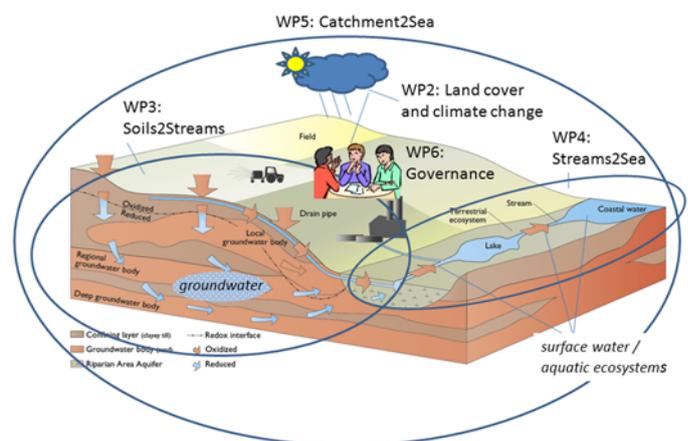


Summary of Scientific/technical Report 2016

Context and objectives

Both the Baltic Sea Action Plan and the EU Water Framework Directive require substantial further reductions of nutrient loads (N and P) to the Baltic Sea during the coming years. Achievements of these goals will only be possible by the implementation of fundamental changes in agricultural practices and land use. This will require the introduction of additional new and innovative measures, because the easiest applicable measures have, in most cases, already been utilised. The BONUS Soils2Sea project proposes to exploit the fact that the retention (removal by biogeochemical processes or sedimentation) of nutrients in groundwater and surface water systems shows a significant spatial variation, depending on the local hydrogeological and riverine regime to achieve the goals for nutrient load reduction set out in the Baltic Sea Action Plan. The traditional uniform regulations do not account for local data and knowledge and are much less cost-effective than spatially differentiated regulations with measures targeted towards areas where the natural retention is low. In order to fully exploit the potential of differentiated regulations it is required to utilise all local information and find locally designed and optimised solutions. Besides the need for improved knowledge on the subsurface and nutrient transport and retention processes on a local scale, this calls for new innovative governance regimes with active involvement of key stakeholders. Not the least as the new measures most probably will differentially affect stakeholder groups with conflicting interests.

If we more accurately can predict where in a catchment N and P are retained by estimating the retention in the different compartments along the flow path, and also include the delayed effects of mitigation measures due to long solute travel times in groundwater, then we can more cost-effectively design measures to reduce the nutrient loads to the Baltic Sea. Soils2Sea will therefore study the retention of N and P between the soils/sewage outlets and the coast, including transport pathways such as overland flow and flows in macropores, subsurface tile drains, shallow and deep groundwater, rivers, wetlands and lakes. The concept and the Soils2Sea work packages are illustrated in the figure.

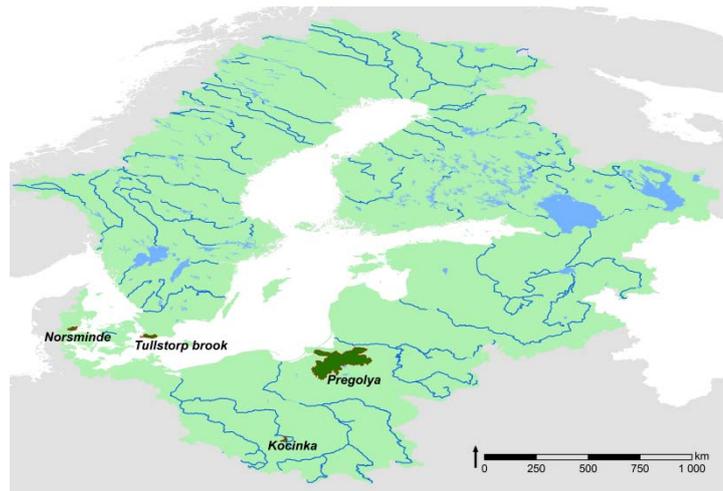


Work carried out and main results achieved until now

The BONUS Soils2Sea project has now been running for three years and is entering into its final year.

During the first three project years comprehensive field work activities have been carried out at the four case study sites.

The four sites (see figure) and their respective focus are i) the Norsminde catchment in Denmark focussing on improved understanding of retention processes in groundwater; ii) the Tullstorp brook catchment in Sweden focussing on improved understanding of retention processes in streams and the hyporheic zone; iii) the Kocinka catchment in Poland focussing on nutrient transport and delays in



the groundwater and surface water system; and iv) the transboundary Pregolya river catchment in Poland and Russia focussing on establishing a catchment scale hydrological model including nutrient transport and retention. Most of the field work has now been completed. At all four sites the analyses of the field work is supported by comprehensive modelling studies.

Modelling of flows and nutrients at the Baltic Sea Basin is performed by the HYPE model, which has been further developed and recalibrated in 2016. A major effort has been made to develop, test and implement upscaling procedures so that the knowledge obtained at the local study sites can be used to improve the HYPE model simulation at the Baltic Sea Basin. To support the upscaling procedure and the recalibration of HYPE a “retention map” with nitrate reduction in groundwater has been prepared based on national knowledge and expert elicitation.

Scenarios for future developments of land use, agricultural practices and climate around 2050 have been developed. Four climate model projections have been selected from the CORDEX downscaled RCP 8.5 projections. The socio-economic scenarios took their departure in the Shared Socio-economic Pathways (SSPs) for the Baltic Sea region developed jointly with BONUS BalticApp. A new methodology has been developed to project changes in land use in the Baltic Sea Basin as affected by both anthropogenic drivers and climate change. Finally, scenarios reflecting alternative agricultural management practices, including spatially differentiated regulation and other mitigation measures have been included in the set of scenarios. Scenario analyses have been performed for the Pregolya catchment in 2016. Scenario modelling studies will be made for the other three study sites as well as for the entire Baltic Sea Basin in 2017.

The second series of stakeholder workshops have been conducted in study site areas in Poland, Sweden and Denmark with focus on water governance concepts. All workshops followed a similar approach, discussing three different scenarios. Although the scenarios discussed were adapted to the local conditions, they allow for a comparative analysis between the three countries. As a main output of the ethnographic study the 35 minute documentary film "Soils2Sea: Reducing nutrient loadings into the Baltic Sea" was completed 2016.

Four BONUS projects have decided to join forces in arranging a conference for disseminating project results to stakeholders and scientists at the end of the project. The four BONUS projects are Soils2Sea, Go4Baltic, MIRACLE and BalticAPP, who all deal with aspects of nutrient load from agricultural catchments, but

produce complementary outputs and to some extent use different methodologies. The three other projects run until March 2018 and would prefer to have the final conference in March 2018, which is three months after the scheduled termination of Soils2Sea. We have therefore formally requested and received approval for extending the Soils2Sea project period until 31 March 2018.

More information, including the reported deliverables, can be found at the project website www.Soils2Sea.eu

Acknowledgement

The BONUS Soils2Sea project receives funding from BONUS, the joint Baltic Sea research and development programme (Art 185), funded jointly from the European Union's Seventh Programme for research, technological development and demonstration and from Innovation Fund Denmark, The Swedish Environmental Protection Agency (Naturvårdsverket), The Polish National Centre for Research and Development, The German Ministry for Education and Research (Bundesministerium für Bildung und Forschung), and The Russian Foundation for Basic Researches (RFBR).