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Member State Level Analysis: Denmark and Norway

0 Introduction

This report lists and analyses the main policies affecting catchment management in Denmark and Norway, respectively. The policy analyses were undertaken in preparation for the Euro-impacs Decision Support System. They serve a dual purpose. Firstly, the analyses were developed as a template for how to research and structure the policy input to form part of the Decision Support System. Secondly, the policies, regulation and measures described here are also included in the DSS in the form of a document store.

Each country report includes a brief summary of the national policies and regulations that implement key EU directives and regulations regarding catchment management. It offers an overview of the specific policy instruments that have been implemented or considered in order to achieve policy objectives as well as assessments of their effects. Finally, it describes policies from other sectors which may interact with catchment regulation policies, either reinforcing or inhibiting their effect.

1 Methodology

EU directives and regulations which directly or indirectly affect catchment management were reviewed and qualitative as well as quantitative policy objectives identified (see deliverables 36 and 299). For practical reasons the policy issues were limited to the environmental variables most relevant for catchment management, i.e. diffuse pollution, sedimentation and erosion, acidification, flooding and biodiversity. For the member state analyses, national legislation databases were searched systematically for mention of these directives or for mention of the policy issues. All relevant legislation has been listed here. Furthermore, national policy analyses were examined in order to generate data about policy instruments implemented or considered and their effects.

2 Member State Level Analysis: case of Denmark

Laws generally available from www.retsinfo.dk
Specific URL's provided throughout.

2.1 Diffuse Pollution

2.1.1 Policies regarding Diffuse Pollution

Consolidated Act no. 1757 of 22/12/2006 – Law on environmental protection

Objective

The law is to contribute to the protection of nature and the environment, particularly to prevent and control pollution to air, water, soil and the underground, to limit waste of resources and to promote the use of clean technologies.

The law establishes the overall framework for environmental protection, authorising the minister of the environment to establish specific rules for a number of areas.

Objectives related to diffuse pollution

To protect surface water and groundwater, hence authorising the minister of environment to establish rules for the use of manure and other organic fertiliser in agriculture.

Quality standards:

none specified

Implements parts of the following EU-directives (relevant to diffuse pollution)

Water framework directive (2000/60)

Bird protection directive (79/409)

Habitat directive (92/43)

Nitrate directive (91/676)

The Environmental Impact Assessment Directive (97/11/EC, amending directive 85/337/EEC)

Act no. 1572 of 20/12/2006, Law concerning environmental permit for livestock husbandry and Executive order no. 648 of 18/06/2007 re Permits and Approval of etc. of livestock husbandry

Objective

To prevent and to limit pollution of air, water, soil and underground as well as to limit specified nuisances caused by livestock farms, including production, storage and use of manure.

Rules for the granting of permits and approvals of livestock husbandry are set out in the executive order.

Objectives related to diffuse pollution

To prevent and limit pollution caused ammonia, nitrate and phosphorous from livestock manure
Quality standards and emission limits

Quality standards are specified for some substances while emission limit values apply to others

Ammonia

- Ammonia emissions may not increase within 300 meters of ammonia sensitive lakes and other protected sites; in a zone between 300 and 1000 meters, ammonia emissions may increase up to 0.7 kg N per ha. provided no other farms are located within the zone.

Phosphorous

- Emission limit values may apply for phosphorous in organic fertilisers, depending on soil type and existing phosphorous values. Such limits apply only to fertiliser application in catchments of Natura 2000 sites already affected by phosphorous surplus. For drained clay soils with phosphorous values below Pt 4.0, the permit will include no conditions regarding phosphorous, For drained clay soils with Pt values between 4.0 and 6.0, the permit sets an upper limit on the increase in phosphorous surplus of 4 kg P/ha/year. Finally, when the Pt value exceeds 6.0, the P-surplus may not increase. In low-lying areas, the P-surplus may not increase at all.

Nitrate

- In surface water catchments draining into Natura 2000 areas, protection levels are indicated in terms of the number of livestock allowed per hectare. In very nitrogen vulnerable zones, the number of livestock may be reduced by up to 50% of the general levels. For nitrate sensitive water abstraction groundwater areas, there is a limit of 50 mg. nitrate per litre leaching from the root zone.

Measures

- Emission limits, cf. above
 - Ban on farms greater than 15 livestock units (LU) within or near certain protected natural areas. These include ammonia sensitive lakes.
 - Stables and manure storage installations for livestock farms greater than 3 LU may not be established within specified distances from water supply installations (typically 15-50 yards).
 - Establishment, expansion or modification of a livestock farm of a certain size requires permission from local government. The local government must ensure that the applicant has taken all necessary steps to prevent and limit pollution, using best available technology, and that the livestock farm will not unduly impact on its surroundings. A.o. the permit must include terms to ensure that the establishment or expansion will not cause increased ammonia emissions.
 - A general requirement to reduce ammonia implies that any permit to increase or modify
-

livestock farms with more than 75 livestock units must include terms for ammonia reduction. The reduction demand increases gradually to at least 25% below 2005/2006 levels by 2009.

Implements parts of the following EU-directives

IPPC (96/61)

Bird directive (79/409)

Habitat directive (92/43)

Water framework directive (2000/60)

Nitrates directive (1991/676)

The Environmental Impact Assessment Directive (97/11/EC, amending directive 85/337/EEC)

URL:

http://147.29.40.90/_SHOWF_A420110720/1551&A20060157230REGL&0001&000001

Executive order no 1695 of 19/12/2006 on Law on livestock holdings greater than 3 livestock units, manure etc.

Objective

To limit pollution and nuisance from livestock holdings greater than 3 LU

Objectives related to diffuse pollution

The purpose of the rules is to limit pollution from livestock manure by specifying requirements for handling of manure

Measures, requirements regarding

- Design of stables
 - Storage capacity for manure
 - Storage of liquid manure
 - Use and application of manure
 - Maximum amount of manure allowed on the fields, harmonising the livestock holding with land and fertiliser rules
-

Implementation of parts of the following EU-directives

Nitrate directive 91/676

URL:

http://147.29.40.90/_SHOWF_B467248376/485&B20060169505REGL&0001&000001

Consolidated Act no. 1756 of 22/12/2006, Law on Environmental Objectives etc. regarding water bodies and international nature protection sites

Description and objective

The law transposes the Water Framework Directive (2000/60) into Danish law and thus establishes the framework for protection of surface waters and groundwater and for planning

under international nature protection sites. Thus it mandates the setting of environmental objectives for all water bodies within a river basin district and transposes the objectives under the Water Framework Directive that all surface waters and groundwater must achieve good status by 2015. For surface water this means good ecological as well as good chemical status, for groundwater it refers to good quantitative status and good chemical status.

Objectives regarding diffuse pollution

None are specified specifically, but regulation of nutrient pollution would be necessary to achieve the objectives of good ecological status.

Quality standards:

good ecological status

Measures

- River basin management plans which details how the objectives set for the river basin (ecological status, quantitative status, chemical status and protected area objectives) are to be reached within the timescale required.
 - Monitoring programme, including nutrients
 - Action plans to be set up by local governments to meet the objectives of the river basin management plans.
-

Implements all or parts of the following EU-directives

Water framework directive (2000/60)

Bird protection directive (79/409)

Habitat directive (92/43)

Shellfish directive 1979/923

URL:

http://147.29.40.90/_SHOWF_A452676566/494&A20060175629REGL&0001&000001

Executive order no 1355 of 11/12/2006 re Classification of water bodies, inventory of impacts on surface waters and groundwater and mapping of water resources

Description and Objective

The document establishes requirements for form and content of analyses required under the Water framework directive, including classification of water bodies and an inventory of impacts

Objectives regarding diffuse pollution

Sources of diffuse pollution from agriculture, including nitrogen and phosphorous and compounds thereof are to be included in the inventory of impacts on surface water as well as on groundwater

Implements parts of the following EU-directive

Water framework directive (2000/60)

2.1.2 Measures for Reduction of Pollution

Since the mid 1980s, Denmark has adopted three action plans aiming to reduce nitrogen input to the aquatic environment. The first action plan formed part of an overall nitrogen management programme.

First national nitrogen management programme (approx. 1987-1997)

The plan included both an Aquatic Environment Plan and the Plan for Sustainable Agriculture.

Measures

- Requirements for on-farm manure storage
- Nitrogen quota per farm based on economically optimal fertiliser standards and control
- Increasing requirements on the utilisation of nutrients in manure
- Requirements for a balance between livestock herd and land available for manure application
- Mandatory soil winter cover

2nd Plan for Aquatic national nitrogen management programme (approx. 1998-2003)

The second plan was adopted following a comprehensive evaluation of the first plan. The main finding of the evaluation was that although measures had been implemented and farmers generally abided by requirements, discharges were not being reduced to the degree expected in ex ante assessments. Hence, a new set of measures were adopted.

Measures

Relating to nitrogen management

- Reduction of fertiliser standards to 10 percent below economic optimum
- Tougher requirements for utilisation of nutrients in manure
- Requirements for catch crops
- Reduction in livestock density for cattle

Relating to land

- Establishing wetlands
- Reforestation
- Designation of sensitive areas and subsidies for sustainable farming practices in these

- Support for organic farming

Improved utilisation of animal feed

Effects of measures undertaken between 1980s and 2002

The original measures regarding nitrogen management, implemented between 1987 and 1990, were generally voluntary. Farmers' handling of manure did improve, but this did not lead to a decrease in the use of mineral fertilisers. This formed the impetus for the introduction of a maximum nitrogen quota. The quota has been effective, although some minor adjustments had to be implemented along the way. Farmers complain that the fertiliser standards are now too low to enable cultivation of cereals, particularly wheat for bread, of sufficient quality.

Current discussions revolve around the cost effectiveness of a regulatory quota versus the use of economic instruments as well as discussions about regional measures.

Effects regarding discharges from agriculture

- 37 percent reduction in nitrogen surplus in agriculture
- 46 percent reduction in nitrogen leaching from agricultural areas
- 40 percent reduction in nitrogen losses from leaching, ammonia evaporation and denitrification

Nitrogen management measures accounted for the largest share of reductions

Effects in aquatic environment

- Nitrogen concentration in water courses in agriculture dominated catchments has been reduced by 31 percent
- Significant reductions in nitrogen concentration in fjords and coastal waters Source: Aquatic Environment Plan II, final evaluation
- A 30 percent reduction in nitrate run-off from agriculture to marine waters

Action Plan for the Aquatic Environment III 2005-2015

Implementation of the 3rd action plan began in 2005; the plan is being evaluated in 2008 and again in 2011. But the following includes ex ante assessments of the contribution of each measure to reduction of diffuse pollution.

Measures

Relating to management of phosphorous. The objective is to halve phosphorous leaching.

- Tax of 4 DKK per kg of mineral phosphorus in feed
- Close to 30,000 hectares of 10-metre crop-free buffer zones along rivers and lakes before 2009 and a further 20,000 hectares before 2015 will be established. The buffer zones will be established by voluntary transfers of set-aside land along lakes and rivers

Relating to management of nitrogen

The objective is to reduce nitrogen leaching by at least 13 percent

- Afforestation in the range of 20,000-25,000 hectares. Expected to contribute to reduction in nitrogen leaching by approx. 900 tonnes N.

Tightening of regulation regarding late crops. Expected to contribute to reduction in nitrogen leaching by approx. 4,600 tonnes N.

- A general tightening of requirements for utilisation of nitrogen in livestock manure with 4.5-5 percentage points concurrently with research creating a basis for this. This will be assessed in the evaluations in 2008 and 2011. Expected to contribute to reduction in nitrogen leaching by approx. 2,900 tonnes N.
- Establishment of a further 4,000 hectares of wetlands in 2004 and 2005. Expected to reduce nitrogen leaching by approx. 1,100 tonnes N.
- Agri-environmental measures targeting phosphorous and nitrogen. Specific efforts include crop-free buffer zones, wetlands and general set-aside of agricultural land. The total nitrogen reduction resulting from the extra funds for agri-environmental measures is estimated at approx. 400 tonnes N.
- Designation of 300-metre buffer zones around all raised bogs, all lobelia lakes, all heaths larger than 10 hectares, and all endangered and low-nutrient dry grassland larger than 2.5 hectares, as well as all endangered heaths, dry grassland, and other particularly vulnerable types of natural habitat in the Natura 2000 sites. The total area where buffer zones are designated constitutes 180,000 hectares, corresponding to 7 per cent. Within this buffer zone and within the area itself, no extension of livestock farms can take place if such an extension would lead to increased ammonia discharges in natural areas vulnerable to ammonia.
- Strengthening of organic farming through research

Potential measures assessed ex-ante

Table 2.1.1 includes ex ante assessments of policy measures which were evaluated in preparation for the 3rd aquatic environment plan. Not all measures were implemented. Implemented measures are currently being evaluated.

Table 2.1.1: Measures assessed in 2003 in preparation for the 3rd Aquatic Environment Plan

General measures			
Measure	Design	Effect ¹	Notes
Economic measures			
Tax on nitrogen	Tax on difference between N-input and N-outtake	N-leaching is reduced by ² : 1 % when tax is .55 euro/kg. N 7 % when tax is 1.1 euro/ kg. N 10% when tax is 1.6 euro/kg. N It is estimated that a 50 % reduction of leaching compared with current situation is possible at a tax level of 4 – 6.7 euros pr. kg. N	Model calculation. Studies indicate that farmers do not always optimise to the degree assumed in economic modelling. A tax rate of 4-6 euros per kg. would be close to or surpass the marginal rate of return of crop farming and would therefore be considered prohibitive, in violation of EU regulation.
Administrative measures			
Reduced nitrogen quota ³ under current levels, which is at 10% below economically optimal nitrogen level	Further 10 percentage points under current norm	Reduced leaching of 4kg.N/ha. (~ 7% of the total) Reduced ammonia emissions of 800 tons NH ₃ _N total emissions (~ 1.4% of the total)	Reducing n-quota without regulating phosphorous could lead to an increase in P-surplus because less nutrients will be removed with crops

¹ Effects predicted from models

² Reduction is estimated when tax complements other measures including a reduction of nitrogen quota below economically optimal levels. The stand-alone effect of a 1.1 euro/kg.N tax implemented without these regulatory measures would be greater, reducing the N-surplus by an estimated 34%, which given the response function between N-surplus and leaching implies a 12% reduction in nitrogen-leaching.

³ Fertiliser is being regulated to a large extent through a nitrogen quota which is based on a set of nitrogen norms. The norms vary by crop, soil type, climate etc. and have been calculated as the economically optimal level of nitrogen fertilisers.

Member State Level Analysis: Denmark and Norway

Reduction in livestock holdings	400,000 livestock units	Reduced leaching: 6560 tons N or 14.4 kg/livestock unit Reduced ammonia emission 9,300 tons (~ of total emissions)	Realised reduction depends on the alternative use of the land; reduction potential is greater for marginal land which is taken out of production but small if land is still used in production and fertilised
Stricter requirements on the use of nitrogen in manure	5 percentage points 10 percentage points	Reduced leaching: 3600 tons N (2% of total N leaching) Reduced leaching 7200 tons N	
Taking land out of production in wetlands		Reduced leaching 100 kg N/ha	This is usually considered a cost effective measure but at around 200,000-400,000 ha. the marginal effect falls drastically as there is a limited supply of suitable wetlands
Afforestation		Reduced leaching 0.04 tons N/ha	
Further conversion to organic farming		Reduced N 17 kg N/ha	

References:

Blicher-Mathiasen, Gitte and Grant, Ruth (2003). Faglig vurdering af VMP III scenarier. National Environmental Research Institute, November 7 2003. (English: Technical Assessment of Scenarios for the 3rd Aquatic Action Plan).

Ministeriet for Fødevarer, Landbrug og Fiskeri (2003). Forberedelse af Vandmiljøplan III. Rapport fra Arbejdsgruppen om Generelle Virkemidler. Del II. December 2003. (English: Ministry of Food, Agriculture and Fisheries. Preparations for Aquatic Environment Plan III. Report from the working group on general policy measures. Par II).

Table 2.1.2: Measures under consideration for the implementation of the Water Framework Directive⁴

Measures to be implemented locally					
Measure	Primary effect	N-emission reduction kg/ha	P-emission reduction kg/ha	Secondary effects	
				Ammonia	Biodiversity, landscape
Changes in cultivation methods					
1. Conversion of extensive cattle production to organic production methods	N	6-41	-	+	+
2. Ammonia fertilisers instead of NO ₃	N	6-8	-	-	
3. Catch crops – current practice	N	12-55	-		
4. Optimised use of catch crops	N	20-95	-		
13. Requirement for a. injection of fertiliser during winter or b. no tilling or ploughing in winter	P	a. -6 to 0 b. 10-25	a. 0.01 – 0.125 b. 0.025-0.25	b+	b+
5. Reduced nitrogen application by 80%	N	3.4-5	-	+	
6. Harvest of hay instead of permanent cattle grazing	N	26-109 13-54 (harvest twice)	-	-	
7. Reduced N-application to pasture	N	18-85 (dep. on grass type)	-	+	
8. Catch crops two years after ploughing permanent pastures	N	55-100	-		
9. Early sowing of winter crops	N	5-7	-		
10. Commercial fertiliser instead of manure	N	24-28	0.01-0.1	-	-
11. Only winter crops and undersowing of catch crops on fields with high risk of soil erosion	P	12-55	0.06-0.25		

⁴ Effect is calculated or estimated based on evaluations of already implemented measures and models.

Member State Level Analysis: Denmark and Norway

12. Reduced P-application	P	-	0.03-0.1		
13. Requirement for a. injection of fertiliser during winter or b. no tilling or ploughing in winter	P	a. -6 to 0 b. 10-25	a. 0.01 – 0.125 b. 0.025-0.25	b+	b+
Changes in land use					
14. Permanent energy crops on land in rotation	N/P	30-55	0.003-0.1	+	+/-
15. Permanent pastures or grassland in river valleys	N/P	100-150	10-30	+	+
16. Permanent grassland on high-lying fields	N	26-66	0.06-0.25	+	+
17. Afforestation of agricultural land	N	30-70	?	+	+/-
18. Permanent grassland on fields with high risk of soil erosion	P	26-66	0.06-0.25	+	+
19. Buffer zones with permanent grassland along lakes and streams	P	26-66	1-3	+	+
Technical measures					
20. Incineration of livestock manure	P	0.7-6.5	Case specific		

Source: Source: Schou et al. (2007)

For comparison, average N-leaching per year is about 61 kg N/ha.

References:

Blicher-Mathiasen, Gitte and Grant, Ruth (2003). Faglig vurdering af VMP III scenarier. National Environmental Research Institute, November 7 2003. (English: Technical Assessment of Scenarios for the 3rd Aquatic Action Plan).

Ministeriet for Fødevarer, Landbrug og Fiskeri (2003). Forberedelse af Vandmiljøplan III. Rapport fra Arbejdsgruppen om Generelle Virkemidler. Del II. December 2003. (English: Ministry of Food, Agriculture and Fisheries. Preparations for Aquatic Environment Plan III. Report from the working group on general policy measures. Par II).

Schou, Jesper et al. (2007). Virkemidler til realisering af målene i EU's Vandramme-direktiv. Udredning for udvalg nedsat af Finansministeriet og Miljøministeriet: Langsigtet indsats for bedre vandmiljø. Faglig rapport fra DMU nr. 625, 2007. (In English: Policy instruments for achievement of the objectives in the EU Water Framework Directive. An analysis on behalf of the committee established under the Ministry of Finance and the Ministry of the Environment: A longterm effort for a better aquatic environment. NERI Technical Report no. 625 2007).

2.2 Sedimentation and Erosion

2.2.1 Policies regarding Sedimentation and Erosion

Consolidated Act no. 1756 of 22/12/2006, Law on Environmental Objectives etc. regarding water bodies and international nature protection sites

Description and objective

The law transposes the Water Framework Directive (2000/60) into Danish law and thus establishes the framework for protection of surface waters and groundwater and for planning under international nature protection sites. Thus it mandates the setting of environmental objectives for all water bodies within a river basin district and transposes the objectives under the Water Framework Directive that all surface waters and groundwater must achieve good status by 2015. For surface water this means good ecological as well as good chemical status, for groundwater it refers to good quantitative status and good chemical status.

Objectives regarding sedimentation and erosion

The act does not specify objectives regarding sedimentation and erosion.

Quality standards: good ecological status

The act does not include quality elements specifically related to sedimentation and erosion, but *executive order no. 1355* which further specifies the act (see table below) lists hydromorphological conditions among classification criteria for surface water body types.

Measures

- River basin management plans which details how the objectives set for the river basin (ecological status, quantitative status, chemical status and protected area objectives) are to be reached within the timescale required.
- Monitoring programme
- Action plans to be set up by local governments to meet the objectives of the river basin management plans.

Implements all or parts of the following EU-directives

Water framework directive (2000/60)

Bird protection directive (79/409)

Habitat directive (92/43)

Shellfish directive 1979/923

URL:

http://147.29.40.90/_SHOWF_A452676566/494&A20060175629REGL&0001&000001

Executive order no 1355 of 11/12/2006 re Classification of water bodies, inventory of impacts on surface waters and groundwater and mapping of water resources

Description and Objective

The document establishes requirements for form and content of analyses required under the Water framework directive, including classification of water bodies and an inventory of impacts.

Objectives regarding sediment and erosion

None are specified

Measures

Surface water body types must be established with regards to, a. o., hydro-morphological conditions. Hydro-morphological conditions may impact on sedimentation and erosion.

Implements parts of the following EU-directive

Water framework directive (2000/60)

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13004>

Executive order no. 1436 of 11 December 2007 on regulation and restoration of watercourses etc.

Description and Objective

The order establishes rules for:

- regulation of watercourses, lowering of water levels in lakes, establishment of new water courses
- establishment of facilities for drainage or irrigation
- establishment of bridges and dams
- restoration of watercourses

The rules are administered by a watercourse authority, which has the power to grant or deny permission to regulate the watercourse or to lower water levels in lakes. The watercourse authority must administer the rules in respect of articles 6, 12, 13 and 16 of the Habitat Directive. These articles establish the protection of flora and fauna.

Objectives regarding sediment and erosion

None specified, but regulation of watercourses, including water levels, may serve to prevent sedimentation and erosion.

Measures

Rules and need to gain permission in order to undertake activities that may affect water courses

Implements parts of the following EU-directives

Bird protection directive (79/409)

Habitat directive (92/43)

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=113577#>

Executive order no. 21 of 21/01/200 on Cross Compliance

Objective

The order establishes the requirements farmers must meet under the Cross Compliance mechanism in order to receive agricultural subsidies.

Measures related to erosion (Annex I, cross compliance area no. 4)

- Soil not used for production purposes must be covered by plants
- Maintenance of set aside land and soils not used for production purposes

Set aside land and soil not used for production must not be used in a manner which destroys or removes plant cover.

Implements parts of the following EU-directives

Council Regulation 1782/2003

Council Regulation 1698/2005

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=114510>

Executive order no. 1316 of 20 November 2006 regarding support for private afforestation

Objective

To authorise subsidies for afforestation on agricultural land

Objectives related to sedimentation and erosion

The order does not explicitly address the policy issue of sedimentation and erosion, but increased afforestation near streams could prevent or reduce erosion

Measures

Subsidies

Implements parts of the following EU-directive

Council Regulation 1698/2005

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=12948>

Executive order no. 457 of 7 May 2006 regarding support for sustainable forestry

Objective

To authorise subsidies for the promotion of sustainable forestry practices in existing forests

Objectives related to sedimentation and erosion

The order does not explicitly address the policy issue of sedimentation and erosion, but sustainable forestry practices may help prevent or reduce erosion

Measures

Subsidies for sustainable forestry practices including agreements about permanent layout of forest areas as unmanaged and management practices which support and promote biodiversity.

Implements parts of the following EU-directive

Council Regulation 1698/2005

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=12916>

2.2.2 Measures to reduce Sedimentation and Erosion

Measures targeting erosion and sedimentation are typically related to multiple objectives. Moreover, they are not typically evaluated specifically nor precisely. This document lists measures which aim wholly or in part to reduce erosion and sedimentation but does not contain data on specific effects.

Rules regarding watercourses

- regulation of watercourses, lowering of water levels in lakes, establishment of new water courses
- establishment of facilities for drainage or irrigation
- establishment of bridges and dams
- restoration of watercourses
- requirement for permission to undertake activities that may affect water courses

Source:

Executive order no. 1436 of 11 December 2007 on regulation and restoration of watercourses etc.

Rules regarding agricultural practices

- Soil not used for production purposes must be covered by plants
- Maintenance of set aside land and soils not used for production purposes
- Set aside land and soil not used for production must not be used in a manner which destroys or removes plant cover

Source: *Executive order no. 21 of 21/01/2008 on Cross Compliance*

Land use changes considered for implementation of the Water Framework Directive

-
- Only winter crops and under sowing of catch crops on fields with high risk of soil erosion
 - Permanent grassland on fields with high risk of soil erosion
 - Buffer zones with permanent grassland adjacent to lakes and Streams
 - Catch crops in fields two years after plowing of permanent pastures
 - Permanent pastures or grassland in river valleys
 - Restrictions on farming practices on fields with high risk of soil erosion
-

Sources: *Schou et al. 2007; Miljøministeriet, Miljøcenter Odense 2007*

Subsidies

Afforestation

Agro-environment measures, e.g.

- Uncultivated buffer zones along lakes and streams to reduce brink erosion and sediment leaching
 - Re-establish wetlands
 - Permanent pasture
-

Source: *Schou et al. 2007; Miljøministeriet, Miljøcenter Odense 2007*

Physical measures

- Cease maintenance of water courses and extensivate land in rotation (establish uncultivated buffer zones along water courses)
 - Remeander water courses
 - Re-open culverted streams and establish 5m buffer zones along them
 - Deactivate drainage
-

Source: *Miljøministeriet, Miljøcenter Odense 2007*

Known technological measures to abate erosion caused by hydrological loading of sewer systems

At the source:

- Separation (only joint sewer systems)
- Infiltration
- Percolation
- Permeable surfaces

Within system:

- Basins
- Water breaks

At the outflow:

- Sedimentation basin
- Forced sedimentation
- Louver sedimentation

Source: *Danva 2006*

References:

- Danva (2006). Vejledning nr. 71. Regnbetingede udledninger. Katalog over teknologier til reduktion af effekter i miljøet. Dansk Vand- og Spildevandsforening. (In English: Discharges caused by rain: Catalogue of technologies to reduce environmental effects.) Available at: <http://viewer.zmags.com/showmag.php?mid=pwrrp&preview=1> or from www.danva.dk/publikationer.
- Miljøministeriet, Miljøcenter Odense (2007). Odense Pilot River Basin, Demonstrationsprojekt for Vandplanlægning i Odense Fjord- oplandet. Vandrammedirektivets artikel 13. (In English: Demonstration project on water planning in Odense Fjord River Basin. Water Framework Directive article 13).
- Schou, Jesper et al. (2007). Virkemidler til realisering af målene i EU's Vandramme-direktiv. Udredning for udvalg nedsat af Finansministeriet og Miljøministeriet: Langsigtet indsats for bedre vandmiljø. Faglig rapport fra DMU nr. 625, 2007. (In English: Policy instruments for achievement of the objectives in the EU Water Framework Directive. An analysis on behalf of the committee established under the Ministry of Finance and the Ministry of the Environment: A longterm effort for a better aquatic environment. NERI Technical Report no. 625 2007).

Legislation:

Executive order no. 1436 of 11 December 2007 on regulation and restoration of watercourses etc. Available at: <https://www.retsinformation.dk/Forms/R0710.aspx?id=113577>

Executive order no. 21 of 21/01/2008 on Cross Compliance. Available at: <https://www.retsinformation.dk/Forms/R0710.aspx?id=114510>

2.3 Acidification

2.3.1 Policies regarding Acidification

Consolidated Act no. 1757 of 22 December 2006 – Law on environmental protection

Objective

The law is to contribute to the protection of nature and the environment, particularly to prevent and control pollution to air, water, soil and the underground, to limit waste of resources and to promote the use of clean technologies.

The law establishes the overall framework for environmental protection, authorising the minister of the environment to establish specific rules for a number of areas.

Objectives related to acidification

To protect surface water and groundwater from pollution the law authorises the minister of environment to establish rules for the use of manure and other organic fertilisers in agriculture.

Implements parts of the following EU-directives (relevant to acidification)

Water framework directive (2000/60)

Bird protection directive (79/409)

Habitat directive (92/43)

Nitrate directive (91/676)

The Environmental Impact Assessment Directive (97/11/EC, amending directive 85/337/EEC)

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13072>

Executive order no. 21 of 8 January 2003 on emission ceilings on sulphurdioxides, nitrogenoxides, volatile organic compounds and ammonia

Purpose

The order institutes annual emission ceilings for sulphurdioxides, nitrogenoxides, volatile organic compounds and ammonia to take effect from the year 2010.

Objectives related to acidification

Annual emission ceiling on ammonia, nitrogenoxides and sulphur dioxide in order to reduce acidification.

Referring to directive 2001/81/EC the order states that the acreage where critical load has been exceeded must be reduced by at least 50% compared with 1990.

Quality standards and emission limits

Emission ceilings to be reached by 2010:

- For ammonia: 69 kilotons of NH₃
 - For sulphur-dioxides: 55 kilotons of SO₂
 - For nitrogenoxides: 127 kilotons NO_x
-

Measures

Programmes for gradual reduction of substances in order to keep emission ceilings, cf. directive 2001/81/EC

Implements parts of the following EU-directives

The emission ceilings directive (2001/81/EC)

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=12631>

Act no. 1572 of 20/12/2006, Law concerning environmental permit for livestock husbandry and Executive order no. 648 of 18/06/2007 re Permits and Approval of etc. of livestock husbandry

Objective

To prevent and to limit pollution of air, water, soil and underground as well as to limit specified nuisances caused by livestock farms, including production, storage and use of manure.

Rules for the granting of permits and approvals of livestock husbandry are set out in the executive order.

Objectives related to acidification

To prevent and limit pollution caused ammonia caused by livestock manure

Quality standards and emission limits

Quality standards are specified for some substances while emission limit values apply to others

Ammonia

- Ammonia emissions may not increase within 300 meters of ammonia sensitive lakes and other protected sites; in a zone between 300 and 1000 meters, ammonia emissions may increase up to 0.7 kg N per ha. provided no other farms are located within the zone

Measures

- Emission limits, cf. above
 - Ban on farms greater than 15 livestock units (LU) within or near certain protected natural areas. These include ammonia sensitive lakes.
 - Stables and manure storage installations for livestock farms greater than 3 livestock units (LU) may not be established within specified distances from water supply installations (typically 15-50 yards).
 - Establishment, expansion or modification of a livestock farm of a certain size requires permission from local government. The local government must ensure that the applicant has taken all necessary steps to prevent and limit pollution, using best available technology, and that the livestock farm will not unduly impact on its surroundings. A.o. the permit must include terms to ensure that the establishment or expansion will not cause increased ammonia emissions.
 - A general requirement to reduce ammonia implies that any permit to increase or modify
-

livestock farms with more than 75 livestock units must include terms for ammonia reduction. The reduction demand increases gradually to at least 25% below 2005/2006 levels by 2009.

Implements parts of the following EU-directives

IPPC (96/61)

Bird directive (79/409)

Habitat directive (92/43)

Water framework directive (2000/60)

Nitrates directive (1991/676)

The Environmental Impact Assessment Directive (97/11/EC, amending directive 85/337/EEC)

URL:

http://147.29.40.90/_SHOWF_A420110720/1551&A20060157230REGL&0001&000001

Executive order no 1695 of 19/12/2006 on Law on livestock holdings greater than 3 livestock units, manure etc.

Objective

To limit pollution and nuisance from livestock holdings greater than 3 LU

Objectives related to acidification

The purpose of the rules is to limit pollution from livestock manure by specifying requirements for handling of manure

Measures, requirements regarding

- Storage of liquid manure to prevent evaporation
 - Use and application of manure
-

Implementation of parts of the following EU-directives

Nitrate directive (91/676)

URL: http://147.29.40.90/_SHOWF_B467248376/485&B20060169505REGL&0001&000001

2.3.2 Measures for reduction of Acidification

Measures to reduce acidification target the acidifying gasses separately and often in relation to other policy targets. Hence, sulphur and nitrogen oxide measures often form part of general air pollution policy packages whereas ammonia emissions have been regulated as part of policy packages aiming to reduce nutrient losses from agriculture. Ex-post evaluations typically cannot separate the effect of each measure while ex-ante evaluations usually do estimate the specific pollution reduction from specific measures, often at the national level.

The first part of this chapter outlines the main policy measures which have affected emissions of acidifying gasses and lists the overall trends in emissions. The second part lists measures which have been considered, primarily to reduce NH₃, and their estimated effects.

Measures to reduce sulphur-dioxide emissions

- Installation of desulphurisation equipment in public power and district heating plants
- Use of fuels with lower sulphur content in public power and district heating plants
- SO₂ taxes on fuels with sulphur content above 550 ppm are taxed at 20 DKK per kg sulphur
- SO₂ emissions are taxed at 10 DKK per kg sulphur

Source: Nordic Council of Ministers (draft, forthcoming)

Effects

Table 2.3.1: Emissions and acid deposition for sulphur dioxide

SO₂ emissions	1000 tonnes SO_x
1990	184
2004	24
Target 2010	55
Acid deposition	100 tonnes SO_x
1996	52
2004	13

Source: OECD 2007

Ex ante estimates of the SO₂ fuel tax introduced in 1995 was a total emission reduction of 34000 tonnes by 2005.

Measures to reduce NO_x emissions

Implemented measures

- Vehicle exhaust emission standards
- Requirements for catalytic converters on vehicles
- Installation of low-NO_x burners and de-nitrifying units and power and district heating plants

Effects

Table 2.3.2 Emissions and acid deposition for NO_x

NOx emissions	1000 tonnes
1990	276
2004	181
Projected emissions for 2010	134
Target 2010	127
Acid deposition	100 tonnes NOx
1996	23
2004	6

Source: OECD 2007

Table 2.3.3: Potential measures for reduction of NOx emissions

Measure	Reduction by 2010 – NOx tonnes	DKK per kg reduced NOx
SCR (Selective Catalytic Reduction) on fishing vessels	4,511	3
SCR on heavy vehicles	3,279	72
SCR on tractors and harvesters	3,111	53
Better distribution gear at CPH plants	1,685	11
Low NOx burners, gas and gas oil in industrial boilers	1,400	8-10
Partial boosting at CHP plants	957	312

Source: Environmental Protection Agency 2006; Nordic Council of Ministers (draft, forthcoming)

Measures to reduce ammonia emissions

Three action plans for the aquatic environment have been adopted, targeting mainly nitrogen emissions from agriculture. They have included area-related measures such as subsidies for wetlands well as measures related to fertiliser handling and livestock density. Table 4 lists the overall trend in ammonia emissions and subsequent tables lists demonstrated and estimated effects of implemented and contemplated measures respectively.

Table 2.3.4: Reductions in ammonia emissions 1990-2006

NH3 emissions	1000 tonnes
1990	108
2004	83.8
2006	75.2

Target 2010

69

Source: Nordisk ministerråd, draft forthcoming based on Denmark reporting to the EU.

Table 2.1.7 below lists the main measures to reduce nitrogen discharges under the Second Action Plan, the effects of which were evaluated in 2003.

Table 2.3.5: Calculated effects of measures implemented under the second action plan to reduce nitrogen discharges from agriculture

Area-related measure	Reduced leaching – tonnes N per year	Reduction kg N per ha
Wetlands	800	265
Organic farming	3,700	33
Afforestation	800	12
Sensitive Farming Areas (effect varies by location)	700	23-42
Farm-related measures		
Use of nitrogen in manure – 15% increase over 1991 rules	10,110	
Improved feed	3,800	
Fertiliser application standards	12,850	
Green cover	3,000	
Livestock density	140	

Source: VMP II; OECD 2007

Table 2.3.6: Estimated effect of measures considered for the 2001 Action Plan for Reducing Ammonia Volatilization from Agriculture

Measure	Annual Reduction – tonnes N
Optimization of manure handling in housing for cattle, pigs and poultry ¹	500
Optimization of manure handling in housing for fur animals ²⁾	2,600
Covers on solid manure	1,700
Application	3,400
Ban on ammonia treatment of straw ⁵	1,200–1,400

⁵. Due to the possibility to gain exemption from the ban on ammonia treatment of straw it is estimated that the effect will be reduced by 200–400 tonnes N, such that the net effect will be 1,200–1,400 tonnes.

Source: Danish Nature Agency

Potential measures, evaluated ex-ante

Table 2.3.7: Measures assessed in 2003 in preparation for the 3rd Aquatic Environment Plan

Administrative measures	Design	Effect on ammonia ⁶
Reduced nitrogen quota under current levels ⁷	Further 10 percentage points under current norm	Reduced ammonia emissions of 800 tons NH ₃ _N total emissions (~ 1.4% of the total)
Reduction in livestock holdings ⁸	400,000 livestock units	Reduced ammonia emission 9,300 tons (of total emissions)

Source: Blicher-Mathiasen, Gitte and Grant, Ruth (2003). Ministeriet for Fødevarer, Landbrug og Fiskeri (2003).

Table 2.3.8: Measures under consideration for the implementation of the Water Framework Directive⁹

Measure	Primary effect	Reduced N-emissions kg/ha	Effect on ammonia emissions
Changes in cultivation methods			
Conversion of extensive cattle production to organic production methods	N	6-41	+
No tilling or ploughing in winter	P	10-25	+
Reduced nitrogen application by 80%	N	3.4-5	+

⁶ Effects predicted from modelling

⁷ Fertiliser is being regulated to a large extent through a nitrogen quota which is based on a set of nitrogen norms. The norms vary by crop, soil type, climate etc. and have been calculated as the economically optimal level of nitrogen fertilisers.

⁸ Actual reduction depends on the alternative use of the land; reduction potential is greater for marginal land which is taken out of production but small if land is still used in production and fertilised

⁹ Effect is calculated or estimated based on evaluations of already implemented measures and models.

Member State Level Analysis: Denmark and Norway

Reduced N-application to pasture	N	18-85 (dep. on grass type)	+
Requirement for no tilling or ploughing in winter	P	10-25	+
Changes in land use			
Permanent energy crops on land in rotation	N/P	30-55	+
Permanent pastures or grassland in river valleys	N/P	100-150	+
Permanent grassland on high-lying fields	N	26-66	+
Afforestation of agricultural land	N	30-70	+
Permanent grassland on fields with high risk of soil erosion	P	26-66	+
Buffer zones with permanent grassland along lakes and streams	P	26-66	+

Source: Schou et al.

“+” indicates a positive effect on ammonia emissions, i.e. a reduction

References:

- Blicher-Mathiasen, Gitte and Grant, Ruth (2003). Faglig vurdering af VMP III scenarier. National Environmental Research Institute, November 7 2003. (English: Technical Assessment of Scenarios for the 3rd Aquatic Action Plan).
- Danish Forest and Nature Agency (2001). Action Plan for Reducing Ammonia Volatilization from Agriculture. Available at: <http://www.sns.dk/Landbrug/vandmpl2/AMMONIA%20Action%20Plan%20-%20UK%20Final%20translation231001.pdf>
- Ministeriet for Fødevarer, Landbrug og Fiskeri (2003). Forberedelse af Vandmiljøplan III. Rapport fra Arbejdsgruppen om Generelle Virkemidler. Del II. December 2003. (English: Ministry of Food, Agriculture and Fisheries. Preparations for Aquatic Environment Plan III. Report from the working group on general policy measures. Part II).
- OECD (2007). Environmental Performance Reviews. Denmark. Available at: <http://titania.sourceoecd.org.ez.statsbiblioteket.dk:2048/vl=672726/cl=13/nw=1/rpsv/cgi-bin/fulltextew.pl?prpsv=/ij/oecdthemes/99980061/v2007n16/s1/p11.idx>
- Schou, Jesper et al. (2007). Virkemidler til realisering af målene i EU's Vandramme-direktiv. Udredning for udvalg nedsat af Finansministeriet og Miljøministeriet: Langsigtet indsats for bedre vandmiljø. Faglig rapport fra DMU nr. 625, 2007. (In English: Policy instruments for achievement of the objectives in the EU Water Framework Directive. An analysis on behalf of the committee established under the Ministry of Finance and the Ministry of the Environment: A longterm effort for a better aquatic environment. NERI Technical Report no. 625 2007).

2.4 Biodiversity

2.4.1 Policies regarding Biodiversity

Consolidated act no. 749 of 21 June 2007 on the Protection of Nature Act

Objective

To contribute to the protection of nature and environment in order to ensure sustainable development respecting the conditions of life of human beings and the preservation of fauna and flora.

Objective regarding biodiversity

Among other objectives, the act specifically aims

- To protect nature and its population of wild fauna and flora as well as their natural habitats a. o.
 - To improve, re-establish or establish protected areas for wild flora and fauna a. o.
-

Measures

- The act prohibits modification in the state of natural lakes larger than 100m² or parts of watercourses designated as protected or in specified natural habitats
 - The act obligates municipal governments to institute those measures outlined in the action plan for implementation of the Natura 2000 plan
 - In areas designated as international protected natural habitats, land owners must notify the municipal government before undertaking a number of activities, for instance planting of trees or construction of roads, in order for the municipal government to assess the effect of such activities on the area considering conservation objectives.
-

Implements parts or all of EU regulation

Bird directive (79/409/EC)

Habitat directive (92/43/EC)

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13137&exp=1>

Consolidated Act no. 1756 of 22/12/2006, Law on Environmental Objectives etc. regarding water bodies and international nature protection sites and

Executive order no. 815 of 27 June on classification of and objectives for biological status and

Executive order no. 408 of 1 May 2007 concerning designation and administration of international nature protection sites and protection of certain species

Description and objective

The law transposes the Water Framework Directive (2000/60) into Danish law and thus establishes the framework for protection of surface waters and groundwater and for planning regarding international nature protection sites. Thus it mandates the setting of environmental objectives for all water bodies within a river basin district and transposes the objectives under the Water Framework Directive that all surface waters and groundwater must achieve good

status by 2015. For surface water this means good ecological as well as good chemical status, for groundwater it refers to good quantitative status and good chemical status.

The executive order lists protected sites under the habitat and bird directives (Natura 2000 sites) and the Ramsar convention and determines rules for the administration of these sites.

Objectives regarding biodiversity

Natura 2000 sites and sites protected under the Ramsar Convention serve to protect and enhance biodiversity.

Rules for classification and objectives for the biological status in international nature protection areas are set out in executive order no. 815 of 27 June 2007 (URL provided below)

Measures

The act obligates the Minister of the Environment to develop the Natura 2000 plan for international nature protection sites. The plan must include:

- an baseline analysis mapping habitat types, assessment of current conditions and threats and maps indicating areas
- identification of objectives for biological status in order to ensure or re-establish a favourable status of conservation
- a programme of measures including guidelines for municipal action plans
- The public must be offered the opportunity to contribute proposals for the Natura 2000 plan.
- The Natura 2000 plan must be revised every 6 years
- Municipal action plans prioritise management activities regarding nature protection sites for the planning periods; they should indicate objectives and expected outcomes of each planned activity as well as methods and management activities planned in order to improve or maintain a favourable conservation status
- Local and national planning instruments must take into consideration the location of of international nature protection sites and thus must not allow for new dwelling areas, major road construction or construction of major traffic installations or extraction of raw materials within the protected sites.

Implements all or parts of the following EU-directives

Water framework directive (2000/60)

Bird protection directive (79/409)

Water Framework directive (2000/60)

Habitat directive (92/43)

URL:

Consolidated Act no. 1756:

http://147.29.40.90/SHOWF_A452676566/494&A20060175629REGL&0001&000001,

Executive order 815: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13148>,

Executive order 408: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13043>

*Consolidated act no. 793 of 21 June 2007 on the Act on Forests and
Executive order no. 335 of 26 March 2007 on the making of Natura 2000 forest plans*

Objective

The objective of the act is to conserve and protect the forests, to increase forest acreage and to promote sustainable forestry. Sustainable forestry involves, among others, conservation and increase of the biodiversity of forests.

Measures

- The act mandates formulation of a Natura 2000 plan for forested areas and forest reserves located within international nature protection sites. Such a plan consists of an analysis of baseline status and threats, determination of objectives, a binding programme of measures and guidelines for local forest action plans
 - Local forest action plans should prioritise management activities regarding nature protection sites for the planning periods; they should indicate objectives and expected outcomes of each planned activity as well as methods and management activities planned in order to improve conditions for specified natural habitats or maintain a favourable conservation status
 - Subsidies for the promotion of sustainable forestry and afforestation of agricultural land
-

Implements parts or all of EU regulation

Bird directive (79/409/EC)

Habitat directive (92/43/EEC)

Water Framework directive (2000/60/EC)

URL:

Consolidated act no. 793:

<https://www.retsinformation.dk/Forms/R0710.aspx?id=13145#FN501>,

Executive order no. 335: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13095>

Act no. 1572 of 20 December 2006, Law concerning environmental permit for livestock husbandry and

Executive order no. 648 of 18/06/2007 re Permits and Approval of etc. of livestock husbandry

Objective

To prevent and to limit pollution of air, water, soil and underground as well as to limit specified nuisances caused by livestock farms, including production, storage and use of manure.

Rules for the granting of permits and approvals of livestock husbandry are set out in the executive order.

Objective related to biodiversity

Not specified, but expansion of livestock farms is regulated within or near protected natural areas, cf. below

Measures

-
- Ban on establishment of livestock farms greater than 15 livestock units (LU) within 300 metres of specified protected natural habitats
-

Implements parts or all of EU regulation

Bird directive (79/409/EC)

Habitat directive (92/43/EC)

Environmental Impact Assessment (85/337/EC)

Integrated Pollution Prevention and Control (96/61/EC)

Water Framework Directive (2000/60/EC)

Nitrate Directive (91/676)

URL:

the act: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13068>,

the executive order: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13133>

Executive order no. 901 of 11 July 2007 announcing the protection of certain species of animal and plants, capturing and trading of wildlife etc.

Objective

To protect listed species of animals and plants

Measures

- Rules prohibiting the killing, capture, collection etc. of protected species
 - Rules prohibiting trading, keeping, preserving or transporting protected species
 - Rules prohibiting removal or destruction of the nesting or breeding places of wild birds
 - Subsidies may be offered in order to safeguard the habitats including breeding places of animal and plant species
-

Implements parts or all of EU regulation

Bird directive (79/409/EC)

Habitat directive (92/43/EC)

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13138#>

Executive order no. 1398 of 22 October 2007 concerning Act on environmental impact assessment of certain plans and programmes

Objective

To promote sustainable development by ensuring that certain plans and programmes are assessed with regards to their impact on the environment. This includes a.o. plans and programmes within the agriculture, forestry and fishery sectors.

Objective regarding biodiversity

Impacts on biodiversity is among the parameters that must be included in the environmental reports

Measures

An environmental report must be undertaken before issuing permits for the plans and programmes with a potential impact on the environment. The plan describes likely significant effects on the environment of implementing the plan or programme and reasonable alternatives are identified, described and evaluated.

Implements parts or all of the following EU regulation

SEA directive (2001/42)

URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=113557>

Implementation of the *Directive 2004/35/EC on environmental liability with regards to the prevention and remedying of environmental damage* is delayed. Proposals for regulation are expected to be presented to the Danish Parliament during its 2007-8 session.

2.4.2 Measures to improve Biodiversity

In accordance with EU policy, Denmark has as its policy objective to halt the decline in biodiversity by 2010. However, an actual conservation strategy with time-bound objectives has not been adopted (OECD 2007: 98). Likewise, Denmark has yet to developed a full set of indicators or “a monitoring system to evaluate the progress towards this objective” (OECD 2007: 87).

This is reflected in a lack of ex-ante or ex-post evaluations of the effect on biodiversity of policy measures. This chapter therefore lists measures which have been adopted or implemented but for lack of data does not include effects on biodiversity.

Protected areas

About 11% of the total area has been designated as protected. Half of these sites are located in Natura 2000 areas (OECD 2007).

Table 2.4.1: Protected areas established under international conventions or EU directives

Protection type	No. of sites	Area km ²		Share of Denmark's area
Natura 2000		Terrestrial	3,591	8% (of terrestrial)
		Marina	13,047	12% (of marine)
		Total	16,638	
Sites of community importance under Habitat	254	Terrestrial	3,173	7.4% (of terrestrial)
		Marina	7,963	7.5% (of marine)

Member State Level Analysis: Denmark and Norway

directive		Total	11,136	
Special protection areas under birds directive	113	Terrestrial	2,596	6.1% (of terrestrial)
		Marina	12,112	11.4% (of marine)
		Total	14,708	
Ramsar sites	27	Terrestrial	1,402	
		Marine	5,981	
		Total	7,383	

Source: OECD 2007; Ministry of the Environment 2004.

Planned measures to protect nature and biodiversity

Table 2.4.2: Action plan for biodiversity and nature conservation 2004-2009

Measures	Scale/objective	Comment
Establishment of national parks	5 parks	Established to create coherent natural areas over 20-30 years
10 m. uncultivated marginal zones along streams and lakes	30,000 ha by 2009 50,000 ha by 2015	
300 m. buffer zones around ammonia sensitive habitat types	180,000 ha	Livestock farms within the zones may not expand if expansion involves increased ammonia discharges
A tax on mineral phosphorous used in livestock feed – 4 DKK per kg	25% reduction of P-surplus by 2009 Another 25% reduction of P-surplus by 2015	
Planning tools	Environmental Impact Assessments Strategic Environmental assessments Nature planning tool to assess status, set objectives and prioritise efforts	Projects within certain sectors such as agriculture must be assessed with regards to their impact on nature in order to gain permit
Nature-friendly management of state-owned nature areas	5-6 ministries. Minsitry of Environment owns 188,0000 ha.	
Active management of Natura 2000 sites		

Near-nature forestry	10% of forested areas will be managed with biodiversity as the primary consideration	Objective to be reached by 2040
Increase in forested area	20-25% of total area to be covered by forest	To be reached within a three-generation, i.e. 80-100 years
Agro-environmental measures <ul style="list-style-type: none"> • Establishment of wetlands • Extensive buffer zones • Strips • Organic farming • Pilot and demonstration projects: grazing associations and nature plans • Compensation for restrictions caused by the implementation of the Bird Directive and the Habitat Directive 		Compensation to be considered

Source: Ministry of the Environment 2004

Agreement on water and nature

A 2006 parliamentary agreement set aside 558 mill. DKK for nature conservation projects to be appropriated between 2007 and 2009. The following types of projects are prioritised:

- Restoration of wetlands in river valleys
- Re-meandering of streams
- Removal of physical barriers in streams
- Establishment of water-meadows
- Set aside of agricultural lands
- Afforestation

Source: Danish Forest and Nature Agency 2006

In addition to these funds, a number of subsidy schemes under the EU Life programme, the EU INTERREG IV programme, the Rural Development Programme under the Common Agricultural Policy and smaller national pools all target nature conservation. An overview of these is available at:

<http://www.skovognatur.dk/Service/Tilskud/Naturprojektguide.htm>

Implemented measures

Table 2.4.3: Measures implemented under the Aquatic Environment Plans

Measures	Objective	Evaluation
Wetlands	6,900 ha by 2009	Objective will be met
Environmentally beneficial agriculture	4,000 ha by 2009	2006: 6,113 ha Based on experience, it is predicted that some farmers will leave the programme, hence the expectation is that the objective will <i>not</i> be met
Afforestation	11,400 ha for each of the periods 2004-2009 and 2010-2015	Results for 2004-2006: 8,8441 ha Objective will be met

Source: VMP II and III (DMU/DJF)

Potential measures

Table 2.4.4 Measures assessed in 2003 in preparation for the 3rd Aquatic Environment Plan

General measures		
Measure	Design	Effect ¹⁰
Economic measures		
Tax on nitrogen	Tax on difference between N-input and N-outtake	N-leaching is reduced by 1 % when tax is .55 EUR/kg N 7 % when tax is 1.1 EUR/ kg. N 10% when tax is 1.6 EUR/kg. N It is estimated that a 50 % reduction of leaching compared with 2003-levels is possible at a tax level of 4 – 6.7 euros pr. kg. N
Administrative measures		
Reduced nitrogen quota ¹¹	Further 10 percent reduction of nitrogen norm	Reduced leaching of 4 kg N per ha (~ 7% of the total) Reduced ammonia emissions of 800 tons NH3_N total emissions (~ 1.4% of the total)

¹⁰ Effects predicted from model calculations

Reduction in livestock holdings	400,000 livestock units	Reduced leaching: 6560 tons N or 14.4 kg per livestock unit Reduced ammonia emission 9,300 tons (~ of total emissions)
Stricter requirements on the use of nitrogen in manure	5 percentage points 10 percentage points	Reduced leaching: 3600 tons N (2% of total N leaching) Reduced leaching: 7200 tons N
Taking land out of production in wetlands		Reduced leaching 100 kg N/ha
Afforestation		Reduced leaching 0.04 tons N/ha
Further conversion to organic farming		Reduced N 17 kg N/ha

Sources: Blicher-Mathiasen, Gitte and Grant, Ruth (2003); Ministeriet for Fødevarer, Landbrug og Fiskeri (2003).

Table 2.4.5. Measures under consideration for the implementation of the Water Framework Directive¹²

Measure	N-discharge reduction kg/ha	P-discharge reduction kg/ha	Corollary effect
			<i>Biodiversity, landscape</i>
Changes in cultivation methods			
Conversion of extensive cattle production to organic production methods	6-41	-	+
No tilling or ploughing in winter	10-25	0.025-0.25	+
Changes in land use			
Permanent energy crops on land in rotation	30-55	0.003-0.1	+/-
Permanent pastures or grassland in river valleys	100-150	10-30	+
Permanent grassland on high-	26-66	0.06-0.25	+

¹¹ Quota is based on a set of nitrogen norms which are currently 10 percent below economic optimum

¹² Effect is calculated or estimated based on evaluations of already implemented measures and models.

lying fields			
Afforestation of agricultural land	30-70	?	+/-
Permanent grassland on fields with high risk of soil erosion	26-66	0.06-0.25	+
Buffer zones with permanent grassland along lakes and streams	26-66	1-3	+

For comparison, average N-leaching per year is about 61 kg N/ha.

“+” indicates a positive effect on biodiversity;

“-“ indicates a negative effect

Source: Schou et al. 2007

Table 2.4.6: Regulation

Rules regarding development

- Prohibition against modification in the state of natural lakes larger than 100m² or parts of watercourses designated as protected or in specified natural habitats (Protection of Nature Act)
- Ban on establishment of livestock farms greater than 15 livestock units (LU) within 300 metres of specified protected natural habitats (Environmental permit for livestock)

Rules protecting certain species of animals and plants:

- Rules prohibiting the killing, capture, collection etc. of protected species
- Rules prohibiting trading, keeping, preserving or transporting protected species
- Rules prohibiting removal or destruction of the nesting or breeding places of wild birds

Table 2.4.7: Planning tools and environmental impact assessments

Land owners within international protected natural habitats are required to notify the municipal government before undertaking certain activities, for instance planting of trees or construction of roads.

The municipal government must assess the effect of such activities on the area considering conservation objectives (Protection of Nature Act).

Natura 2000 plans to be developed by Ministry of Environment, including:

- A baseline analysis mapping habitat types, assessment of current conditions and threats and maps indicating the areas
- identification of objectives for biological status in order to ensure or re-establish a favourable status of conservation
- a programme of measures including guidelines for municipal action plans (Law on Environmental Objectives)

Municipal action plans regarding nature protection sites, indicating objectives and expected

outcomes of each planned management activity as well as methods and management activities planned in order to improve or maintain a favourable conservation status (Law on Environmental Objectives)

Local and national planning instruments must not allow for new dwelling areas, major road construction or construction of major traffic installations or extraction of raw materials within international protected sites (Law on Environmental Objectives)

Natura 2000 plan for forested areas and forest reserves including:

- an analysis of baseline status and threats
- determination of objectives
- a binding programme of measures and
- guidelines for local forest action plans

(Source: Forests Act)

References:

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- Law on environmental objectives. Consolidated Act no. 1756 of 22/12/2006, Law on Environmental Objectives etc. regarding water bodies and international nature protection

sites. Available at URL:

http://147.29.40.90/SHOWF_A452676566/494&A20060175629REGL&0001&000001

Forests Act. Consolidated act no. 793 of 21 June 2007 on the Act on Forests and associated legislation. URL: <https://www.retsinformation.dk/Forms/R0710.aspx?id=13145#FN501>

3. Country level analysis: the case of Norway

Regulation generally available from www.lovdata.no

URL's provided throughout.

3.1 Diffuse Pollution

3.1.1 Policies regarding Diffuse Pollution

Regulation about the framework for water management 2006-1096

Objective

The law aims to prevent deterioration, to improve and to restore the status of surface waters in order to ensure that water bodies achieve at least a good ecological and good chemical status.

Objectives related to diffuse pollution

None specified, but nutrient concentrations are included among the physical and chemical criteria for classification of surface water bodies, and nutrient sensitive areas are to be included in the inventory of protected areas

Quality standards:

Surface water: for classification as very good nutrient concentrations match pristine conditions; for good nutrient concentrations should not exceed levels which permit the ecosystem to function and allow for the achievement of specified biological quality elements; for classification of moderate, nutrient concentrations must allow for the achievement of specified biological quality elements

Measures of relevance for diffuse pollution

- Inventory of protected areas to be completed by 2009
 - Monitoring:
 - groundwater: nitrate and ammonium concentrations to be monitored
 - surface water: monitoring nutrient conditions every 3 months
 - Programme of measures must include monitoring, prevention and, if relevant, ban on
-

discharges of diffuse pollution sources which may pollute water

URL: <http://www.lovdata.no/ltavd1/filer/sf-20061215-1446.html>

White paper to the Storting (Parliament) no. 26 – on the environmental policy of the government and the state of the environment of the country

Objective

The white paper – or report – to the parliament is the primary document laying out the environmental policy of the government

Objectives related to diffuse pollution

Section 8.2 concerns over-fertilisation and sludge

The overarching or strategic objective listed in this section is to ensure a quality of water in freshwater bodies and marine areas to maintain species and eco-systems and to allow for the health and welfare of human beings

Specific objectives regarding nutrients:

The national discharges of nutrients and particles for freshwater bodies and marine areas characterised by over-fertilisation must be reduced to a level which ensures good ecological status before 2021

No water body must deteriorate, i.e. be reclassified to a lower quality standard, due to nutrients or particles

Quality standards

- Good ecological status
-

Measures

- Provide legal base for local officials to strengthen environmental regulation of agriculture in areas with polluted water bodies and in coastal areas. Regulations would vary by area based on the specific problems in that area, but examples of new regulations mentioned are requirements for less intense use of livestock fertilisers, requirements to establish catch basins and border vegetation.
 - Research and development on reduced nitrogen in animal feed and increased use of injection technologies for fertiliser application.
 - Regionally administered economic subsidies
-

Implements the following EU directive

2000/60 (Water Framework Directive)

URL: <http://www.regjeringen.no/nb/dep/md/dok/regpubl/stmeld/2006-2007/Stmeld-nr-26-2006-2007-.html?id=465279>

Regulation no. 931 of June 1 2004 on limitation of pollution

Objective

To regulate and limit pollution from a number of sources and activities

Objective related to diffuse pollution

None specified

Measures

- Permits for wastewater discharges from private dwellings, smaller tourist facilities and other facilities with discharges less than 50 pe. Any significant increase in discharges from existing facilities or construction of new facilities must apply for permission. The law requires that the wastewater drainage system is built and maintained using best available technology, unless this leads to disproportionate costs.
 - For discharges into sensitive or normal areas phosphorous contents must be reduced by 90 percent, when there are user interests associated with the recipient, when there is a risk of eutrophication. If neither of these conditions apply, P-content must be reduced by 60 percent.
 - Permit for certain facilities under the Law on Pollution, including large-scale facilities for poultry or pig production. To get a permit the company must take all appropriate preventive steps against pollution using best available technologies; measures to prevent accidents and limit their consequences.
 - The authority issuing the permit must specify conditions including discharge limits for nutrients. Discharge limits may be replaced by similar criteria or requirements for technological measures. Discharge limits must build on best available technologies. If necessary, special conditions to ensure adequate protection of groundwater.
-

Implements parts of the following EU-directives

(only those relevant for diffuse pollution included):

Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and poly cyclic aromatic hydrocarbons in ambient air,

Urban wastewater treatment directive (91/271),

Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community

URL: <http://www.lovddata.no/cgi-wift/ldles?doc=/sf/sf/sf-20040601-0931.html#map094>

Regulation no. 951 of July 4 2003 on fertiliser products of organic origin

Objective

The objective is to ensure proper quality of the products covered by the regulation, to prevent pollution from production, storage and use of fertilisers of organic origin and to ensure that such fertilisers are used as a resource. Additionally, the regulation should

contribute to an environmentally sound management of the land and to protect biodiversity.

Fertilisers of organic origin cover manure and other fertilisers from livestock, sludge from wastewater treatment, composting, a. o.

Objective related to diffuse pollution

See above.

Measures

Rules regarding

- Storage of livestock manure and other fertilisers
- Fertiliser use:
 - Requirement for a fertiliser plan (cf. regulation on fertiliser planning, see below)
 - Livestock manure may be spread only on areas approved for this purpose;
 - Minimum requirement for the proportion between land and fertiliser units; for nitrate vulnerable areas cf. the EU nitrate directive (91/676) the amount of manure per hectare must not exceed 17 kg total N
 - Application allowed only from February through October and not on ice-covered or frozen ground

Implements parts of the following EU directive(s):

Water Framework Directive 2000/60,
Council directive 86/278 on protection of the environment and soil when sewage sludge is used in agriculture

URL: <http://www.lovdata.no/cgi-wift/ldles?doc=/sf/sf/sf-20030704-0951.html#2>

Regulation no. 791 of July 1 1999 on fertiliser planning

Objective

The regulation aims to promote high quality production, to limit discharges of nutrients to waters as well as losses to the air and to ensure efficient use of nutrients in the soil and from fertilisers.

Objective regarding diffuse pollution

To reduce discharges of nutrients from fertiliser, cf. above

Measures

- A fertiliser plan, including information on acreage, soil type and soil analyses focusing on phosphorus and potassium, crops and expected yields, estimated need for nitrogen, phosphorus and potassium and distribution of mineral and livestock fertilisers as well as other fertilisers of organic origin, a.o.
 - Requirements for soil tests to be conducted every 4th or 8th year
 - Farms using livestock manure or other fertilisers of organic origin must calculate proper amounts for each growing season
-

-
- Fertiliser amounts must be based on soil tests, yield and fertiliser norms for the district, expected yield and the previous crop
 - If growing conditions depart from the assumptions laid down in the plan, the fertiliser plan must be adjusted accordingly
-

Implements parts of the following EU directives

Nitrate directive (91/676)

URL: <http://www.lovdatab.no/for/sf/ld/td-19990701-0791-0.html>

Act no. 79 of June 17 2005 regarding aqua culture

Objective

To promote the profitability and competitive strength of aqua culture within the parameters of sustainable development

Objective regarding diffuse pollution

None specified, but as aqua culture is a source of diffuse pollution from nutrients the requirement for environmentally sound operations potentially involved control of nutrient pollution

Measures

License for aquaculture business is required

- The permit specifies location as well as scope
- It may awarded only if warranted by environmental conditions

Environmental requirements

- The aqua culture facility must be operated in an environmentally sound manner. Specific conditions may be laid out in regulation
 - Applicants for a permit may be required to carry out environmental assessments to document environmental conditions at the location
 - Monitoring in the form of a trend analysis of the sea bottom, to be carried out in accordance with the Norwegian standard NS 9410 - "Environmental survey of marine fish farms" - or equivalent
-

URL: <http://www.lovdatab.no/all/hl-20050617-079.html>

3.1.2 Measures for reduction of Diffuse Pollution

This chapter lists measures implemented to reduce diffuse pollution in Norway as well as evidence of their effect. However, measures have either not been evaluated separately or have been evaluated with regards to their behavioural but not their environmental effects. To provide some indication of individual measures, the abstract also includes findings from research as to the effect of specific measures.

Norwegian policy to curb diffuse pollution emphasises phosphorous rather than nitrogen as P is the limiting factor for algae growth in the water bodies. At the core of the policies, therefore, are measures aiming to reduce loss of soil and thereby the transport of P to the water bodies.

Efforts to regulate fertiliser use are limited; the fertiliser plan is the main instrument. The recommended levels of phosphorous for certain crops have been lowered in recent years, but the levels are not mandatory caps.

Implemented measures to limit nutrient runoff 1985-2005

- Fertiliser management to reduce surplus of nutrients
- Improved storage facilities for livestock manure and silage
- Rules for manure handling and handling of silage effluent
- Subsidy schemes to promote environmentally friendly agricultural practices, including cultivation methods to protect against erosion

Effects of measures

Table 3.1.1: Effect in absolute reduction

Discharges, tonnes	1990	1998
N tonnes:		
All coastal waters	22,020	21,992
North Sea	12,029	10,289
P:		
All coastal waters	719	663
North Sea	266	214

Table 3.1.2: Effect in percent

1985-2005	Total antropogenic discharges, reductions	Agricultural discharges, reductions
Nitrogen	Objective: 50 percent Result: 42 percent	Objective: 44 percent Result: 28 percent
Phosphorous *	Objective: 50 percent Result: 64 percent	Objective: 40 percent Result: 38 percent

* Applies to P-sensitive area, cf. Ospar Convention and North Sea Declaration

Sources: OECD 2001; Gundersen et al. 2008

National Environmental Programme

Adopted annually, evaluated 2003

Measures:

- Environmental requirements tied to production subsidies. These include requirements for a 2 m wide vegetation covered buffer zone along water bodies and authorisation of local authorities to apply requirements for gentle soil tillage practices on erosion prone lands.
- Grant schemes for production practices that reduce or prevent erosion, including (differentiated according to the degree of erosion sensitivity of the location)
 - no or reduced soil tillage during fall and winter
 - catch crops
 - grass covering of waterways.
- Funds for information and development which can bring about effective measures, contribute to knowledge transfer from research to agricultural production, contribute to updating of agricultural advisory services and to render visible environmental efforts in the agricultural sector
- Subsidies for organic agriculture

Effects, national programme

Erosion reduced by 312000 tons or by 213 kg per hectare subsidised (2003)

Regional environmental programmes

Adopted annually from 2005, evaluated 2006

Measures:

Grant schemes for production practices that reduce or prevent erosion, including

- no or reduced soil tillage during fall and winter
- catch crops
- grass covering of waterways
- grass covered buffer zones
- retention/sedimentation ponds

Subsidies are differentiated by region and according to the degree of erosion sensitivity of the location.

Effects, regional programme

Erosion reduced by 282,000 tons or by 188 kg per hectare receiving subsidies (2006, nationwide).

Comment: smaller effect compared with 2003 due in part to a reduction in subsidies on areas less prone to erosion.

Estimated effects on erosion from specific measures

- Catch crops: a potential for a 20 percent reduction in annual nitrogen losses according to simulations
- Stub fields on levelled fields: potential loss of soils by as much as 85%.

- Light fall tillage (compared with ploughing) could reduce erosion by 50%

Overall conclusion

Subsidies do not bring about sufficient reduction in erosion and nutrient runoff. There is no correlation between subsidy rates and the number of hectares registered under the schemes; hence it is concluded that subsidy rates in and of themselves do not determine participation in the programmes. Evaluators suggest a more targeted approach, and a higher degree of differentiation. They also point to the need for higher participation rates and more measures.

References:

Statens Landbruksforvaltning 2004 . Nasjonalt Miljøprogram 2004.

URL: <http://www.slf.dep.no/iKnowBase/Content/3437/Nasjonalt%20miljøprogram-trykkoriginal.doc>

Bioforsk 2008. Evaluering af regionale miljøprogram. Vurdering af ordningene ”avrenning til vassdrag og plantevernmidler”. Bioforsk rapport Vol. 3 No. 51 2008

Measures tested in research

Measure 1: Environmentally adjusted soil tillage – including no fall ploughing and no or only light tillage before seeding

Effects

Reduction in soil erosion compared with regular ploughing (spring crop):

- Fall harrowing twice and spring harrowing once: 86%
 - Fall harrowing once, spring harrowing once: 50 %
 - Spring ploughing: 14%
 - Spring harrowing, twice: 12%
 - Direct seeding: 11%
-

Source:

Bioforsk Tema Vol. 3 No. 11 2008 - www.bioforsk.no

Measure 2: Vegetation zones -

Zones along waterways covered by vegetation which holds back nutrients and particles and reduces erosion and thus reduces runoff to waterways. Zones should be at least 5 metres wide.

Effects

- 42-96 percent of phosphorous runoff is removed
-

-
- 27 – 81 percent of nitrogen runoff
 - And works year round.
-

Source

Bioforsk Tema Vol. 2 No. 22 2007 - www.bioforsk.no

Measure 3: Sedimentation (retention) ponds -

Wetlands constructed to retain particles, nutrients and pesticides from diffuse sources

Effects

For retention ponds which amount to 0.1 to 0.4 percent of the precipitation area, the retention effect is 21 to 44 percent for phosphorous and 3- 15 percent for nitrogen

Source:

Bioforsk Tema Vol. 3 No. 13 2008 - www.bioforsk.no

Aquaculture

Background

Aquaculture is a significant source of nutrient pollution in coastal waters (OECD 2001; Gundersen 2008). It is debatable whether it qualifies as diffuse pollution but is included here for the sake of completion.

The law on aquaculture specifies that aquaculture must be operated in an environmentally sound manner.

Measures

A licensing system which limits the number of aquaculture businesses allowed and specifies requirements to be fulfilled, including environmental requirements.

Licenses will be granted in part based on the environmental carrying capacity of the locality in question with regards to a.o. discharges of organic substances. Monitoring is required and includes a trend analysis of the bottom with regards to silt sedimentation.

Effects

No evaluation has been carried out.

References:

Bioforsk Tema Vol. 2 No. 22 2007. Vegetasjonssoner bidrar til renere vann i vanndrag og innsjøer (English title: Vegetation Zones contribute to cleaner waterways and lakes).

Bioforsk Tema Vol. 3 No. 11 2008. Miljøtilpasset jordarbeiding reduserer tap av jord og næringsstoffer (English: Environmentally adjusted soil tillage reduces loss of soil and erosion).

Bioforsk Tema Vol. 3 No. 13 2008. Fangdammer – effektive oppsamlere av jord og næringsstoffer (English: Retention ponds – effective collectors of soil and nutrients).

Gundersen, Geir I. et al (2008). Jordbruk og miljø 2007. Statistics Norway: Rapportar 2008/1 Bioforsk (2008). Evaluering af regionale miljøprogram. Vurdering af ordningene ”avrenning til vassdrag og plantevernmidler”. Bioforsk rapport Vol. 3 No. 51 2008.

URL:

http://www.slf.dep.no/iKnowBase/Content/8373/RAPPORT_EVALUERING_RMP6MARS08.PDF

Fiskeri- og kystdepartementet (2005). Fiskeri- og kystdepartementet miljøhandlingsplan 2005 – 2008. http://www.regjeringen.no/nb/dep/fkd/dok/rapporter_planer/Rapporter/2005/Fiskeri-og-kystdepartementets-miljohandlingsplan-2005--2008.html?id=106366

OECD (2001). Environmental Performance Review Norway 2001, Statens Landbruksforvaltning 2004 . Nasjonalt Miljøprogram 2004. URL: <http://www.slf.dep.no/iKnowBase/Content/3437/Nasjonalt%20miljøprogram-trykkoriginal.doc>

3.2 *Acidification*

3.21. Policies regarding Acidification

Regulation no. 362 of 2002 on treatment of permits under the Act on Pollution

Objective

The regulation specifies requirements for permits regulating enterprises which may cause pollution

Objectives related to acidification

The regulation concerns emissions of acidification of nitrogenoxides and other nitrogen compounds as well as sulphur oxides

Measures

Permit including emission criteria

URL: http://www.lovdatab.no/cgi-wift/wiftldles?doc=/usr/www/lovdatab/ltavd1/filer/sf-20020416-0362.html&emne=utslippsgrense*&#map004

Pollution Regulation no. 931, chapter 7 on local air quality

Objective

The regulation concerning local air quality aims to promote the health and well-being of human being and to protect vegetation and ecosystems.

Objectives related to acidification

Not specified, but the objective to protect vegetation and ecosystems implies that acidification should be prevented or reduced, and NO_x and SO₂ are both regulated under the directive

Quality standards or emission limits

Quality standards (if exceeded, measures must be implemented)

- SO₂: 20µg/m³, average for calendar year and for the winter period
- NO_x: 30µg/m³, average each for calendar year

Requirements for monitoring and/or calculating air quality

Air quality must be measured in relation to a.o. vegetation based thresholds

- SO₂: upper threshold: 12 µg/m³; lower threshold: 8 µg/m³ (winter average)
- NO_x: upper threshold: 24 µg/m³; lower threshold: 19.5 µg/m³ (annual average)

If the upper threshold is exceeded, monitoring stations must be set up every 20,000 km²; for concentrations between the lower and upper threshold monitoring stations must be set up every 40,000 m².

Measures

- Establishes minimum standards for local concentrations of nitrogen oxides and SO₂
- Requirements for monitoring of air quality

URL: <http://www.lovddata.no/for/sf/md/xd-20040601-0931.html#7-1>

Pollution Regulation no. 931, chapter 17 on emission of dangerous substances into water

Objective

This chapter aims to protect freshwater and marine water against emission of dangerous substances; it implements the EU directive 76/464

Objectives related to acidification

None specified, but ammonia is on List II of the directive and therefore the introduction of ammonia into the groundwater must be limited

Implements parts of the following EU directives

Dangerous substances directive (76/464)

URL: <http://www.lovddata.no/for/sf/md/td-20040601-0931-053.html>

Regulation 1206 of 2001 on the content of sulphur in various oil products

Objective

The regulation aims to limit polluting emissions from combustion of fuel oils and marine gas oils

Objectives related to acidification

The implied purpose of the regulation is to reduce acidification caused by the burning of sulphur-containing fuels

Measures

- Regulation of the content of sulphur in heavy fuel oils used in combustion or used as fuel in vessels
 - Prohibition on combustion of heavy fuel oils in Oslo and Drammen
 - Requirement for emission permits for enterprises exceeding set limits for SO₂ emission or with specified cooling capacities or using fuel oils with high sulphur contents
-

Implements parts of the following EU-directives (relevant to acidification):

Directive 1999/32/EC, reduction in the sulphur content of certain liquid fuels

Directive 1987/219 approximation of the laws of the Member States relating to the sulphur content of certain liquid fuels

URL: <http://www.lovddata.no/cgi-wift/ldles?ltdoc=/for/ff-20011008-1206.html>

Regulation no. 1122 of 1983 on prevention of pollution from marine vessels

Objective

The regulation serves to protect the environment from pollution and reduce emission of polluting substances from marine vessels

Objectives related to acidification

None specified, but reduction in NO_x and SO₂ emissions will reduce acidification

Measures

Requirement that specified diesel engines must abide by a set of emission criteria for nitrogenoxides and sulphur oxides

Implements parts of the following EU-directives

Directive 1999/32

Directive 96/98

Directive 2005/33

URL: <http://www.lovddata.no/cgi-wift/ldles?doc=/for/ff-19830616-1122.html#map0>

Decision no 1836 of 28 November 2007 on excise duties for 2008

Objective

Establishing levels of excise duties on various products, including fuels

Objective related to acidification

Not specified

Measures

- Environmentally differentiated excise duties on diesel-driven vehicles based on EURO degassing classifications
- Excise duty on mineral oil for vehicles with a slightly higher tax on higher-content sulphur oil
- SO₂ tax on mineral oils, increasing by weight content of sulphur

URL: http://www.lovdato.no/cgi-wift/wiftldles?doc=/usr/www/lovdato/ltavd1/filer/sf-20071128-1386.html&emne=kj%d8ret%d8yforskrift*#map017

Regulation no. 951 of July 4 2003 on fertiliser products of organic origin

Objective

The objective is to ensure proper quality of the products covered by the regulation, to prevent pollution from production, storage and use of fertilisers of organic origin and to ensure that such fertilisers are used as a resource. Additionally, the regulation should contribute to an environmentally sound management of the land and to protect biodiversity.

Fertilisers of organic origin cover manure and other fertilisers from livestock, sludge from wastewater treatment, composting, a. o.

Objectives related to acidification

Not directly specified, but the objective of environmentally sound management of land and protection of biodiversity would encompass ammonia emissions

Measures

- Large scale pig and poultry facilities must be designed so that they reduce ammonia emissions by 20% compared to a reference facility
- For such large scale pig and poultry facilities fertiliser storage installations must be designed to reduce ammonia emissions compared with emissions from uncovered outdoor manure storage.

Implements parts of the following EU directive(s):

Water Framework Directive 2000/60

Council directive 86/278 on protection of the environment and soil when sewage sludge is used in agriculture

URL: <http://www.lovdato.no/cgi-wift/ldles?doc=/sf/sf/sf-20030704-0951.html#2>

Regulation no. 918 of 1994 on technical requirements and approval of vehicles, parts and equipment

Objective

Establishing technical requirements for vehicles

Objectives on acidification

None specified

Measures

Emission limit values for NO_x from vehicles, specified by type of vehicle

Implements part of the following EU directives

Directive 98/69

URL: <http://www.lovdata.no/cgi-wift/ldles?doc=/for/ff-19941004-0918.html#1-1>

Regulation no. 1096 of 2006 about the framework for water management

Objective

The law aims to prevent deterioration, to improve and to restore the status of surface waters in order to ensure that water bodies achieve at least a good ecological and good chemical status.

Objectives related to acidification

None specified, but nutrient sensitive areas are to be included in the inventory of protected areas and the state of acidification must be included in the water classification criteria

Implements parts of the following EU directive

Water Framework Directive (2000/60)

Measures of relevance for acidification

- Inventory of protected areas to be completed by 2009
 - Monitoring: groundwater: nitrate and ammonium concentrations to be monitored.
-

URL: <http://www.lovdata.no/ltavd1/filer/sf-20061215-1446.html>

3.2.2 Measures for Reduction of Acidification

Measures to reduce acidification target the acidifying gasses separately and often in relation to other policy targets. Hence, sulphur and nitrogen oxide measures often form part of general air pollution policy packages whereas ammonia emissions have been regulated as

part of policy packages aiming to reduce nutrient losses from agriculture. This is reflected here as the abstract lists general air pollution measures as well as measures targeting each of the acidifying gasses separately. Evaluations typically do separate the effects of each of the measures, but evaluate general trends in emissions.

Moreover, acidification is a transboundary pollution issue implying that the development in levels of acidification is affected not only by national policies but also by measures undertaken in other countries. Hence, in the early 2000s, nearly 80% of the sulphur compounds and the nitrogen deposited in Norway originated from its neighbouring countries (OECD 2001: 158).

Measures targeting air pollution in general

The following measures target air pollution in general, particularly fuel related air pollution. Hence, to the extent that they work they would reduce also emissions of acidifying gasses.

- Tax exemptions and subsidies for R&D in renewable energy
- Taxes on transportation fuels
- Fee/tax on heavy vehicles, partially levied based on emissions
- Emission permits for companies affected by the Integrated Prevention and Pollution Control directive have been revised to include requirements for Best Available Technologies

Source: Kongelive Miljøverndepartementet, 2006; OECD 2001

Effects on acidification

Based on a study of about 50 lakes, acidification of lake water has decreased considerably between 1986 and 1999, including a 30-to-40 percent reduction in sulphate concentrations; likewise, sulphate concentrations (SO₄) in precipitation were reduced by 48 to 58% in the same areas (OECD 2001: 58).

The share of the country's surface area on which acidification exceeds critical levels has also been reduced:

- 1980: approx. 30%
- 1990: approx. 20%
- 2000: 13%

Full implementation of Gothenburg Protocol: 7% expected

Source: OECD 2001

Measures to reduce sulphur-dioxide emissions

- Sulphur tax on fossil fuels, levied according to sulphur content, introduced in 1971, increased successively to reach 0.86 EUR cent/ l oil in 1995; levied on each .25% sulphur content based on weight

- Tax on coal and coke, in effect between 1999 and 2001
- Voluntary agreement scheme on reduction of SO₂ emissions, introduced in 2001

Source: Nordic Council of Ministers 2006.

Effects

- 1980-2000: 78% reduction in SO₂ emissions

Table 3.2.1: Emissions for sulphur dioxide

SO₂ emissions	1000 tonnes SO_x
1990	53
2005	24
Target 2010	22

Source: Statens Forurensningstilsyn, website

Ex-ante estimates of the effect of SO₂ fuel tax was a total emission reduction of 34000 tonnes between 1995 and 2005.

NO_x emissions

Implemented measures

- Emission permits under the Law on Pollution
- Annual tax on vehicles differentiated according to weight and emissions
- Low-NO_x burners to be required for installation of new gas turbines
- NO_x emission limits for vessels, according to the UN International Marine Organisation
- Exhaust emission criteria, de facto forcing all new petrol fuelled vehicles to be equipped with three-way catalytic converters (since 1989); since 2000, all new vehicles must conform to EURO III emission norms

Source: OECD 2001

Recent measures

- NO_x tax of 15 NOK per kg NO_x, covering 55% of emissions (adopted 2007).
- Voluntary agreement with 14 sectors which are exempted from the tax if they reduce emissions by an agreed upon amount (Adopted 2008)
- Companies covered by the IPPC directive are required to use Best Available Technologies

Effects

- 1986-98: .8% reduction

Table 3.2.2: Emissions and acid deposition for NO_x

NOx emissions	1000 tonnes
1990	219
2005	190
Projected emissions for 2010	193
Target 2010	156

Source: Statens Forurensningstilsyn, website; Kongelige Miljøverndepartement 2006

According to OECD 2001, reductions up until that point stemmed primarily from the exhaust emission criteria for vehicles

A recent analysis of technological measures estimated a reduction potential of up to 75,500 tonnes of NOx across off-shore petrol industry, onshore industry, domestic shipping transport and construction of new vessels. More than half of the reduction potential relates to technology changes in domestic shipping transport (SFT, 2006).

Ammonia emissions

Ammonia emissions were below the levels allowed for under the Gothenburg Protocol, hence Norway has increased its ammonia emissions slightly since 1990. Even so, agricultural emissions which contribute the largest share of ammonia emissions are now being regulated

Measures to reduce ammonia emissions

- Requirements for design of livestock buildings
- Requirements for storage of organic fertilisers from large pig and poultry herds
- Emission criteria for vehicles

Effect

Emission criteria led to a decrease in the relative load of emissions from road traffic, as their share of total ammonia emissions declined from 34% of total emissions in 1990 to 19% in 2003)

Table 3.2.3: Reductions in ammonia emissions 1990-2006

NH3 emissions	1000 tonnes
1990	20.4
2005	23
Target 2010	23

Source: Statens Forurensningstilsyn, website

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