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Global Research Forum on Sustainable Production and Consumption
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sustainability REDUCTIONS
Reducing Environmental Degradation & Unsustainable Consumption Trends & Impacts On Nature & Society:
Research, Policy and Practice

Fact Sheet
April 2014

Reducing fertiliser use in Denmark

1. Introduction

This case study focuses on the use of fertilisers in agriculture. Fertilisers are added to soils to improve the growth, yield and quality of crops. Fertilisers can be organic (e.g. manure) or inorganic (e.g. phosphate and synthetic fertilisers). Direct discharges of manure and excessive or inappropriate use of fertiliser leads to leaching of nutrients to aquatic environments and can cause eutrophication or nutrient enrichment and algal blooms, which in turn leads to hypoxia (oxygen depletion) in water bodies, extensive fish death and ultimately loss of biodiversity.

Besides eutrophication, the diminishing reserves of phosphorus are also of concern in terms of global resources. As reserves of phosphorus are diminishing at a rapid rate, it is most likely that by 2050 all phosphate rock used in the European Union (EU) will come from Morocco, making all EU Member States very dependent on imports from Morocco.

This case study covers policies in Denmark, including the transposition of EU policies, over a period of time of almost 30 years from the 1980s to today.

2. Description of the case

The use of fertilisers in Danish agriculture has increased considerably since the Second World War. This is partly due to a 50% increase in crop land, but also a reduction of clover as animal feed. The energy crisis in the mid-1970s only could stop this trend for a short while as the price of oil rose drastically. The use of nitrogen fertilisers then continued to rise until the 1980s.

Methodologically this case has been analysed following the DYNAMIX project framework. It uses a case study approach based on ex post evaluation of policy measures targeted at economy wide resource reduction. A specific emphasis in this framework is given to agricultural goods and biotic materials, fossil fuels, metals and construction material. The evaluation of the identified policy mixes usually distinguished between the **effect** of the policy mix, i.e. the results of a measure that can be attributed to its implementation (which implies a causal link between the policy action and its intended impacts on human behaviour and the environment) and its **effectiveness**, i.e. whether or not the intended objectives and targets have been achieved. In addition, the policy mix's **efficiency** and **(social) sustainability** were evaluated. Efficiency of the policy mixes was assessed by comparing the achieved level of resource and impact decoupling with the monetary (or other) resources applied to achieve the outcome. Sustainability of the policy mixes was assessed by evaluating the social effects and environmental effects not covered in the key targets (e.g. local effects, toxicity, marine issues). Social effects, however, were only assessed for EU countries, while environmental effects were assessed globally based on data availability. This fact sheet mainly reflects on the effectiveness.

3. Measured absolute reductions

The use of commercial nitrogen fertiliser in Denmark dropped from 394,000 tonnes nitrogen (tN) in 1990 to 203,900 tN in 2011. The use of nitrogen in manure dropped from 244,000 tN to 226,000 tN in the same period. Overall the nutrient balance has decreased from 397,000 tN in 1990 to 211,400 tN in 2011 - a reduction of 45%.

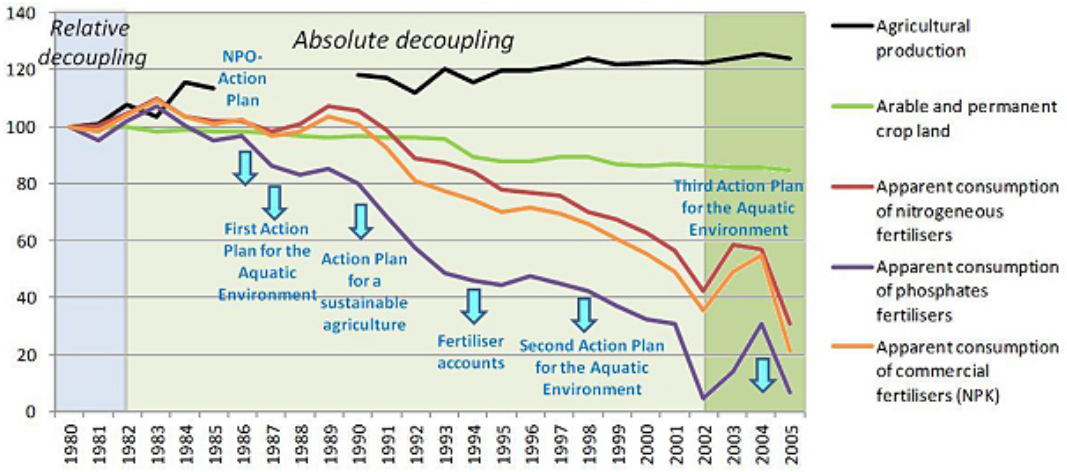
So, **absolute decoupling between agricultural** production and the apparent consumption of different types of **fertilisers has occurred** in Danish agriculture since 1991. However, we cannot yet say that this has achieved a sustainable level.

A target was set to reduce nitrogen leaching by half from 1985 levels and this was met in 2003 (rather than 1993, the initial deadline). Despite this absolute decoupling, average nitrogen surpluses in Denmark (76 kg N/ha in 2009) still remain above the EU average (49 kg N/ha in 2008). Phosphorous surpluses are now closer to EU averages.

Figure 1

Decoupling trends in agricultural use of fertilisers in Denmark

Agricultural production in relation to land and fertiliser use – Index 1980=100



Source: Tan and Mudgal 2013, p. 9

4. Policy implications on reductions

Since the 1980s a mix of national strategies, policies and instruments have been implemented with an overall aim to improve the quality of the aquatic environment in Denmark. The strategies and policies also address issues not related to agriculture or fertiliser use. Regulatory instruments (e.g. bans, limits and requirements) form the primary instruments. Bans on direct discharges from manure were accompanied with government subsidies for investments in animal manure storage capacity.

A wide range of policy instruments were introduced to reduce fertiliser use and nutrient losses in agriculture in Denmark. The instruments were implemented through various actions plans. For each of the Action Plans a clear target (i.e. quantitative objective to be achieved by a certain time period) was set and the estimated contribution of the various initiatives was also provided. This helped guide the instruments and allowed the government to adjust policies according to progress and achievement of targets.

In the 1980s awareness of the poor state of Denmark's aquatic environment led to the NPO (Nutrients-Phosphorus-Oxygen) Action Plan in 1985, which focused on direct pollution from farms and fields. In 1987 the First Action Plan for the Aquatic Environment was adopted, and included targets to reduce phosphorus leaching from sewage treatment plants by 80% and nitrogen leaching (including fields) by 50% by 1993. In 1991, when it was clear that the nitrogen leaching reduction target could not be achieved, the policy was strengthened with an Action Plan for Sustainable Development in Agriculture.

Since 1993/94, farmers have been required to produce accounts to track fertiliser use as a means of regulating fertiliser use and management. These efforts were strengthened in 1998 with the passing of the Danish Regulation on agricultural use of fertilisers and plant cover. In order to achieve policy targets, other requirements on farmers were increased in the Second Action Plan for the Aquatic Environment. Stricter requirements were implemented for

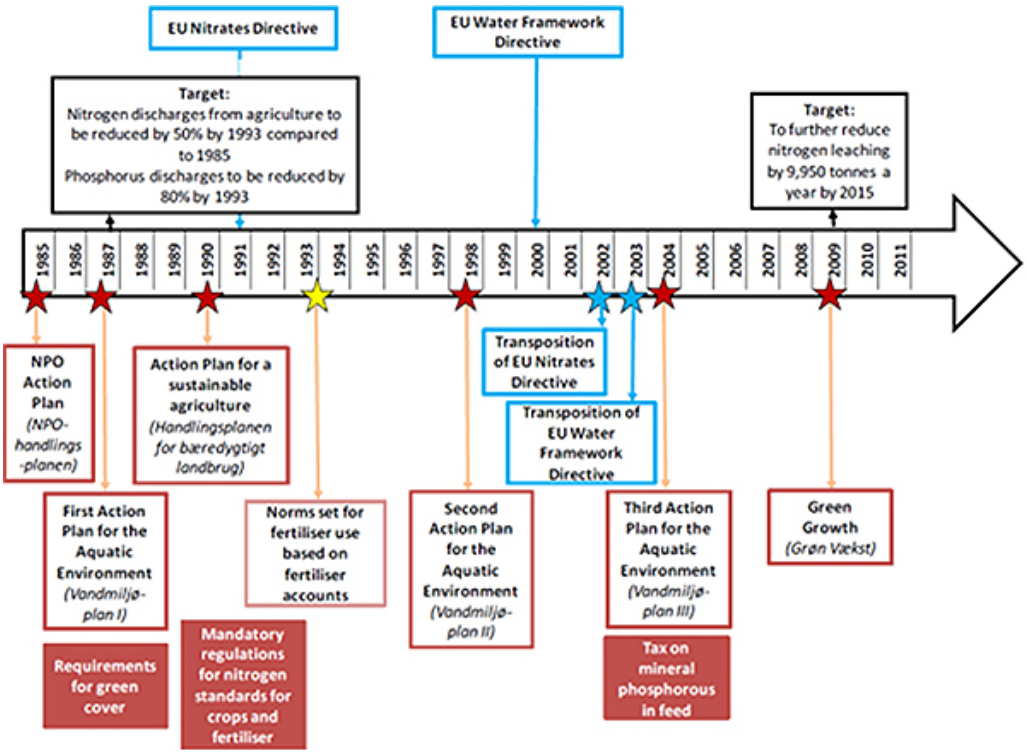
the use of nitrogen fertilisers, requirements for low nitrogen feed were introduced and targets were set for increasing the area of forests, organic agriculture and wetlands. In 2000 a mid-term assessment of the Aquatic Plans revealed that the leaching of nitrogen had decreased by about a third. This was achieved by better use of manure as a fertiliser which resulted in a 50% decrease in commercial nitrogen fertiliser. Limits on livestock density were also introduced to balance livestock manure production and the area of adjoining farmland on which it is applied.

The 2004 Third Action Plan for the Aquatic Environment aimed to further reduce nitrogen and phosphorus leaching from agriculture. It included subsidies for establishing buffer zones between fields and water bodies to stop phosphorus leaching. It also introduced a mineral phosphorus tax on feed, with tax revenues returning to the agricultural sector through a reduction in land taxes. Since 2005 farmers have had to comply with the Danish regulatory measures as a condition for benefiting from EU Common Agricultural Policy support.

The 2009 Green Growth Plan provided funding to ensure better conditions for the country's nature and environment while allowing agriculture to develop. Among its targets and measures are further reductions in the discharge of nitrogen and phosphorus from 2010 to 2012. Nitrogen quotas were to come into force in 2012, but were delayed in 2013 as an independent committee considered acceptable options for this. The plan also stipulates that 50% of farm animal manure must be used to produce biogas in 2020 and that, with time, all farm animal manure must be used as a source of renewable energy.

Figure 2

Implementation timeline of Danish fertiliser use policies, 1985-2011



Source: Simon et al. 2004, p. 15.

5. Transferability to other areas

The introduction of various policy measures with clear reduction targets for nutrient losses together with constant monitoring, enforcement and follow up appears to be a good approach for decoupling. The policy mix applied a wide range of instruments, e.g. regulatory, voluntary, economic and information based, that each addressed a specific contribution to the nutrient reduction targets.

The success of multiple strategies, objectives and policy instruments can be better ensured through constant monitoring and enforcement, as well as adaptation of instruments according to their performance against targets.

EU Member States have taken different approaches to reducing agricultural fertiliser use. Although there are considerable variations in rules, regulations and application standards, the general approach to setting clear targets, that of using regulatory instruments that are supported by economic incentives and voluntary measures, could be transferred to other countries. However, a consistent monitoring system is fundamental for the policy to be successful.

6. Other reflections and conclusion

The introduction of various policy measures with clear reduction targets for nutrient losses together with constant monitoring, enforcement and follow-up appears to be a good approach for decoupling. The policy mix applied a wide range of instruments, such as regulatory, voluntary, economic and information based instruments that each addressed a specific contribution to the nutrient reduction targets. Also EU policies have contributed to setting stricter requirements in Danish policies.

In general, the implementation of Action Plans for the Aquatic Environment has been a success, even though this may have come at a price. According to the OECD the farm-level nitrogen quota has proved to be effective but costly. Farmers bear the greatest costs of implementing the policy measures to reduce the use of fertilisers and nutrient losses. The majority of government costs for implementing the various policy measures are subsidies and payments to farmers for environmental actions and compensation for losses. A minor part of the costs are administrative. Overall, the total annual cost of reducing nitrogen losses was slightly less than expected. However, in terms of cost efficiency the mid-term evaluation showed a doubling in costs, as cheap measures have not achieved the expected effect. The overall total annual cost for phosphorus reduction is higher than originally estimated and the tax on mineral phosphorus has not reached the expected impact.

Although the Danish case has shown a decoupling of fertiliser use and agricultural production, it seems that the nitrogen balance per hectare in agriculture is still relatively high compared to other EU or OECD countries. While the concentration of nitrogen and phosphorous in water bodies has generally been decreasing over the past 20 years, oxygen conditions in Danish waters have not improved. Instead, severe oxygen depletion in Danish waterways still occurs regularly. There is, therefore, a further need to improve fertiliser use and reduce leaching in order to achieve a sustainable level. A further influence is the increasing temperatures caused by climate change. With temperatures set to increase further, the state of Danish waters will continue to degrade if the flow of nutrients is not further reduced.

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Related website: http://dynamix-project.eu/results

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