POLICY BRIEF NO. 3

STRUCTURAL CHANGE AND MANURE MANAGEMENT

Structural change of livestock production changes the needs for efficient manure management. Larger animal quantities at fewer farms means that manure nutrients are being concentrated in fewer locations. If efficient utilization of manure nutrients in crop production is to be achieved, manure needs to be hauled to more distant locations. This sets new pressure on regulatory frameworks and creates new perspectives for technological development. In this policy brief, we present estimates of structural change in the coming decades, and discuss the implications for manure nutrients. The policy brief is based on research conducted in the Go4Baltic project. We characterize the past and estimate future development of poultry, pig and bovine production in the Baltic Sea region, and quantify the effects of the development on manure nutrients.

FOOD CHAIN – NUTRITIOUS BY NATURE

The main source of anthropogenic nutrient loading is the food chain. Nutrient loading can be controlled quite effectively in wastewater treatment plants (WWTP) and other parts of the food chain where the loading takes place via isolated and controllable point source outlets. Indeed, regulators have been able to set unambiguous effluent limits to point source polluters, who have been able to comply with these. As a result, the last three-four decades have witnessed substantial reductions in point source nutrient loading.

Regulation at the initial stages of the food chain is more problematic due to the non-point character of pollution. Crops are produced in large, open areas and the link between polluters and their impact on water quality is difficult to establish. Animal husbandry has to manage the manure excreted by production animals. Countries in the Baltic Sea drainage basin (Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Germany and Sweden) apply a total of 218 thousand tons of phosphorus and about five times as much nitrogen in the form of manure in their agricultural production. For comparison, nutrient quantities in human excrements are only fractions of this, in Finland for instance, the total volume of animal manure contains six times more phosphorus than all human wastes. Furthermore, human wastes are mostly treated in technically developed wastewater treatment plants. Animal manure is utilized in agricultural crop production as a resource in food production, and efficiency of this utilization process governs the nutrient loading risk of livestock production.

STRUCTURAL CHANGE – AN ONGOING DEVELOPMENT

Structural change is continuously altering the landscape of agricultural industry. Small farms are more likely to exit production while the largest farms are the most likely to stay in business and grow. Because of returns to scale, larger farms have better capabilities to adopt new technologies. In crop production this enables, for instance, adopting precision farming which has economic and environmental benefits because of more prudent input use.

In livestock production, structural change means larger local accumulation of manure nutrients, increasing the risk of nutrient loading. First, nutrients are brought to the farms in the form of feed. Part of the nutrients leaves the farm as food products, but the largest share is excreted in the manure. Due to the high water content of manure, hence high weight, it is expensive to transport manure for long distances. Also, the ratio of nitrogen compared to phosphorus, implies that direct spreading of the manure is not optimal with respect to crop needs.

In the Go4Baltic –project a 'business as usual' estimate for the ongoing structural development towards 2030 was produced. In countries surrounding the Baltic Sea, most of the livestock production in 2010 took place in facilities holding more than 500 livestock units (LSU). Most of the intensification will take place in Poland, which traditionally has been dominated by small-scale farming, but is continuously moving towards modern and large scale farming systems. Parallel to the structural development the production of manure nutrients is similarly being concentrated at fewer but larger units.

POLICY BRIEF NO. 3

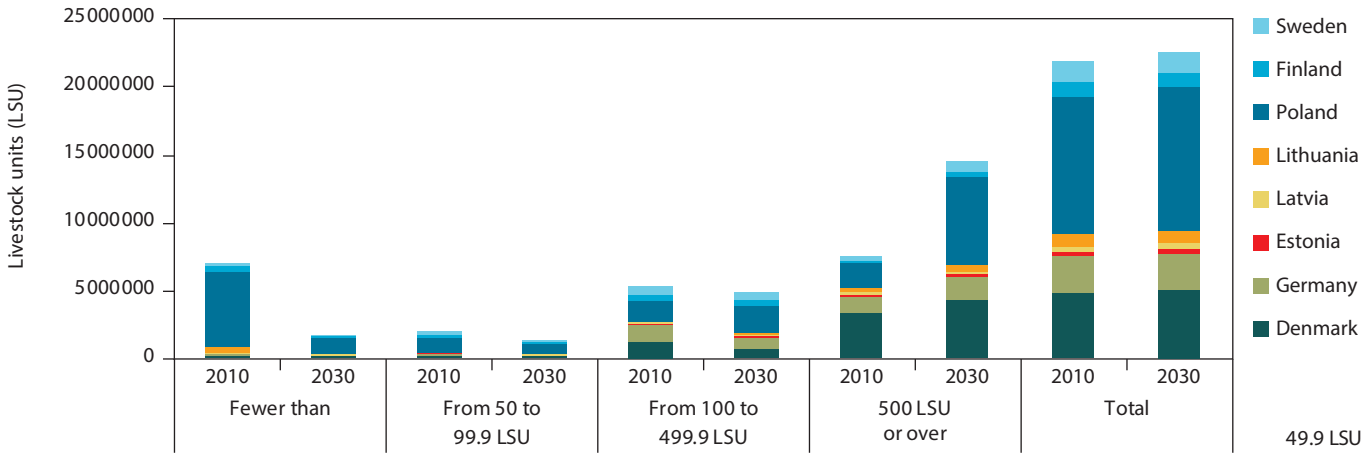

Figure 1. Development of production animals' (in livestock units) distribution to farms of four different size categories from 2010 (actual) to 2030

WHAT IMPACTS DOES THE DEVELOPMENT HAVE?

The impacts of the structural development on agriculture, the environment and rural areas are wide-ranging. The specialization may strs of livestock production and promote innovations in hot spot areas. However, it is also likely that the transition to larger production units increases the agronomic segregation of livestock and crop production areas, making it more difficult to transport the nutrients to areas where they would be most needed in crop production. Agglomeration of livestock in certain regions may also alter the threat that manure nutrients represents in terms of nutrient runoff and water quality.

WHAT SHOULD BE DONE TO ALLEVIATE THE RISKS OF NUTRIENT LOADING?

An obvious solution for the elevated accumulation of manure nutrients is utilizing them in crop production areas. This can be promoted either by pushing manure away from animal production areas or by pulling it toward crop production areas.

- An example of the pushing effect is the setting of an upper limit for manure phosphorus application. The stricter the limit is set, the stronger the push.
- The pull effect may be promoted by making manure nutrients more competitive substitutes for chemical fertilizers, thereby increasing farmers' demand for manure. This can be achieved by increasing the cost for chemical fertilizers, e.g. through environmental taxation, or by enhancing the value of manure nutrients in crops production. For the latter, nutrient contents and their plant availability must be known and stable for manure nutrients to match crops' agronomic needs).
- Environmentally sound, agglomerated large-scale livestock production might call for large-scale manure treatment facilities. From the regulatory point of view, the treatment facility would constitute a new source for point-wise pollution. Regulation should be able to recognize that the environmental benefit of such new point source would be a net reduction in the associated non-point source loading.

Upon designing new regulations, one must take into account the relevant markets and other pollutants associated with animal production and affected by water protection measures, most notable GHG emissions.

In terms of phosphorous regulation, this highlights the importance of ensuring coherence of regulatory initiatives across all Baltic countries. It is important to ensure equal economic and environmental terms for producers and food processors throughout the region, and simultaneously preventing the emergence of new spatial hot-spots of nutrient loading from in any of the Baltic countries. Any policy measure must also be assessed in terms of its impact on GHG emissions. Manure processing technologies, for instance, often include the generation of biogas and hence replace the use of fossil energy sources. Such policies could potentially benefit both water and climate protection. Subsidizing transportation of manure to crop production regions, on the other hand, would increase fuel consumption, with unknown net effects on GHG emissions.

RECOMMENDATIONS

1. Promote movement of nutrients from livestock farms to crop farming by, for instance, setting comprehensive caps for per hectare phosphorus applications.
2. Promote innovations for manure nutrient management and make sure regulation leaves room for innovations that have a positive net effect on total nutrient loading, i.e. the sum of point and non-point loading.

The policy brief is based on manuscripts:

- Scenario for structural development of livestock production around the Baltic Sea. Olli Niskanen, Antti Iho & Leena Kalliovirta.
- Regulating Manure – by Promoting Trading or Investments? Antti Iho & Markku Ollikainen

and the article

- Kauppila, J., Ekholm, P., Niskanen, O., Valve, H. & Iho, A. 2017. Muuttuva kotieläintalous ja vesistökuormituksen sääntely (in Finnish). Ympäristöpolitiikan ja -oikeuden vuosikirja 2017. Vol. 10: 227–273.

ACKNOWLEDGEMENTS

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.

CONTACT DETAILS

Antti Iho, Biosociety unit, Natural Resources Institute, Finland (Luke), PO Box 2, FI-00791 Helsinki, Finland. E-mail: antti.iho@luke.fi

This policy brief disseminate 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.

CONTACT DETAILS:

For more information on this policy brief please contact Katarina Elofsson: katarina.elofsson@slu.se
For more information on the project please contact coordinator Berit Hasler: bh@envs.au.dk

ACKNOWLEDGEMENTS:

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 BONUS GO4BALTIC project is also supported by the BalticEye at the Baltic Sea Centre, Stockholm University.