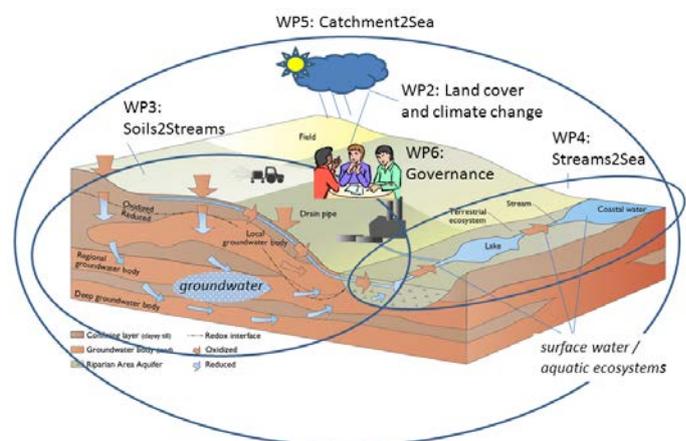


Summary of Scientific/technical Report 2015

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.

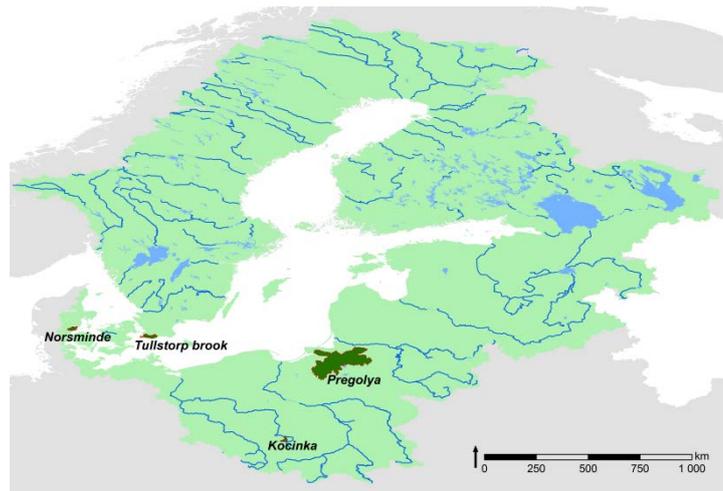


Work carried out and main results achieved until now

The BONUS Soils2Sea project has now been running for two years, which is half of the total planned project period.

During the first two project years comprehensive field work activities have been carried out at the four case study sites. The four sites (see figure on next page) 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. The field work is still ongoing and is being supported by modelling analyses.



At the Baltic Sea Basin scale work has been initiated to further develop and calibrate the HYPE model. For this purpose the water quality observation data already available for HYPE use have been significantly expanded by collection of new data from national agencies in Finland, Estonia, Latvia and Germany, while the data coverage for Poland is still very weak. Furthermore, work regarding upscaling of local findings from the four case areas to modelling at the Baltic Sea Basin scale is progressing well.

A major review of current literature on the use of land use scenarios has been undertaken and reported. This state-of-the-art knowledge has formed the basis for designing a set of Soils2Sea scenarios with the objectives of being able to i) analyse how changes in regulatory paradigms will affect nutrient loading to the Baltic Sea; and ii) analyse how climate changes and associated land use changes will affect nutrient loading to the Baltic Sea. Scenario analyses will be conducted for each of the four case areas with focus on local issues and stakeholder views and for the entire Baltic Sea Basin to assess the impacts on nutrient loadings to the Baltic Sea. A key aspect of the scenario analyses will be to assess how spatially differentiated measures affect N and P loading.

A study on the impacts of dam regulation on phosphorous load has been conducted and reported. The study focussed on the River Dalälven in Sweden, where a large network of hydropower plants and reservoirs exist. The study showed that it is possible to optimize the reservoir operation so that the phosphorous load to the sea is reduced, but there is a trade off (pareto front) between energy production from hydropower and phosphorous loads. It was shown that a 2% reduction of the nutrient discharge can be achieved with a limited loss of future power production (<5 %), but that additional reduction is associated with a significantly higher loss in power production.

The ethnographic study aiming at understanding the culture-induced knowledge and perceptions of the different stakeholder groups and at identifying differences and similarities in cultural perspectives between countries have been initiated with interviews with stakeholders in Poland and Denmark. This information will be taken into account in the design of new monitoring and governance concepts.

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

Expected final results

- New methodologies for the planning of differentiated regulations based on new knowledge of nutrient transport and retention processes between soils/sewage outlets and the coast.
- Evaluation of how differentiated regulation can offer more cost efficient solutions towards reducing the nutrient loads to the Baltic Sea.
- Analysis of how changes in land use and climate may affect the nutrient load to the Baltic Sea as well as the optimal location of measures aiming at reducing the load.
- A high-resolution model for the entire Baltic Sea Basin with improved process descriptions of nutrient retention in groundwater and surface water tailored to make detailed simulations of management regulations differentiated in space.
- New knowledge based governance and monitoring concepts that acknowledge the relevant aspects of EU directives and at the same time are tailored towards decentralised decision making. The proposed spatially differentiated regulations will aim for incorporation of local scale knowledge to optimally design solutions.

Acknowledgement

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