

# TOWARDS A SOCIOECONOMIC ACTION PLAN FOR THE BALTIC SEA COST-EFFECTIVE ACHIEVEMENT OF GOOD WATER QUALITY IN THE BALTIC SEA

*There is an increasing gap between the state-of-the-art policy alternatives, studied and recommended by the research community, and the existing mix of command-and-control-based approaches and voluntary mechanisms that are used to regulate nutrient loads to the Baltic Sea.*

*It is time to evaluate the socio-economic design of the existing nutrient policies, and develop it to the same level of sophistication as the ecological foundations of the HELCOM Baltic Sea Action Plan (BSAP).*

*The nutrient load reduction targets required by the BSAP (HELCOM 2007, 2013) are based on innovative ecological modeling of the Baltic Sea environment. The implementation of the objectives and requirements in the BSAP are supported by national regulations and action plans in the countries adjacent to the Baltic Sea. The plan has had impact on the Baltic Sea environment, but targets have not been met, and costs have been unnecessarily high.*

*This policy brief outlines key proposals for a Baltic Sea Socioeconomic Action Plan, based on results from the BONUS project GO4BALTIC: Coherent policies and governance of the Baltic Sea Ecosystems.*



Fulfilling the Baltic Sea Action Plan (BSAP) is costly for all countries around the Baltic, but implementation of more cost-effective nutrient policies might save costs for the Baltic Sea region as a whole.

- Cost-effectiveness means that the smallest possible amount of resources is allocated to the pollution abatement, which is necessary to achieve the target (e.g. BSAP targets on nutrient load reductions).
- Cost-effective implementation of the water quality in the Baltic Sea has been analysed in a number of studies. The studies show that the BSAP targets can be achieved cost-effectively to a total cost between 2 and 4 billion Euro. The costs will be significantly higher if the abatement strategy relies too heavily on reductions at either point sources or nonpoint sources.
- An analysis of how the nitrogen load reductions between 1996 and 2010 could have been implemented cost-effectively revealed that only 12% of actual costs would have been necessary to achieve the observed reduction. The reduction in costs could have been obtained by an efficient reallocation of abatement between the countries around the Baltic Sea, all having signed the HELCOM treaty. Alternatively, the total abatement budget could, if it had been used cost-effectively, have doubled the nitrogen load reduction.

#### RECOMMENDATION:

Cost-effective abatement with equalization of marginal load abatement cost should be the guiding principle of nutrient policies towards point and nonpoint sources. This principle reflects best the technological and economic possibilities to reduce loads.

#### DO YOU WANT TO READ MORE?

- Elofsson, K. 2010. Cost-effectiveness of the Baltic Sea Action Plan. *Marine Policy* 34: 1043-1050. <https://doi.org/10.1016/j.marpol.2010.03.003>
- Gren, I.M. & Elofsson, K. 2017. Credit stacking in nutrient trading markets for the Baltic Sea. *Marine Policy* 76, 1-7. <https://doi.org/10.1016/j.marpol.2017.01.026>
- Hasler, B., Smart, J.C.R., Fønnesbech-Wulff, A., Andersen, H.E., Thodsen, H., Blicher-Mathiesen, G., Smedberg, E., Göke, C., Czajkowski, M., Was, A., Elofsson, K., Humborg, C., Wolfsberg, A. & Wulff, F. 2014. Hydro-economic modelling of cost-effective transboundary water quality management in the Baltic Sea. *Water Resources and Economics*, vol 5, pp. 1–23., 10.1016/j.wre.2014.05.001

#### NUTRIENT LOAD ABATEMENT BY POINT SOURCES

The best available technique at Waste Water Treatment Plants facilitates higher emissions reductions than the current abatement rates in parts of the Baltic Sea region.

- In the wastewater sector, performance standards are used, setting limits on emissions.
- Research indicates that it would be justified to require WWTPs to abate at least 95% of phosphorus and close to 90% of nitrogen. Investments in higher abatement rates could be financed by increased consumer fees for sewage treatment. Thus, no governmental funding and associated debates of the alternative uses of these funds is needed for this improvement, only political will to strengthen water policy.
- An analysis of the Swedish patent data for technological improvements over a 50-year period shows that increased regulation induced innovation in the wastewater treatment sector. Short-run effect was estimated to 40-70% in the years after the introduction of new environmental regulations.

#### RECOMMENDATION:

Both the EU's Urban Waste Water Directive and HELCOM recommendations are inattentive relative to current abatement possibilities and abatement costs. We propose that they should be scaled up in order to ensure target achievement and efficient resource use.

Innovation policy must be directly linked to water policies in agriculture in the Baltic Sea region by tighter regulation and use of market-based instruments.

#### DO YOU WANT TO READ MORE?

- Hautakangas, S. & Ollikainen, M. 2019. Nutrient trading between waste water treatment plants in the Baltic Sea region. *Environmental and Resource Economics*. [doi.org/10.1007/s10640-018-0273-5](https://doi.org/10.1007/s10640-018-0273-5)
- Hautakangas, S., Ollikainen, M., Aarnos, K. & Rantanen, P. 2014. Nutrient Abatement Potential and Abatement Costs of Waste Water Treatment Plants in the Baltic Sea Region. *AMBIO* 43: 352-360.



## INCREASING UTILIZATION OF NUTRIENTS IN MANURE IN AGRICULTURE

Manure is an important source of nutrient losses to the aquatic environment, as well as to air.

- Sufficient storage capacity and efficient spreading technologies are important prerequisites for spreading manure efficiently during spring and early summer when the crops grow, and for utilizing the nutrients from the manure.
- The capacity requirements differ between 5 and 10 months in countries around the Baltic Sea. Data are scarce documenting current capacities, but there are options for improvements to facilitate a better utilization. The type of manure also affects the ability to utilize the nutrients. While the share of slurry is 80% in Denmark, this share is only 5-10% in Poland the rest being solid manure. Overall, nearly 50% of the manure in the Baltic Sea region is solid.
- GO4BALTIC has found large differences in the load reductions from manure investments between the countries. While the potential is modest in Denmark, which already has mandatory and high requirements to utilization of nitrogen in manure, the effects are higher in Sweden, Finland, Poland, and the three Baltic states.

### RECOMMENDATION:

There are potentials for increasing investment in manure storage to reduce manure leakage cost-effectively.

### DO YOU WANT TO READ MORE?

Konrad, M.T.H., Nielsen, H.Ø., Pedersen, A.B. & Elofsson, K. 2019, Drivers of farmers' investments in nutrient abatement technologies in five Baltic Sea countries. *Ecological Economics*, vol. 159, pp. 91-100. <https://doi.org/10.1016/j.ecolecon.2018.12.022>



## STRUCTURAL CHANGE IN AGRICULTURE: THE NEED FOR MORE EFFECTIVE MANURE MANAGEMENT

The structural change in livestock farms, which is ongoing in all countries around the Baltic, has important implications for the availability of land for manure applications.

- Increased farms sizes entail higher risks that manure will be over-applied on the fields closest to animal facilities. Solutions to tackle the problem vary over countries. In many countries the Nitrate Directive or nitrogen/phosphorus fertilizer limits command that expanding livestock farms are required to have enough spreading area. Denmark has promoted biogas production, which provides climate benefits but does not alleviate the transportation cost problem unless nutrient separation techniques are adopted.
- Large livestock farms are industrial plants and should be treated as such. Performance based environmental permits provide a tool to promote progress in solving the manure problem. Experience from the US poultry industry can be used as a good example, showing positive results of tighter regulation. This is also in line with the recommendations we have made based on patent data analysis of wastewater treatment plants.

### RECOMMENDATION:

Tighter regulation of land application of manure from livestock production and the processing of manure are important to obtain new technological solutions and business opportunities.

The increasing farm sizes and regional concentration may provide a standpoint for new solutions to the environmental problems related to manure.

- With strong spatial concentration, it may become profitable to process the manure in industrial scale facilities providing a way out of the problems of large scale animal production. It would also help prevent spatial accumulation of manure nutrients by processing them into forms less expensive to transport; and over-application of the relatively more abundant manure nutrient by decoupling nitrogen and phosphorus fractions.



## RECOMMENDATION:

Promoting industrial scale treatment of manure would provide a solution to the multiple environmental challenges created by current manure management in livestock farms.

## DO YOU WANT TO READ MORE?

Iho, A. 2010. Spatially optimal steady-state phosphorus policies in crop production. *European Review of Agricultural Economics* 37:187-208.

Kauppila, J., Ekholm, P., Niskanen, O., Valve, H. & Iho, A. 2017. Changing livestock farming regulating water load. *Yearbook of Environmental Policy and Law* 10: 227-273. (In Finnish)

## COMBINED POLICIES – COHERENCE BETWEEN POLICY GOALS

Agriculture contributes to nutrient emissions both to air and water. There are no effective climate policies towards agriculture at the moment, but by 2020 the land use sector will become a part of EU's climate policy. All countries have signed up to international agreements (BSAP nutrient load reductions, climate mitigation), and all countries regulate nutrient loads from agriculture. It is necessary to ask if policies can be implemented coherently, and whether society can save costs by a coherent implementation. As part of BONUS GO4BALTIC we have studied combined policies:

- Combining target N and P reductions in the whole Baltic Sea catchment reduces costs by 20% compared to individual implementation.
- Combining climate and nutrient policies reduce costs by 35% compared to individual implementation.

Examples of measures that simultaneously promote climate and water include crop rotation with legumes, buffer strips, catch crops, set aside and reduced husbandry production.

## RECOMMENDATION:

Introducing required climate policies to agriculture must be made in full coherence with water quality targets requiring novel performance-based types instruments for agriculture.

## DO YOU WANT TO READ MORE?

Nainggolan, D., Hasler, B., Andersen, H.E., Gyldenkærne, S. & Termansen, M. 2018. Water quality management and climate change mitigation: cost-effectiveness of joint implementation in the Baltic Sea region. *Ecological Economics*, vol. 144, pp. 12-26. DOI: 10.1016/j.ecolecon.2017.07.026

Lötjönen, S. & Ollikainen, M. 2017. Impact of crop rotation with legumes on nutrient loads and GHG emissions. *Agricultural, Food and Environmental Studies* 98: 283-312.

## COST-EFFECTIVE POLICY INSTRUMENTS

To improve the cost-effectiveness of both climate change and nutrient abatement policies better instruments should be introduced.

Water quality trading schemes are cost-effective policy mechanism with reliable target achievement.

- Large heterogeneity in costs of abatement across polluters provides opportunities for increased cost-effectiveness through implementation of economic instruments for water quality management. Examples include trade of manure and trade of nutrient measures or water quality requirements.



- Few trading schemes have been implemented in practice and even fewer successes have been reported. But hypothetical experiments indicate potentials. Creating trading markets with sufficiently many participants, and ensuring trust among stakeholders is important.
- Nutrient offsets can be utilized when, e.g., investing in biogas plants. The facility can create nutrient credits by decreasing the nutrient loading risk from the livestock farms from which it collects the manure. These credits should be taken into account when evaluating the net effect of the new facility on water quality standards. Similar practice should be applied to other new or expanding economic activity, i.e., permissions should consider the net effect on nutrient loading.
- As part of BONUS GO4BALTIC we have studied the incentives of entering into contracts. This shows diversification of the contracts across countries and farm types is highly recommendable.

An obstacle for introducing more diverse and performance-based incentives is the green box of the WTO agreements, which allow only compensation for costs- because of competition requirements. This refusal to accept results-based incentives hinders the performance based regulation, but the ongoing reform to change the CAP payment system to better facilitate diverse schemes might change this. The suggestions include offering grants as incentives to farmers to adopt environmental and climate friendly practices, going beyond the costs incurred or the income foregone, but still conforming to least-trade-distorting rules (green box) set by WTO.

### RECOMMENDATION:

We must ensure that the regulation is keeping pace with both structural change and the challenges it imposes, and with new innovations that help mitigating nutrient loading.

### DO YOU WANT TO READ MORE?

Hansen, L.B., Hasler, B. & Tjernansen, M. 2019. The potential for nitrogen abatement trading in agriculture: A hypothetical market experiment. *Journal of Agricultural Economics*, vol. 71, no. 1, pp. 1-41.

### PERFORMANCE BASED REGULATION OF AGRICULTURAL ABATEMENT

Economic subsidies are used to promote environmental friendly practices in agriculture in all countries around the Baltic Sea.

- Voluntary Agri-Environmental Schemes (AES) compensate farmers for taking the requested measures, irrespective of their impacts on nutrient loads. Thus, a farmer adopting a measure which gives no improvement in water quality, receives the same compensation as a farmer that efficiently reduces nutrient loads. This is a wasting of both public funds and farmers' efforts.
- A shift to performance-based schemes, drawing on modelled impacts of input choices on loads, would enhance environmental effectiveness, promote the best measures in each location, and provide a higher return to public funds.
- There are two promising avenues to improve performance of policies:
  - a shift from flat rate subsidies to incentive-based instruments, and
  - increasing environmental targeting by introducing environmental benefit indexes.
- Both avenues facilitate improved environmental targeting. The incentive-based instruments help to use of government budget money more efficiently, increasing both farmers' uptake of contracts and the effects of the contracts.

### RECOMMENDATION:

Change the present rigid EU regulation to facilitate modern, performance based incentives to be used in agri-environmental policy in the CAP post 2020.

### DO YOU WANT TO READ MORE?

European Commission 2019: The post 2020 common agricultural policy: environmental benefits and simplification. Agriculture and Rural development. <https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap>

Hasler, B., Czajkowski, M., Elofsson, K., Hansen, L.B., Häggmark Svensson, T., Konrad, M., Nielsen, H.O., Niskanen, O., Nömmann, T., Branth Pedersen, A., Peterson, Poltimäe, H. & Zagórska, K. 2018. Cross country comparison of AES schemes as incentives for nutrient abatement in Baltic Sea catchments - exploring farmers' preferences. WCERE 2018, Gothenburg.

Sidemo-Holm, W., Smith, H. & Brady, M. 2018. Improving agricultural pollution abatement through results-based payment schemes. *Land Use Policy* 77: 209-219.

Iho, A., Lankoski, J., Ollikainen, M., Puustinen, M. & Lehtimäki, J. 2014. Agri-environmental auctions for phosphorus load reduction: Experiences from a Finnish pilot. *Australian Journal of Agricultural and Resource Economics* 58: 205-222.

Winsten, J.R. & Hunter, M. 2011. Using pay-for-performance conservation to address the challenges of the next farm bill. *J. Soil Water Cons.*, 66(4):111A-117A. doi: 10.2489/jswc.66.4.111A

### ACKNOWLEDGEMENT

The work presented is part of the BONUS GO4BALTIC project: <http://projects.au.dk/go4baltic/>. The BONUS GO4BALTIC project is supported by BONUS (Art 185), funded jointly by the EU and national funding institutions in Denmark (the Innovation Fund), Estonia (Estonian Research Council ETAG), Finland (Academy of Finland), Poland (NCBR) and Sweden (FORMAS). The work has also received funding from the Stockholm University Baltic Sea Centre – project Baltic Eye.

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This policy brief disseminates results from the **BONUS Go4Baltic** project (2015-2018).  
The aim of the project is to

- provide policy relevant advice and recommendations for reductions of the eutrophication in the Baltic Sea in coherence with climate and agricultural policies
- examine national and international environmental and agricultural policies across the Baltic countries, to analyze and propose cost-effective solutions
- point at coherence and conflicts between the policies.

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