very important factors for reducing the negative impact on the environment in this scenario. The stakeholders distinguished between the younger and older generation of farmers. As the older generation maybe not use the modern information channels as frequently as the younger generation, there should be different ways to approach them.

For the monitoring, the stakeholders on this table rather favoured independent bodies or non-governmental institutions for carrying out the monitoring schemes.

9.4.5.3 3rd workshop for Polish stakeholders in Sweden

The second BONUS SOILS2SEA workshop in the Swedish case study region was held on 15-16 November 2016 and included Polish stakeholders. Due to different local needs, the scenarios from the 2nd Polish workshop focused more on market-based approaches. To have comparable results on different government scenarios (market-based, centralised and self-organized), Polish stakeholders discussed these at the Swedish workshop. For the scenarios see Annex 2.

Scenario A: Centralised
The Polish stakeholders stated that the issue of centralizing is a trend in Poland, so this scenario might become reality in Poland in the future. Stakeholders have the impression that authorities in this scenario would only manage the guidelines from national or EU level and no actual decisions would be taken on the local level. To manage these implications in the best way and in the interest of the farmers, an expert is needed. This expert would function as bridge between national and local/farmer level, giving the farmers advice for example how to apply for subsidies or inform about new regulations. This person would be an agricultural advisor located at commune or regional level. Another issue that was raised concerned the implications of reducing fertilizer use for the already low efficiency of farming. Farmers would need subsidies, if fertilizer use has to be reduced. But overall, the stakeholders did not perceive this scenario as generally negative. If regulations are set very

clear, fair, and easy to follow, this would be even a positive scenario giving the farmers more time to concentrate on farming and take the burden off them to perform too many administrative tasks.

Scenario B: Flexible (marked oriented)
Generally the Polish farmers were more positive than the Swedish stakeholders; especially the idea of trading N-licenses was seen as a possibly good idea. But in order to be a successful scenario the regulations have to be understandable and very clear rules for subsidies and sanctions are needed. To create such regulation, cooperation within different sectors on the ministry level is recommended. But these regulations stemming from the national or EU level should be adjustable to the local circumstances. A project manager/expert on the local level should be installed. The issue of monitoring was raised as a problem, because it can be very costly. A third party or an authority should be responsible for the monitoring. If farmers have to take this burden, they should be compensated. Within the Kocinka Catchment, there are a lot of different farmers (over 160), this would hinder an effective cap and trade system.

Scenario C: Co governance (water boards)
A first issue addressed by Polish stakeholders was that not only farmers contribute to eutrophication in the Kocinka area and everybody contributing to the problem should also help to solve the problem (for example, households should be connected to the sewage system). But in order to work, a cooperation among the farmers is needed. This is seen as rather unrealistic, because there are many farmers in the catchment and previous experiences with cooperative organisation have failed. Also a strong leadership for this cooperative would be necessary (which is at the moment lacking), in order to steer the group of farmers but also to negotiate with regional or national authorities. The presented Tullstorp Span project was seen as a good example, especially because they managed to collect subsidies for their work.

But overall, this scenario was seen as a fairy tale and was seen as very unrealistic. It would take a lot of effort (time, money, knowledge) that would keep them from farming. Stakeholders are even afraid to lose power as individual farmer in this scenario, because decisions have to be taken in a group and not on their own.

Following the world café, a multiple choice **survey** was distributed and filled out by seven farmers specifying what would be necessary for a water board, and hence, scenario C to work (Figure 11 shows the questionnaire and sums up the answers for each question). The results indicate tendencies, but are not representative of farmers in the area. All farmers filling out the questionnaire could imagine meeting in a water board on a regular basis with a preferences for meeting every three months. Their main motivation to participate would be the financial compensation for their time. Other incentives are that everyone else and a strong leader are involved. Greater autonomy and having their voice heard are incenetives for some farmers. On the other side, it would be demotivating if direction/strong leadership and other stakeholders not being involved were missing. Lack of time was an issue for two farmers. One dismissed the idea as a waste of time. Another feared the lack of voice when others control the process. Regarding monitoring, most farmers prefer a third party employed by the water board to conduct this. Two farmers prefer the government and one famer prefers an alliance of farmers to conduct self-monitoring. The preferred intervals for self-monitoring by taking samplings for 2-4 hours are mainly at intervals of every six weeks,

two farmers would prefer every eight weeks. The main motivation for participation in monitoring is the trust of the results and in the avoidance of sanctions or gaining compensation. Farmers might not participate due to lack of time. One also stated that lack of trust in the analysis would hinder participation.

Figure 11: Polish answers to Scenario C - Self-organised management in water boards (n = 7)

3.) **How often** would you be willing to meet as part of a water board?		2.) What would **motivate you** to participate in a water council? (2 choices maximum)		3.) What would **prevent you** from participating in a water council? (2 choices maximum)	
		Greater autonomy	2	It is not my responsibility	0
Every month	0	A strong leader	3	Lack of strong leadership/direction	3
Every 3 months	5	Everyone else is involved	3	No one else is involved	3
Every 6 months	2	Financial compensation for your time	5	Lack of time	2
Every year	0	Public recognition) of your contribution (e.g. through media	0	Don't want to engage with other farmers	0
		Have my voice heard	1	Waste of time, don't see usefulness	1
		Potential for information exchange	0	Lack of voice, others control process	1
		Other	0	Other	0
4.) **Who** would you prefer to conduct monitoring activities?		5.) What would **motivate you** to participate in monitoring activities?		6.) What would **prevent you** from participating in self-organised monitoring?	
Me	0	Have some control in the process	0	It is not my responsibility	0
An alliance of farmers	1	I can trust the results	4	No one else is involved	0
Independent 3rd party employed by water board	4	To avoid sanctions / gain compensation	3	Lack of time	4
Government / Authorities	2	Other	0	Don't trust the analysis of results	1
				Other	1

7.) If you were responsible for monitoring and each round of sampling took 2-4 hours to carry out, how often could you feasibly take measurements?	Once every…			
	… 2 weeks	0	… 6 weeks	4
	… 4 weeks	0	… 8 weeks	2

9.4.5.4 Governance-related findings from ethnographic interviews

In total, eight ethnographic interviews were conducted in the Kocinka region. Two interviewees were farmers, three represent governmental authorities with two having a farming background, one is a farmer representative and another one is a NGO representative also with a farming background. Furthermore, one representative of the local Water and Sewage System Company further provided his knowledge on the local water and sewage system and opinion on environmental pollution. The interviewees highlight similar challenges and development in the region.

- **Farmer 1**: has farmed 8 ha for several generations and grows only grains. He is active as the chairman of the Board and president since 1965.

- **Farmer 2**: manages a farm of 15 hectares. He continued the much smaller family farm of 3,5 ha and increased the land size over time. He went from a mixed farm to concentrate on growing rapeseed, wheat and potatoes. Besides being a farmer, he works in a community office.
- **Agri-Environmental Authority**: is the head of the regional Department of Agriculture and Environment with postgraduate studies in environmental protection. He and his wife own an 8 ha farm though half of it is currently not in cultivation.
- **Local Authority 1 / Mayor:** of Mykanow and worked on his family farm while being a teenager.
- **Local Authority 2 / Clerk**: is a local government clerk working in the office of the municipality: He is educated in agriculture, but not a farmer anymore.
- **Farmer Rep**: Interviewee is representing farmers' interests and concerns working for a farmers' association. The association estimates agricultural harms e.g. crops destroyed by wild animals, gives their expert opinions on land use change proposals, provides training for farmers and organize strikes. He has a farm of 10 ha which decreased from a former 20ha.
- **NGO Rep**: works at the community's culture resort in Mykanow and is the vice-chairman of two NGO's: One is a local action group called 'together on uplands (wyzyny)' which rather large and operates in six municipalities. The second NGO, which was started recently, is called the 'Foundation to support local development activity' ANKRA. Through its Internet radio, ANKRA is talking about the promotion, development and educational aspects around rural lands. He has a degree in agriculture but is currently leasing his land and not working as a farmer.
- **Water Manager** of the Water and Sewage System Company of the Częstochowa District, serving ten communities with water supply and waste water treatment including Mykanów.

Farm structure, land use and local cooperation

In the Kocinka region, most farmers have approximately 10 ha, though one farmer is larger with 80 ha. The **soil class in the region is fairly poor** with mostly class 3 - 6 soils. Some soils are class 2 or 3 on small surfaces. 90% of the production is cereals as they tolerate poor soils and are easier to store. Farmers mostly use the grains for themselves rather than for animal feed. Corn is difficult to grow as a grain because of the poor soil. In the past, potatoes were very widely grown, on around 500 ha, but now there are maybe 2 ha of potato fields. At one point there was a dialogue about cultivating crops for biogas, but the topic was dismissed as the quality of the crops was considered as too low for biogas. Greenhouse production was once popular and profitable, but since the last 1980s, privatization occurred and farmers could no longer hold on to their greenhouses. The biggest changes in agriculture have been the **transition from mixed farms to stockless, specialized farms**. In the past, there was a dairy sector in the region, but the production was too inefficient for the market. According to farmer 1, there are four farmers with milking barns with cows and all other farmers in the region have no animals except pigs. Farmer 2 has grown his land size thanks to financial incentives but he still could not support his family without his job in a community office. The EU incentives lead to his decision to change from a mixed to a more specialized farm as he receives money for the land size rather than amounts of crops. Most interviewees grew up and lived on small-scale mixed farms that had diverse crops until the 1990s. It was typical to have a subsistence farm with grains, potatoes, different vegetables,

a cow and a pig. The three major crops were rye, oat and potatoes though market demand for rye and oat (which grow well in poor soils) has gone down.

Land fragmentation is seen as a barrier to more profitable farming by Farmer 1 and the agri-environmental authority. Farmer 1 sees a lack of pooling land ("brak komasacji") where people have 2 - 3 ha in six different places. This fragmentation is not effective for spraying or even for using a tractor, when the area of cultivation is narrower than the harrow. From his visits to Germany and the Netherlands, he finds that larger acres and no fences bring much more flexibility. According to the agri-environmental authority, the average farm size, at least, has increased, from 2.5 ha to 5 ha but farming activities per head decreased and it is difficult to fatten cattle or use equipment. The clerk states, that many farms stopped farming since the 1990s because of political changes. These days, there are fewer and fewer small farms due to farming being unprofitable or as younger generations do not wish to continue the family farming business. Most interviewees state that many, especially small farms are sold or leased which has led to some **farm consolidation** or the land is abandoned which leads to the growth of forests where there were once farmers. The NGO representative estimates that some one-sixth of the land is naturally converting to **overgrown fields or forest**, which has allowed many wild animals like boars, wolves and deer to reappear.

The NGO representative states that there are **many local action groups throughout Poland** today. Thanks to them, people begin to take advantage of funds for the development of the community and their enterprises. At the same time, locals are conservative and often need someone to show them that it is possible and how it works. He has organized social and economic initiatives. For example, with a group of five people he founded a welfare cooperative, for which they received about PLN 20.000 each in funds and, amongst others, helped to realize a community project in a neighboring town. If a group has its own ideas, the cooperative helps in the application process with the Office of the Marshal, and then follow through on their ideas and needs. Another example is the cooperative's assistance in the implementation of the ANKRA project, which, on behalf of residents of the Częstochowa and Globudkiego districts, supports the foundation of rural schools. In workshops with local stakeholders like village administrators and teachers, they create thematic working groups for each community to realize local initiatives. At the time of the interview, these were rather informal groups, but maybe with time and support, they can become organized NGOs. The farmer also observes **local initiative at the district level to consolidate farming grants**. Farmers can exchange pieces of land with other farmers which helps their farming.The farmer representative is active in the organization of farmers through his **farmers' association**, giving them a voice, e.g. on the sale of state farms, on proposals relating to land use changes, e.g. from agricultural to building or forests to building etc.. They further provide training and organize educational and international trips for farmers.

Rural economy

Several interviewees think that **EU incentives are the main source of profit** in regional farming and that, without them, no one would even think to farm and the economy would collapse. The farmer representative, who decreased his farm size from 20 ha to 10 ha, calls farming an expensive hobby. One problem is the poor quality of soil in the region which reflects in poorer crop quality and lower prices compared to the EU or even within Poland. Farmer 1 describes **farming as unprofitable** considering the cost for seeds, the harvester, etc. and even just little fertilizer, and the low prices on the market. The agri-environmental

authority interviewee stopped farming in 1992/93 because profitability had dropped so steeply. He said that in those times it was better to own a greenhouse with flowers and tomatoes, but now competition from the Netherlands has made that also unprofitable. He noted that farming was unprofitable even with the EU incentives. He had tried it for 2-3 years but was paying double what he was earning. **Farming costs especially increased due to higher mechanization**. In the 1980s, the farmer representative's farm had specialized equipment such as tractors and harvesters working on 12 - 15 ha. The new equipment is modern and the farmer has less physical work, but it is more expensive. Profitability from one hectare has decreased, which has caused farmers to accumulate land for larger farms to maintain profits. There are fewer people and more machines so farmers need capital to finance the new equipment and often end up with high debts.

Overall, **farming is, and also was in the past, largely a supplementary form of income** for most people in the region. The district is very agricultural but since the 1990s there has been more industry, processing and services related to vegetables and fruits, especially in the northeast municipalities. In the southeast, there is more metal industry and services. Overall, Silesia is known for mining. Today, as well as at least a generation ago, many people work in a large steel factory in Czestochowa and have small tracts of land as a supplement to their main income. Hundreds of retired miners and their families continue to live off pensions as the last iron mine in the region closed in 1982. The farmer representative states that much land is no longer used for agriculture because the Mykanow community borders with Czestochowa and many residents work there.

Perception of regulations

According to the agri-environmental authority, about half the farmers benefit from the multiple agricultural advisory services in the region. However, when it comes to practicing, e.g. **the 'good agricultural practices', only half of the farmers apply** these rules. The situation could be improved through meetings, recommendations, education, raising awareness and invitations to cooperate with the agencies of the agricultural market as most of them receives additional payment.

Effective, transparent **regulation or control around ditches is lacking** to prevent areas from flooding. The agri-environmental authority reports of three trends that lead to conflicts: 1) Flooding occurs when agricultural land use changes, roads are being rebuilt and the terrain is raised. 2) Or if farmers want to use the land for agriculture, they check maps for ditches and if there are none, they try to create them which often fails. 3) And a very noticeable trend is that miners buy off lands to build a cottage. Any ditches in their way get buried which in turn is flooding the neighbor. Farmers suggest re-canalization, but the authorities would like to reserve these areas for potential settlements. In the past there was a small tax from farmers to maintain the ditches, but now nobody really cares about it.

Farmer 1 further sees **injustice in the tax system** where private firms have advantages over farmers when selling agricultural equipment tax-free whereas farmers have to pay taxes. He blames the EU for not helping farmers buy equipment and demands more justice, also amongst farmers that receive benefits.

Incentives are crucial but very limited according to the agricultural advisor. Especially national incentives are decreasing and the additional funding to reach EU standards during Poland's phase-in to the EU stopped. The advisor thinks that additional payments for agri-

cultural fuel are necessary. The NGO representatives noticed that farmers complain about having to fill out questionnaires. Agricultural advisory centers could act more like a bridge between farmers and legislation. Farmer 2 further states that he farms according to incentive structures and make maximum use of the grant system. He participates in an agri-environmental program which foresees a rotation system and decides on the crops to grow. This is guided by training.

Perception of environmental threats
In general, the quality of the river is perceived as improving for several reasons.

The clerk finds that the water quality has improved to the point that there are many trout where there was once none. Other interviewees report from anglers from Kocinek that are alarmed by the river's oxygen content decreasing and trouts suffering.

According to the agri-environmental authority, **the development of a sanitary sewage system started about 10 years ago**. Before that, waste water from agriculture was often randomly discharged according to the options and knowledge of the farmers. However, some interviewees also voiced doubts that agriculture is the main source of environmental pollution. The mayor thinks that municipal and domestic waste water are the main sources of pollution which is underlined by data from the waterworks in Czestochowa showing higher nutrient levels near major cities and not by the farming areas. The water manger states that agriculture contributes to 10% of nitrate contamination of groundwater, whereas bad sewage treatment accounts for 70%. For households, it is a traditional way to merely dump waste water on the field with the benefit of low costs and the perceived impression of fertilizing it. The installation of sewage treatment has made the river significantly cleaner though connecting households to the sewage system remains an issue in the region. The mayor's impression is that the poorer the village, the more difficult it is to introduce changes and connect households to the sewage system. The water manager states that households are obliged by law to connect to a sewage system if there is one, or otherwise use a septic tank. To his knowledge, in the town Częstochowa around 5% of households are not connected, in Mykanów it is around 30% and in some communities around 50% of household are not connected. Farmer 1 observes that with few people farming, many never use a septic tank as a farmer does for agricultural purposes. And in some towns like Wreczyca there is no treatment plants or they are not working properly, so waste ends up in the river. Or dirt like oil etc. is spilled by floodings from the streets to the rivers. The mayor noted that even with municipal hazardous waste collection, villagers had a problem with paying the nominal fee of PLN 6 per month. He sees this as a matter of conservatism and them needing a few years to get used to it.

Since farming is fragmented and less profitable and fertilizer prices are high, **many family farms have stopped altogether with fertilizers** and use liming instead which in some areas is subsidized depending on the soil. According to farmer 1, even the local fertilizer company quit. Farmer 2 states that he has experimented with fertilizers over the years and tries to use the minimum amount because of rising prices but not to the extent that crop yields suffer. He uses mainly artificial fertilizers and tries to mix in plant refuse, but **there are no animal farms in the region to source organic fertilizers**. Crop type rather than soil decides on his fertilizer output. On the other side, some **large enterprises** transport their sewage and use it on agricultural lands, often outside of existing regulations. The farmer representative states that farmers live in harmony with nature and does not see an

environmental risk there but rather through boars destroying his crops. The NGO representative, notes that there are two factors that could reduce fertilizer use: 1) Farmers need to continue to earn at least as much with fewer organic crops as they do with artificially fertilized crops. 2) Education and the provision of good examples to encourage them and counter conservatism.

Also, **mining activities in the region ended** in the 1980s, so the river has been able to significantly recover since then.

Environmental awareness

There was some disagreement among interviewees about the extent of environmental awareness among farmers. In terms of fertiliser use, all agree that there is **more awareness today** than in earlier times and that the quality of the river has improved.

On one hand, farmers' awareness is relatively **high with regard to water treatment**: Even if they are not connected to the sewage systems, most a have local sewage treatment. But even as awareness has increased, only about half of farmers are conscientious in applying good agricultural practices, according to the agri-environmental authority.

Farmers generally do not want to harm the environment but are rather unaware or lack the knowledge, according to the farmer representative, and it is sometimes hard to convince them. According to the mayor, farmers are not ashamed of their role. They are rather concerned with making a profit which is more easily done by the ones with a vision, hard work and some sort of risk. The farmer representative confirms that farmers' main aim is good quality grain so they gain high prices on the free market.

Nowadays people are more aware of the effects of artificial fertilizers and perceive them as unhealthy. According to the NGO representative, organic products and being active in nature (cycling, running, Nordic walking) becomes trendier.

Annex 4: Policy options, instruments and measures

In this Annex, seven different policy options, instruments and measures are described in more detail in the following boxes. Table 8-1 gives an overview of the different policy instruments, that are addressed.

Table 8-1: Types of Policy instruments

Regulatory instruments	Compulsory regulation, bans, standards, limits
Market-based instruments or economic instruments	Revenue-generating instruments (taxes, charges) Subsidies (direct payments, tax allowances) Property rights (licenses, tradable permits) Others (user benefits, environmental liability, payments for ecosystem services)
Cooperation-based instruments	Voluntary commitments, negotiations, networks
Information-based instruments	Information campaigns, education, advisory services and capacity building, labelling, environmental reporting, environmental monitoring, access to information and justice rights

Option 1: Shift from agricultural to non-agricultural land use
Type of policy instrument Regulatory instrument
Suggested for (case studies) - Tullstorp (SE) - Norsminde (DK) - Kocinka (PL)
Short description and rationale for use Measures such as re-establishing wetlands; establishing two-stage water courses, pesticide-free margins or uncultivated buffer zones along watercourses and lakes could deliver ecosystem services e.g. reduced pollution, provision of clean water, and increased biodiversity. This would help to reduce nutrient inputs and contribute to improved water conditions for recreational fishing or aquaculture. Top-down targets can be set by government authorities requiring a certain percentage of land to be dedicated to provision of ecosystem services. *Creating two stage watercourses, where the stream is broadened and accompanied by plantings along the banks, can also help reduce runoff.* Two-stage ditches can be used to control erosion, flooding and nutrient losses. Bench vegetation reduces erosion in the channel and when erosion is reduced, the loss of particle-bound phosphorus is also reduced. The plants also take up soluble nutrients in the same

way as in wetlands. A two-stage ditch is more expensive to construct than a normal ditch. It also takes more area and so the cultivation area is smaller, which can be a critical point for some farmers. At the same time, the risk of crop damage caused by flooding is reduced

Tools for implementation

- Targets for ecosystem-based measures on farmland

Actor (authority) responsible for defining the policy instrument

Authority responsible for implementing WFD/Nature protection/Rural development programmes

Actor (authority) responsible for implementing the policy instrument

Authority responsible for implementing WFD would need to decide which land management practices should be promoted in what way and by whom. Farmers, with support and guidance from authorities will carry out measures on-the-ground.

Target group

Farmers

Legal aspects

These measures would be need to be contained in administrative law or in an EU directive or regulation. A need for monitoring would arise if there were such binding rules on the uptake of such measures or any financial incentives linked to it.

Example: Tullstorp Brook

By 2012, 21 wetlands had been constructed in the catchment area as part of the Tullstorpsan project, which was initiated by a farmer and a former municipal environmental official. More than 50 farmers and landowners joined the project, which is perceived as a big success and has gained attention for its innovative catchment-based approach. The Stockholm Environmental Institute identified key success factors in the project and found strong leadership with knowledge about how to deal with political interactions and drive complex processes, enthusiastic farmers as well as strong support from politicians. The Rural Development Programme allocates financial support for the restoration and construction of wetlands. Other important financial mechanisms include the Marine Environment Grant. In some cases municipalities have supported and invested in wetland projects

Option 2: Emissions trading scheme

Type of policy instrument

Economic/Market based instrument

Short description and rationale for use

Rather than a uniform input quota regime, the regulatory framework could be centered on a transferable quota trading system based on nutrient discharge. Individual farmers in the catchment would hold permits issued by local or regional regulatory agencies that allow discharges into water bodies. The discharges would be determined using retention maps. This way, farms in high-retention areas would receive higher allowances for fertiliser use than low-retention areas. This is also an alternative to a land exchange system, as it is not land, but rather “retention” that can be traded and transferred.

Farmers could purchase discharge credits from a centralised credit bank. The system would require market infrastructure with a credit registry, a documentation flow tool and a secure transaction platform. The nitrate emission permits in the case study area could be registered in the same databases that the Danish Ministry of Environment and Food uses to manage the EU's Common Agricultural Policy.

Suggested for (case studies)
- Tullstorp (SE)
- Norsminde (DK)
- Kocinka (PL)

Tools for implementation
- emissions permits and market for trading

Actor (authority) responsible for defining the policy instrument
The system would require a market infrastructure with a credit registry, documentation flow tool and a secure transaction platform.

Actor (authority) responsible for implementing the policy instrument
The Nitrate emission permits in the case study area would typically be registered in the same databases in the Ministry of Food and Agriculture that also manages the EU's CAP. The individual farmers in the catchment would hold permits issued by local or regional regulatory agencies that allow discharges into water bodies.

Target group
Farmers

Legal aspects
With trading schemes, where different participants can trade pollution permits or credits for reducing environmental harm (e.g. emissions trading) a specific legal framework is required; this is true in particular as these schemes are normally established at the regional or national level to allow for a meaningful number of participants (Greiber 2009: 13[66]). The relevant legal framework would have to define, among other, the allocation of credits and set up a mechanism for trading them. Monitoring and verification on whether activities leading to the generation of credits have actually been carried out will need to take place.

Example:
An example for this kind of approach is the Water Quality Trading Project in the Ohio River Basin. It exists since 2007 and is the world's largest water quality trading program. It is entirely voluntary and based on an exchange of water quality credits for nitrogen and phosphorus.

Lit: Electric Power Research Institute, Ohio River Basin Water Quality Trading Project, http://wqt.epri.com/pdf/3002001739_WQT-Program-Summary_2014-03.pdf

Views from the Case Study Area:
This approach was discussed in Denmark by the stakeholders during the first workshop and was perceived as realistic. They were also open to a scenario in which farmers could buy shares of nitrate-reducing wetlands within the catchment, which would then allow them to gen-

[66] Greiber T (Ed.) (2009) Payments for Ecosystem Services. Legal and Institutional Frameworks, IUCN, Gland, http://cmsdata.iucn.org/downloads/eplp_78_1.pdf

erate a larger nitrate emission in their own holding. In another possible scenario, a farmer could grow nitrate-reducing catch crops and then sell unneeded emission permits to other farmers in the same catchment.
A concern among stakeholders was the possibility that not enough farmers were willing to purchase permits in the first place, so that the market would not have enough participants to function properly. The benefit for the farmers would have to be made very clear along with possible economic incentives for them to participate.

Option 3: Voluntary bodies for water management

Type of policy instrument
Cooperation based

Short description and rationale for use
A bottom-up approach in water management would address situations where legislation is perceived as top-down, with little respect for stakeholders wishes and needs.
Under this option, a water council made up of farmers, water managers, providers and other stakeholders such as fishermen could submit proposals for remediation plans and management plans and agree, in consultation with the water authority, on the measures to be adopted. The water authority would approve the remediation and management plans devised by the farmers within a catchment area. By actively allowing these stakeholders to work on remediation plans approved by the authorities, farmers and other actors would be able to make their ideas and concerns heard and a more efficient information network between experts, stakeholders and authorities could be created.

Suggested for (case studies)
- Norsminde (DK)

Tools for implementation
- water network

Actor (authority) responsible for defining the policy instrument
Farmers or water users themselves would jointly agree on how to (better) meet the existing targets for reducing N and P loadings. If it is necessary to allocate responsibility a relevant authority or body for coordination would need to be identified or established in cooperation with stakeholders to agree on certain rules for making decisions, implementing agreements, etc

Actor (authority) responsible for implementing the policy instrument
With this participatory catchment-based approach, responsibility has to be taken by the stakeholders for the water quality. This could work in Norsminde as awareness about the importance of improving water quality is already high. Many stakeholders and hence many different interests have to be taken into consideration (also those of the water/environment).

Target group
Farmers and other landowners (incl. foundations, communities, churches, NGOs)

Legal aspects
A voluntary water network is unlikely to need new or additional legislation. It would be done

on the basis of existing water laws and be focused on information sharing and cooperation to improve water quality. Only if financial support is provided from public budgets, would there need to be a specific legal basis allowing this financial provision.

Views from the Case Study Area:
In this context, the installation of a Norsminde Fjord water network for at least a test period has been positive received by stakeholders according to the interviews. The water network could be incorporated into the local farmers union “Landboforeningen Odder-Skanderborg” and serve as a specialised part of the existing agricultural advisory system. Its role would be to submit proposals for remediation and management plans and agree, in consultation with the water authority, on the measures to be adopted. By actively allowing the farmers and farmers' associations to work on remediation plans approved by the authorities, farmers would be able to make their ideas and concerns heard and a more efficient information network between experts, stakeholders and authorities could be created.
There is a good chance of success with this participatory catchment-based approach in Norsminde as awareness about the importance of improving water quality is already high. The water network would help identify solutions specifically based on retention map data. It is further a chance to involve other actors responsible for nitrogen emissions e.g. from sewage treatment plants and hence lower the perceived high burden of famers to have high costs and low benefits for the public good ‘water quality’.

Option 4: Cooperative land management systems / land exchange

Type of policy instrument
Cooperation based

Short description and rationale for use
Usually, a voluntary exchange of agricultural land between landowners is undertaken to reduce operating costs and to improve the competitiveness of agricultural enterprises. With spatially differentiated knowledge on the danger of N and P leaching, exchanging land can be one option to increase yield while decreasing the needed amount of fertilizers. This would be useful for landowners affected by differentiated regulation as those with less potential for natural retention on their land may be forced to fertilize less or install more expensive safety measures. It could furthermore lead to changes in land price, which would require compensation or subsidies for measures. The procedures for land bank use involved would have to be simplified and made less expensive. In addition to the spatially differentiated knowledge, this approach would presumably also require a solid basis of trust between all involved parties as well as a financial backup for the administrative costs. Alternatively, a different option could be working together with foundations or NGOs that could support land exchange programmes (e.g. through buying up fields that are in danger of leaching N and losing P).

Suggested for (case studies)
- Norsminde (DK)

Tools for implementation
- retention maps, classification of vulnerability types
- land bank
- mechanism for voluntary exchange of land

Actor (authority) responsible for defining the policy instrument
Farmers themselves would jointly agree on how to (better) meet the existing targets for reducing N and P loadings.

Actor (authority) responsible for implementing the policy instrument
Farmers would need to create an authority and would need to agree on certain rules for making decisions, implementing agreements, etc.

Target group
Farmers and water users (incl. fishermen, aquaculture companies)

Legal aspects
A voluntary exchange of land is unlikely to need new or additional legislation. It would be done on the basis of existing property laws, through a civil law contract between the landowners.
Only if financial support is provided from public budgets, would there need to be a specific legal basis allowing this financial provision.

Example:
For example, within the rural development program (RDP) of Lower Saxony (Germany) a voluntary exchange is financially supported under the programme ZILE, *Zuwendungen zur integrierten ländlichen Entwicklung* (grants for integrated rural development) particularly for land consolidations

Views from the Case Study Area:
There has previously been a land swap in Tullstorp for one of the wetland installations as precedent.

The aim of a land bank would be efficient and productive land use planning in the Kocinka region. This would serve agricultural, economic and ecological goals:

- Offering suggestions for land grouping and swapping

One of the main challenges in Kocinka and in Poland more broadly is patchy land use. Family farms are often made up of many small plots with irregular shapes, making efficient management difficult. A policy aim could be supporting land consolidation to foster productivity.

- Using retention maps to determine the most efficient use of land

For land that is infertile or particularly susceptible to erosion and nutrient loading, a land bank programme can facilitate compensation and encourage alternatives to cultivation, such as afforestation, establishing shrubbery and uncultivated biodiversity refuges and the creation of insulation belts along water streams.
The legal basis for this policy recommendation could be found in the 1982 Act on Land Consolidation and Exchange, 2003 Act on Spatial Planning and Development as well as
Instruction No. 1 of the Agriculture and Food Minister on land consolidation.
Funding opportunities can arise from the EU, which funded up to 75% of consolidation works in the 2007-2013 period under the Rural Areas Development Programme, Axis

Option 5: Economic instruments to encourage lower use of mineral fertilizers

Type of policy instrument
Economic/Market based instrument

Short description and rationale for use

Precision farming allows farmers to adapt fertilizer and manure to the specific requirements of the soil and demands of the plants, which leads to an optimized use of fertilizer and therefore reduction of nutrient loss to the aquatic environment. However, the technology is rather expensive and some farmers may be reticent to adopt this new technology. In order to increase the attractiveness, supportive regulations and financial incentives are important policy instruments. Organic production would remove the application of mineral fertilisers from the system, eventually reducing N and P loading. Organic farming also promotes the use of crop rotations and cover crops which in turn supports healthy soils and ecosystems. Payments can be calculated according to the income foregone due to extensification of land use and lower protein value of crops.

Suggested for (case studies)
- Kocinka (PL)

Tools for implementation
- subsidies for organic farming
- subsidies for precision farming
- compensation for foregone income

Actor (authority) responsible for defining the policy instrument
The instrument is either defined by the Managing Authorities of Rural Development Programmes or private actors (e.g. Water companies) depending on type of payment (public or private).

Actor (authority) responsible for implementing the policy instrument
The instrument is either implemented by the Managing Authorities of Rural Development Programmes or private actors (e.g. Water companies) depending on type of payment (public or private).

Target group
Farmers, RDP managing authorities, public and private water companies, industry

Views from the Case Study Area:
Many farms in the Kocinka region are currently stockless and stakeholders have noted that it is difficult to work the land with neither livestock nor readily or cheaply available equipment. Mechanisation through precise fertiliser application equipment could take into account topographic variables such as water retention and other soil properties. For stockless farms, off-farm organic fertilisers (e.g. urban food waste) can be an alternative to mineral fertilisers. The objective would be to improve nutrient management and possibly to enable mechanical weeding as well.

Option 6: Awareness raising on alternative land use and management

Type of policy instrument
Information-based instrument

Short description and rationale for use
One approach to reducing the pressures of agricultural land use on ecosystems in the Baltic is through awareness raising in order to ensure that environmentally friendly practices are used. This can be through information campaigns or training material on land use management as well as land use change. This could be accompanied by an advisory service that could be pro-

vided by a (local) authority.
This could include for example appropriate crop management and good fertiliser management to enhance use efficiencies of fertilisers and thus reduce losses; the need to restrict grassland upheaval in certain soils, appropriate disposal of sewage, all with the aim to reduce the nutrient leaching in general.

Building communication networks
Creating a communication network can bring stakeholders together for advisory services and awareness raising. Despite existing monitoring mechanisms, target figures for the reduction of nutrient runoff as set by Poland's environmental authorities have not come close to being met. This body would allow farmers to participate in consultations on measures to reduce nutrient loading. It would raise awareness about manure/fertiliser storage and waste disposal as well as best fertilisation practices more generally. A model project could be the United Nations Development Programme-Global Environment Facility (UNDP-GEF) Danube Regional Project (DRP), which has trained farmers in the Danube basin in fertiliser planning and other methods.
An objective of the network would be to reach out to all households rather than only farming households and assist in, for example, building household sewage treatment plants to replace septic tanks for households not connected to the community sewage system.
It could potentially be integrated into the Agricultural Advisory Centres, which operate with offices in all counties in Poland.

Suggested for (case studies)
- Kocinka (PL)

Tools for implementation
- integrated agriculture
- awareness raising about N and P
- use of off-farm organic fertilizers / reduction of mineral fertilisers
- retention maps
- agro-tourism
- adding value to agricultural products

Actor (authority) responsible for defining the policy instrument
Responsibility of formulation and implementation of RBMPs is split over various actors at different levels in Poland. A relevant authority for this policy options would need to be identifiedin cooperation with stakeholders.

Actor (authority) responsible for implementing the policy instrument
Authority responsible for implementing WFD and rural development programmes would need to decide which land management practices should be promoted in what way and by whom.
Farmers are addressed as the target group and should eventually improve their techniques.

Target group
Farmers, rural communities, outreach and advisory services

Legal aspects
If the competent authorities engage informally in training measures, information dissemination etc., no specific legal rules would normally be required. However, the legal framing of this option depends on whether the uptake of any new or changed agricultural methods is compulsory for the farmers or would entitle them to any benefits, notably receiving subsidies.

Option 7: Diversification in the rural economy

Type of policy instrument
Cooperation-based instruments

Short description and rationale for use
Diversification in the rural economy involves diversifying both agriculture and other activities in the rural economy as part of a long-term strategy to reduce nutrient runoff. At present, some 90% of all crops cultivated in the region are grains. If crops and off-farm sources of income are diversified, it will ensure that farms can thrive according to a low-intensity (perhaps organic) model and put fewer pressures on soil and water (i.e. decrease N and P leaching).

- Linking farm and off-farm businesses

The majority of farm households are not able to depend on farming as their main source of income and supplement their income through non-farm work. In order to make farming more relevant to the local economy, measures should aim to integrate small-scale farming with off-farm businesses such as agrotourism. This would allow the region to take advantage of the existing family-scale and low-intensity approach to agriculture rather than adopting a large-scale, intensive cultivation model. This will decrease the pressure on land and water while allowing the region to preserve its (agri-)cultural heritage, as supported by the Acts on National and Regional Land Use Planning.

- Adding value to agricultural products

A goal is to preserve the existing family farm model while increasing profitability through promoting low-tech alternative forms of agriculture such as organic and permaculture. This could be achieved by adding value through food processing and marketing, with a special orientation toward in-demand artisanal products. This would involve building networks and supply chains for the promotion of these products.
The aim would be to introduce/implement a system of control and certification to ensure consistent supply, large-enough batches to process and market higher-end products at a premium price.
A potential source of information toward this end could be FertilCrop, which is an EU and national level project (2015-2017) that supports the sustainable management of organic farming systems.

Suggested for (case studies)
- Kocinka (PL)

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