

Success story in Denmark - Implementation of new drainage measures

Resumé

In Denmark constructed wetlands and other drainage measures have become part of the national program to reduce loss of nitrogen and phosphorus. DKK 390 million is set aside for a period of four years in the national program to make drainage measures. One of the schemes in the program is [oplandskonsulenter](#) (catchment officers) who should help facilitate that farmers voluntarily and against compensation establish drainage measures. In 2018 45 projects were approved and in 2019 it looks like approx. 300 projects will be approved.

Introduction

In Denmark regulation of nitrogen supply and implementation of nitrogen measures has historically been based on a central "top-down" approach with national rules and legislation. This general regulation has produced significant results. The application of fertilisers to Danish fields was for the period 1990-2005 reduced by 50 percent from 400,000 t nitrogen (N) to approx. 200,000 t, while the amount of livestock manure from 1990 until today has fallen from 244,000 to 224,000 t N. From 1990 until today nitrogen emission to the sea has been reduced by approx. 50 percent. In addition to the reduced use of fertilisers other measures also play an important role such as rules for cultivation practices (winter green fields, catch crops, storage of manure and time of application, utilisation rate of livestock manure etc.). Several of the mentioned environmental measures appears from Vejledningen om gødnings- og harmoniregler 2019 (Guidance on fertiliser and harmony rules)

Measurements from the national monitoring program show that emission of nitrogen to Danish coastal waters has been reduced by almost 60,000 t over the last 10 years. A commission from 2013 recommended that additional effective reduction in nitrogen emissions would require differentiated regulation where efforts are targeted to the areas where the need and effect of the efforts will be largest.

For this reason, the decided efforts to reduce nutrients in drainage are one of the government's initiatives in the targeted effort. The following is a description of the preliminary work leading to the decision about efforts with drainage measures.

From idea to research and documentation

The EU LIFE project [Agwaplan](#) (2006-2009) included the catchment area of Norsminde Fjord as one of three pilot areas. The project aim was to demonstrate how cooperation between agriculture, authorities and researchers would help facilitate the implementation of the Water Framework Directive and reduce the N and P contribution from agriculture to the water environment. The project demonstrated that there is great potential in targeted advising when new knowledge and advising was integrated with local adaptation. The Agwaplan project led to increased understanding, commitment and desire to find solutions for the benefit of all and it was this project that inspired to start a number of other projects and collaborations in the area.

At the end of the Agwaplan project in 2008 a new drainage measure was established. A constructed wetland with straw. The straw increased the reduction of nitrate but was quickly decomposed so one year later the straw was replaced by woodchips. The constructed wetland turned out to have a good effect on the removal of nitrate in drainage water, but the method was not approved and understood in wider circles.

This first constructed wetland evoked an interest amongst other farmers and after AgWaplan a new project was initiated where 3 new constructed wetlands were established. Again, it was a collaboration between advisers, farmers and researchers that led to the new design of surface flow constructed wetlands.

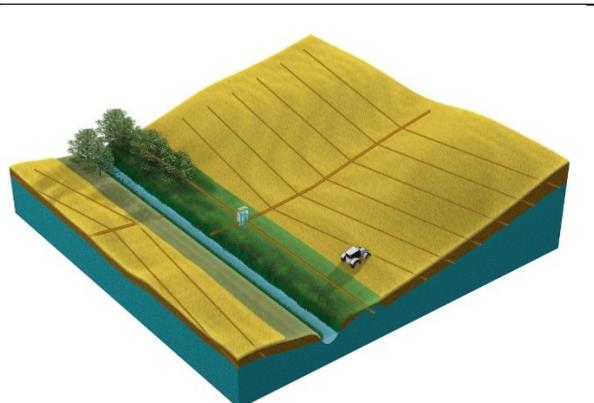


The first constructed wetland in Denmark was established with straw and subsequently woodchips 2006-2008.

In the following years especially, research became the driving force for a process towards documenting new drainage measures in various projects and pilot schemes. Important projects were iDRÆN, SupremeTech and BufferTech, but in all the projects advising played an important role and farmers voluntarily provided the land for a number of field trials.

These projects resulted in several new drainage measures which have now been officially approved. The drainage measures can now be implemented in most of Denmark in areas with regulation targets. Implementation is still challenging, and a lot of effort is still put into finding new and more effective drainage measures.

Project	Environmental drainage measures	Launched
iDRÆN Constructed wetlands	 <p>Constructed wetlands. Photo: SEGES</p>	Launched in 2017/2018 Link to guide Video
SupremeTech /Constructed wetlands with woodchips /biofilters /woodchip bioreactors		Launched as approx. 20 pilots in 2019. Several experimental sites. Link to guide Video

		<p>Videos: Construction in the MMM-project</p>
<p>BufferTech</p>		<p>Scientific studies finished. Expected new measure in 2020.</p> <p>Link to guide.</p> <p>Video</p>
<p>Innovation Platform for drainage measures (No website yet)</p>		<p>Scientific studies initiated in the project area.</p> <p>Saturated buffer zones Iowa</p> <p>Video</p>

Constructed wetlands with woodchips (Woodchip bioreactors). Photo SEGES.

Intelligent bufferzones. Photo SEGES.

Saturated bufferzones. Illustration: SEGES

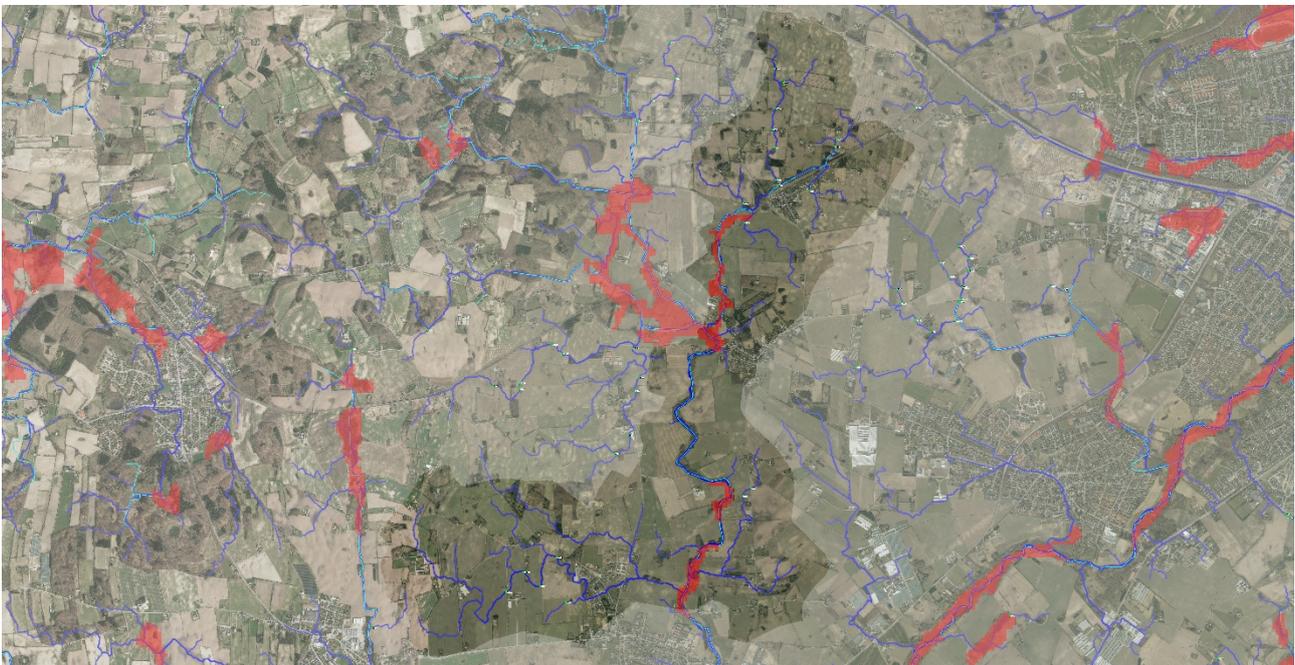
Leadership

In 2017, as part of the strategy to ensure the implementation of constructed wetlands, it was decided to set up a scheme with Catchment officers. The scheme involves that more than 20

catchment officers from all over Denmark will contact farmers and help them find suitable sites for constructed wetlands. The scheme is paid half by the state and half by agriculture.

In Denmark, the setup is now in place to establish drainage measures, and a lot of efforts are put into finding new effective collaboration models with increased involvement of landowners in the process. Collaboration between landowners, municipalities, catchment officers and local agricultural advisers is of great importance. In Denmark the measures have to take place voluntarily and expropriation is rare.

Waterdrive will carry on the work to establish local collaboration between landowners, municipalities, catchment officers and agricultural advisers. Denmark is divided into approximately 3.000 ID 15 subcatchments of approximately 1,500 hectares. It is in one or more of these subcatchments the project will take its starting point.



The dark green area is an example of an ID 15 subcatchment.

Recommendations and what did we learn?

There is a long way from a good idea for a new measure to a scheme where money and collaboration are in place for a large scale implementation of the new measure.

The development of measures has taken place in a collaboration between research, farmers and agricultural advisers. The first ideas and demonstration plants have typically emerged from interaction between agricultural advisers and farmers and shortly after research has been connected. For a while research was the driving force finding research funds for development and documentation of effects. In this process Advising has typically had a facilitating role and also ensured that the measure is designed to be as functional as possible for the farmer.



Farmer, authorities and advisers at Intelligent bufferzone in Sillerup. Photo: Frank Bondgaard.

It has taken several years to build the chain to ensure implementation of the drainage measures at field level. It concerns every link from approval, legislation, incentive structures, subsidies, construction requirements, involvement of landowners and catchment officers. It is a long chain in which every link has to function optimally. In Denmark, we are still working on improving collaboration and optimising all links in the chain.

It is important that the advisers working with implementation and establishment of drainage measures are well educated. They have to know exactly how the environmental measure is constructed, as backwater in the drainage systems can have major consequences for the landowners.

The way the chain should work for new drainage measures in a Danish context is briefly described in below table based on experiences gained in the period 2008-2019.

Implementation steps of constructed wetlands in Denmark		
State - target defined	Steps	Websites & guidelines
All can suggest a new measure	Innovation of a new measure	Who kick off new measures? The measure must work well with high effect and be cost-effective.
University Scientific research	Scientific approval of effect	Projects with this focus: 1. SupremeTech Constructed wetlands with woodchips 2. iDræn Constructed wetlands 3. BufferTech Intelligent bufferzones Implementation of approved measures must make sense for all involved parties.
Government - Ministry of Environment and Food of Denmark	Cross-sector in relation to implementation	Why should landowners do it? The right incentive structures are important. Financial consequences for the landowners?

University		
Agriculture		
Ministry of Environment and Food of Denmark	Governmental announcements	Announcements
Government	Governmental legislation	Constructed wetlands (DK: minivådområder) Maps with approved locations
Government The Danish Agricultural Agency	Guidelines Support schemes/Funding Rural Development Plans RDP	Guidelines Constructed wetlands (DK: minivådområder) Link to IBZ guide. Intelligent bufferzones
Catchment officers/ Agricultural advisers	The personality GIS tools – hardware & software Education & Training	Catchment officers website
Farmers Union Landowners Catchment officers Municipality	Involvement How – who – when - where? Working in focus groups	Information to farmers
Catchment officers/ Agricultural advisers Municipality	Implementation of measures Finding the right places at farm level Cross-sector cooperation at a technical level	SEGES and the catchment officers use GIS programs and SCALGO (The surface on the earth and flow paths)
Municipality	Approval of the constructed wetland by the municipality	Permits for the implementation of the constructed wetland.
Contractors	Instructions from Catchment Officers to contractors	
Contractors	Measure implemented	Establishment of constructed wetlands by contractors.
Governmental	Control of the construction	Controlled by The Danish Agricultural Agency
All	Acknowledgement	Well done. Make the measure visible for all landowners and inhabitants in the local area.
The state – does it work?	Next steps?	



2019, cross-sector cooperation in the field between landowners, municipality, a crop protection consultant, SEGES and an anthropologist – The meeting resulted in 2 constructed wetlands. Photo: Frank Bondgaard, SEGES.

Reports and websites

Nitrogen efforts in the catchment area of Norsminde Fjord. SEGES

https://www.landbrugsinfo.dk/miljoe/vandplaner/sider/norsminde_fjord.pdf?...true

More measures required in the catchment area of Norsminde Fjord.

<https://ifro.ku.dk/aktuelt/2017/flere-virkemidler-skal-i-spil-i-norsminde-fjord-oplandet/>

Agriculture and the river basin management plans

https://curis.ku.dk/ws/files/178737610/IFRO_Rapport_258.pdf

[VIRKEMIDLER Measures for the realisation of 2. Generation river basin plans and targeted regulation](#)

[Catchment officers](#)

[Environmental measures in Denmark](#)