



# Policy Incentives for Climate Change Mitigation Agricultural Techniques

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**PICCMAT WP3**

**Policy review**

**EU policies relevant in the context of climate change mitigation in agriculture  
and overview of implementation in the Member States**

**Internal paper – do not cite or quote!**

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**Contents**

- 1 Introduction..... 3**
  - 1.1 Agriculture and greenhouse gases – status, trends and projections ..... 3
  - 1.2 Relevant policy processes at EU and international level ..... 5
  
- 2 EU policies relevant in the context of climate change mitigation ..... 6**
  - 2.1 Rural Development..... 6
  - 2.2 Cross Compliance ..... 6
  - 2.3 Nitrate Directive ..... 8
  - 2.4 Soil Strategy ..... 9
  - 2.5 National Emissions Ceiling Directive ..... 11
  - 2.6 Integrated Pollution Prevention and Control Directive ..... 12
  - 2.7 Water Framework Directive ..... 13
  
- 3 References .....13**
  
- Annex I: Summary of standards implemented in the MS under different policies .....15**

# 1 Introduction

The aim of this paper is to review different EU policies that may affect emissions of greenhouse gases from agriculture and that are thus relevant in the context of the PICCMAT project. It also aims to give an overview of the degree to which potential agricultural mitigation measures are already part of national or regional programmes in the Member States (e.g. national implementation of rural development – agri-environmental measures, cross compliance, or the National Emissions Ceiling Directive). To this end, measures contained in these programmes are listed and summarised.

The policy review is intended to provide a link between the scientific work of PICCMAT and the policy aspects of WP 3. It should also support the final decision about mitigation options to be considered in the project. From the minutes of the kick-off meeting and the Baastel meeting with DG Agri it seems clear already that organic farming and biogas production will be excluded from the work of PICCMAT, as well as large-scale changes in land use and biofuels production. While the greenhouse gas emissions from livestock digestion processes should not form a focus of PICCMAT, the management of manure in the sense of application to agricultural soils is relevant. However, for further demarcation of the scope of the project in terms of mitigation options it might be helpful to look at the measures that are already included in policies, and at the scope of existing policies to integrate further mitigation measures.

Chapter 1.1 gives an introductory overview of current activities at EU level on agriculture and climate change and their results.

We hope that this review will be useful for further work on PICCMAT and are happy to include further aspects and take up comments from partners.

## 1.1 Agriculture and greenhouse gases – status, trends and projections

Currently, agriculture is estimated to account for 9 % of greenhouse gas (GHG) emissions from the EU-25. Two major greenhouse gases are emitted from agricultural activities: nitrous oxide (N<sub>2</sub>O) from soils and fertiliser use management and methane (CH<sub>4</sub>) from livestock digestion processes and manure management (ECCP 2006).

Agriculture is responsible for 50% of the EU's total methane emissions. Of these total agricultural methane emissions, 73% are from livestock digestion processes, and 26% from manure management (mainly storage).

About 67% of the EU's N<sub>2</sub>O emissions are attributable to agriculture. Of the total agricultural N<sub>2</sub>O emissions, 88% are caused by activities related to agricultural soils management (the application of mineral and organic nitrogen fertilisers and animal manure), and 12% are caused by manure management (activities related to manure collection and storage). Burning of crop residues also produces emissions (Fuentes 2007).

During the past years, a **decreasing trend** has been observed in agricultural GHG emissions. Total EU-25 GHG emissions from agriculture decreased by 14 % between 1990 and 2003 (ECCP 2006). This development was mainly caused by decreases in livestock numbers (in particular cattle) and in fertiliser use, and by improvements in manure management systems. It is interesting to note that in the case of the agricultural sector, this decrease in emissions is accompanied by economic growth of the sector. For instance, fertiliser consumption decreased while at the same time crop production increased.

It is likely that the recent **reforms of the Common Agricultural Policy** contributed to these emission decreases, although it is difficult to quantify the effect. It can be assumed that the reforms supported a decline in fertiliser use and animal numbers through increasing rural development support (e.g. agri-environmental measures supporting extensification and input reduction), and the obligation to respect minimum environmental standards as a condition for eligibility for support under several rural development measures (good farming practices). The implementation of the Nitrates Directive has led to substantial improvements in manure management and storage conditions and is also likely to have contributed to the decreasing trend in emissions. Other factors that may have played a role are efficiency improvements in farming practices, and the restructuring of the agricultural sector, particularly in the New Member States.

De-coupling is also expected to have a beneficial effect on agricultural greenhouse gas emissions, since it removes or reduces incentives for intensive production. This recent CAP reforms made the agricultural sector more responsive to the market, so farmers are likely to react more strongly to non-policy signals in the future. If market signals were to change, this might also lead to increases in emissions.

Table 1 summarises the main elements of the CAP reform and their expected impacts on farming systems and their greenhouse gas emissions.

**Table 1 CAP reform measures and assumed impact climate-related characteristics of farm systems in Europe**

Measure	Expected impact
<b>Decoupling</b>	<ul style="list-style-type: none"> <li>Reduction of incentives towards intensive production (e.g., extensification, livestock, reduced fertiliser use)</li> <li>Farmers more responsive to non-market signals</li> </ul>
<b>Modulation:</b> Reduction in direct payments. Amounts transferred to rural development	Increased budget for rural development --> Stimulate the adoption of environmentally friendly production techniques
<b>Cross-compliance:</b> <ul style="list-style-type: none"> <li>Direct payments conditional to the respect of Statutory requirements from 19 Community Acts, including 5 environmental Directives</li> <li>Maintenance of agricultural land in Good agricultural and environmental conditions (GAEC)</li> <li>Maintenance of permanent pastures.</li> </ul>	Incentive to comply with statutory environmental requirements, e.g. Nitrate Directive (reduced fertilizer use + improved practices) GAEC --> soil conservation, e.g. <ul style="list-style-type: none"> <li>improved management of soil organic matter (crop rotation, reduced tillage)</li> <li>reduced soil erosion</li> </ul>
<b>Set aside:</b> Maintenance of individual historical set-aside obligation (10 %), Maintenance in GAEC	<ul style="list-style-type: none"> <li>Less fertilizer use</li> <li>Potentially increased carbon sequestration, in particular long term non-rotational set aside</li> </ul>
<b>Non-food (energy) crops</b> can be grown on set-aside land <b>Energy crops support</b>	Carbon substitution potential: promotion of biofuels (however, GHG may be released when converting long-term grassy set-aside back into crop land)

Source: Adapted from Summa 2006.

Future influences of the CAP on agricultural greenhouse gas emissions will depend on the further development of the policy. The European Commission plans a so-called “**health check**” for the CAP in 2008. While it is not yet clear what the outcome of this might be, the Commission has indicated that future reforms could include the following issues<sup>1</sup>:

- Further steps towards full de-coupling in all Member States,
- Possibly abolition of set aside,
- Raising the level of compulsory modulation,
- Excluding farms of less than 0.3 hectares from the subsidy system.
- Adjustments to market mechanisms, in particular no extension of milk quotas beyond the 2015 expiration date.

Generally, emissions from agriculture are **projected to decrease further** until 2010 - by 18% below 1990 levels (EEA projections/Fuentes 2007), due to the continuing effects of the CAP reforms, agri-environmental measures, more efficient implementation of the Nitrates Directive driven by cross compliance, and economic constraints (higher fertiliser prices).

The Scenar 2020 study (Nowicki et al. 2007), which develops projections for the development of European agriculture based on different socio-economic scenarios, also expects that livestock numbers will continue to decrease, due to a decline in beef production on the one hand, but also an increase in productivity on the other hand. The study also predicts fertiliser use to decrease in the EU-15, although it seems to be unclear whether increasing demand for biofuels might change this trend. For the new Member States, a substantial increase in fertiliser use from the currently low levels is expected.

In summary, significant GHG emission reductions were achieved during the past years, but they occurred mainly as side effects of structural changes, CAP reform, and the implementation of water protection legislation, but are not attributable to specific climate change mitigation measures in the agricultural policy area. Policies and measures specifically targeted to climate change mitigation might therefore help to further exploit the mitigation potential of the agricultural sector.

## 1.2 Relevant policy processes at EU and international level

The role of agriculture for the mitigation of climate change is being analysed at EU level in the context of the **European Climate Change Programme (ECCP)**. The working group on agriculture under the ECCP I identified and discussed about 60 measures that might contribute to GHG emission reductions. The mitigation potential, socio-economic implications (costs, effects on farm income, labour), environmental side effects (e.g. biodiversity) and technical feasibility of these measures were assessed.<sup>2</sup> According to the report (ECCP 2001), the most cost-effective measures with the highest emission reduction potential are:

- Set-aside,
- Efficient fertiliser application (e.g. spreader maintenance, precision farming),
- Better manure management and storage,
- Bio-energy production: biofuels and biogas.

Furthermore, the EU is part of the international climate protection process under the **UNFCCC** (United Nations Framework Convention on Climate Change), which also

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<sup>1</sup> See for instance Speech Mariann Fischer Boel at UK National Farmers' Union conference, 26 February 2007.

<sup>2</sup> For a list of these measures, see Annex I of ECCP 2001.

addresses agriculture and forestry. Member States are obliged to report on policies and measures for GHG mitigation implemented and their quantified estimated effects both under the UNFCCC and under the EC Monitoring Mechanism. Methodologies for the accounting of GHG emissions are developed by the Intergovernmental Panel on Climate Change (IPCC). The **IPCC methodology** excludes CO<sub>2</sub> emissions from the energy use of agricultural machinery, buildings and farm operations and transport of agricultural products from the “agriculture” category (they are accounted for under “energy” and “transport”), as well as emission reductions generated from the substitution of fossil fuels by bioenergy. Carbon sequestration in agricultural soils and crops is not accounted either under the “agriculture” category, but reported under “LULUCF” (Land Use, Land Use Change and Forestry).

For the calculation of emissions from agricultural activities (methane and nitrous oxide), country-specific data and mostly default emission factors are used. Consequently, the potential effect of many of the small-scale measures for curbing emissions that will be promoted by PICCMAT will not be reflected in the annual national UNFCCC inventories – unless Member States use more specific emission factors and refine their accounting methodology (Fuentes 2007).

## **2 EU policies relevant in the context of climate change mitigation**

While there is no European policy that specifically addresses climate change mitigation in agriculture, the greenhouse gas emissions from the agricultural sector are influenced by a number of agricultural and environmental policies. The following sections present the most important of these policies and outline their relevance in the context of agriculture and climate change mitigation. Where applicable, the implementation of measures and programmes in the Member States is summarised and presented.

### **2.1 Rural Development**

Agro-environmental measures (AEM) have appeared for the first time in 1985 with regulation (CEE) n°797/85. AEM have then been implemented by two successive programmes resulting from the regulations 2078/92 and 1257/99. In the 1999 reform, rural development has become the second pillar of the CAP with Council regulation (CEE) n°1257/1999, confirming the role of farmers in providing environmental services to society. In the last Rural Development Regulation (RDR), AEM are the only accompanying measure made compulsory to all MS, which demonstrates the importance they have taken.

In a document prepared for the RDR mid-term review (VI/12004/00 Final part D) DG agriculture presents a synthesis of the objectives of each measure in 7 themes as follows:

1. preservation or enforcement of biodiversity of agricultural lands
2. Conservation of high natural value habitats
3. Preservation of endangered animal or plant species
4. Protection of water quality
5. Protection or improvement of water resources
6. Protection of soils quality
7. Preservation and improvement of landscape

Although climate change mitigation is not a specified theme, themes 4, 5 and 6 may contain interesting AEM in terms of greenhouse gas emissions mitigation.

Each member state has defined its own framework for rural development regulation application, in which AEM can be defined either at the national or at the regional level, sometimes at both levels. The result is a very broad variety and a very large number of measures being defined in the entire European Union. However, a typology of practices and their assumed environmental impacts has been proposed in the *Final evaluation of agri-environmental measures* (Oréade-Brèche, 2005), as presented in **Table 2** in the Annex.

Of course, the relative importance of each type of measure in the Member States varies tremendously, according to the national and local environmental priorities defined and the type of agriculture implemented. Considering climate change is a global environmental issue, related measures should be undertaken everywhere, taking into account the local agriculture profiles and mitigation potentials.

In its *Analysis of the requirements for soil, biodiversity and GHG mitigation within RDP (2000-2006)*, GFA consulting (2006) (based on analyses from Wilhelm (1998), Germany) has clustered the agri-environmental measures in categories and sub-categories, in order to make the different measures comparable between countries and regions and to allow for an attribution of environmental potential effects. Table 3 in the Annex gives a list of AEM divided into six types and their potential impact on three environmental issues: soil protection, biodiversity protection, and GHG mitigation. This presentation has the advantage to clearly present the main types of AEM having been implemented in the different MS and European regions, and their potential environmental effects.

Although no MS has specifically designed AEM to mitigate climate change, many of the measures implemented in the RDR programmes have a clear effect on GHG emissions or carbon sequestration.

Introducing a compulsory set of measures specific to GHG emission mitigation into the RDR would clarify this issue within the AEM design and increase the potential effectiveness of measures to this aim. As for most of AEM, the difficulty will however lie in the possibility to measure and verify the real environmental benefits of the measures implemented, and thus to potentially introduce them into the UNFCCC inventories or the European trading scheme for the Kyoto Protocol commitments.

## 2.2 Cross Compliance - GAEC

The 2003 reform of the EU's Common Agricultural Policy made cross compliance mandatory for all Member States (Council Regulation 1782/2003 and Commission Regulation 796/2004). The instrument makes farmers' receipt of direct payments dependent upon their compliance with rules concerning the environment, animal identification and registration, public, animal and plant health, and animal welfare.

The cross compliance standards consist of two strands:

- Good agricultural and environmental condition ("Annex IV"): All farmers claiming direct payments must abide by standards to be newly established by the Member States, which constitute minimum requirements for the maintenance of land and soil conditions and must cover the aspects set out in Annex IV of Regulation 1782/2003.
- Statutory Management Requirements ("Annex III"): Farmers must respect standards called statutory management requirements (SMRs) set up in accordance with 19 EU Directives and Regulations (listed in Annex III of Regulation 1782/2003) relating to the protection of environment, public, animal and plant health, and animal welfare.

Since in the case of non-compliance farmers will be sanctioned through reductions of their direct support, the cross compliance instrument is expected to lead to a higher level of compliance with existing regulations (e.g. Nitrate Directive) and to additional environmental benefits through GAEC.

It is up to the individual Member States to define minimum GAEC requirements, and these requirements may differ according to the specific characteristics of different areas. Annex IV of Regulation 1782/2003 however specifies as a basic framework that standards must cover to soil erosion, soil organic matter content, soil structure and a minimum level of maintenance. A further requirement provided by the regulation is that land under permanent pasture must be maintained as such or at least the total area of permanent pasture within a member state must not decrease.

Regulation 1782/2003 requires that Member States inform the Commission in detail about the measures taken to implement the regulation, in particular about their implementation of the GAEC standards.

In the context of PICCMAT, the most important Cross Compliance standards are those relating to GAEC and to the Nitrate Directive. Table 4 in the Annex gives an overview of GAEC standards implemented in the Member States. The compilation of standards is based on an evaluation of two recent studies on Cross Compliance (CIFAS 2005 and CC Network 2006), which cover GAEC standards in 16 Member States<sup>3</sup>.

## 2.3 Nitrates Directive

The Nitrates Directive aims at mitigating the negative effects of fertilisation on drinking water sources and ecosystems by limiting the input of inorganic fertilisers and manure on farmland.

To this aim, Member States must identify waters that are or could be affected by pollution caused by nitrates from agricultural sources. Those waters and all known areas draining into those waters must be designated as 'nitrate vulnerable zones' (NVZ). For these zones Member States must then establish and implement action programmes to reduce pollution. Alternatively, action programmes may be implemented throughout the national territory; in this case the designation of vulnerable zones is not necessary. For areas outside the vulnerable zones the reduction of pollution has to be promoted by (voluntary) codes of good agricultural practice. The Member States are required to report on the designation of vulnerable zones, the results of the water quality monitoring, the action programmes and the codes of good agricultural practice to the Commission on a four year basis.

The Nitrate Directive limits the total organic manure loading averaged over the whole farmed area per hectare and year to 170 kg total N per ha. Derogation is possible and has been granted to several Member States for certain crop or soil types.

Furthermore Member States may fix N application limits different from the 170 kg under certain conditions:

- long growing seasons,
- crops with high nitrogen uptake,
- high net precipitation in the vulnerable zone,
- soils with exceptionally high denitrification capacity.

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<sup>3</sup> Belgium, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Ireland, Italy, Latvia, Lithuania, The Netherlands, Slovakia, United Kingdom (Scotland), United Kingdom (England).

In addition, the Directive requires Member States to establish standards and codes regulating the following issues:

- Periods during which the application of fertiliser is limited/prohibited
- Crop requirement limits must be respected by not applying more N than a crop requires, taking account of crop uptake, soil N supply, excess winter rainfall, and plant or crop available N from organic manures.
- N fertiliser and organic manures should be spread as evenly and accurately as possible.
- Application of manures or N fertilisers on waterlogged, flooded, frozen or snow covered ground
- Application of manures or N fertilisers to steeply sloping fields and in the vicinity of watercourses
- Sufficient manure storage facilities (or alternative arrangements) – storage capacity must exceed that required for storage throughout the longest period during which land application in the vulnerable zone is prohibited.
- Farmers must keep farm and field records on cropping, livestock numbers, N fertiliser usage and manure usage, for a minimum of five years after the relevant activity takes place.

The Nitrate Directive provisions belong to the Statutory Management Requirements under the Cross Compliance Regulation (see section 0). A summary of the standards regarding N application to agricultural land implementing the Nitrate Directive is given in Table 5. The table presents implementation examples from the Member States. The compilation is based on the reviews of Cross Compliance implementation carried out in CIFAS (2005) and CC Network (2006), which cover the SMRs of 13 Member States<sup>4</sup>.

## 2.4 Soil Strategy

Soil plays an important role in the context of the effects of agriculture on greenhouse gases, being the largest carbon store in the world (1,500 gigatonnes). Degradation of soils can lead to additional greenhouse gas emissions, while appropriate soil management can help to exploit its potential as a carbon store and lead to sequestration of carbon from the atmosphere.

The EU's **Thematic Strategy on Soil Protection** (COM(2006)231 final), which includes a proposal for a Soil Framework Directive (COM82006)232 final), was adopted by the Commission on 22 September 2006. It identifies a number of pressures on soil that need to be addressed: erosion, decline in organic matter, local and diffuse contamination, sealing, compaction, decline in biodiversity, salinisation, floods and landslides, and desertification. It also recognises that soil degradation affects other environmental areas, and that soil protection among other things can contribute to climate change mitigation.

The Thematic Strategy on Soil Protection (STS) aims to ensure the protection and sustainable use of soil in the EU, by preventing soil degradation, preserving soil functions and restoring degraded soils. To achieve these objectives, it proposes the following **actions and means**:

- Framework legislation – Soil Framework Directive;

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<sup>4</sup> Belgium, Czech Republic, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Lithuania, The Netherlands, United Kingdom (Scotland), United Kingdom (England).

- Integration of soil protection in the formulation and implementation of national and Community policies;
- Closing the current recognised knowledge gap in certain areas of soil protection through research supported by Community and national research programmes;
- Increasing public awareness of the need to protect soil.

The obligations of the Member States introduced by the proposed **Soil Framework Directive** are to identify areas at risk of soil degradation within 5 years after entry into force of the Directive, and to specify risk reduction targets for these areas (within 7 years) and establish programmes of measures, which have to be put in place (within 8 years). For the identification of risk areas, the Directive defines common criteria. The Commission encourages Member States to use existing monitoring schemes.

The Directive lets Member States choose their own level of ambition (e.g. acceptable levels of soil erosion), as well as measures for their programmes to achieve the targets. A flexible, subsidiarity-based approach has thus been chosen, which would leave sufficient room for Member States to accommodate regional and local conditions, needs and priorities, and to build on the efforts for soil protection that they are already making. The programmes could for instance build on measures already implemented under cross compliance and rural development, codes of good agricultural practice and action programmes under the Nitrate Directive, future measures under the river basin management plans for the Water Framework Directive, and others.

The Commission plans to publish a **list of measures** for soil organic matter protection prepared by DG ENV that could serve as a guideline for Member States for the designing of programmes. This list includes the following measures (information from Luca Marmo, DG ENV):

- Change arable land to grassland
- Afforestation of agricultural and degraded land
- Use organic soil improvers with predominance on humic acids (e.g. composts, manure)
- Restrict construction works on particularly vulnerable sites
- Adequate choices of crops/crop rotations
- Incorporation of crop residues
- Application of conservation tillage
- Appropriate site preparation techniques for afforestation
- Use of catch and interim crops
- Creation of buffer strips
- Construction and maintenance of terraces
- Creation of hedgerows and groves
- Adjust stocking rates
- Regulate controlled burning
- Restrict uncontrolled burning
- Cultivation of fire resilient plant communities
- Rise water table to restore cultivated or afforested peat soils
- Application of continuous cover forest management

- Allow for natural decay of forest exploitation debris when appropriate

An **impact assessment** was carried out for the proposed Soil Framework Directive (SEC(2006)620). The assessment lists several beneficial effects for climate to be expected from anti-erosion practices, practices to avoid loss of organic matter, and practices to avoid compaction: a reduction in carbon dioxide and other greenhouse gases emissions due to less machinery use (reduced tillage) and reduced stocking rates, and contributions to carbon sequestration.

The policy process on the Soil Framework Directive is ongoing, with political agreement expected towards the end of 2007 and adoption expected for 2008.<sup>5</sup>

## 2.5 National Emissions Ceiling Directive

The National Emission Ceiling Directive (NECD) sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (which includes ammonia), but leaves it largely to the Member States to decide which measures to take in order to comply. Member States are obliged to draw up national programmes that demonstrate how they are going to meet the national emission ceilings by 2010 (Fuentes 2007).

In the context of a review of the NECD, an in-depth analysis of the national programmes was carried out by Entec UK Limited for the European Commission in 2005 (Entec 2005). The review has a summary of the policies and measures reported by each Member State in their national programmes aimed at reducing ammonia (NH<sub>3</sub>) emissions in the agricultural sector (see Table 6 in Annex). The institutional level (local, national and European) at which policies and measures have been/will be implemented, is also indicated, along with quantitative information relating to the impact on emissions.

This Directive is not directly related to climate change, since it targets the agricultural emissions of ammonia which is not a greenhouse gas. However, the measures used to reduce ammonia have an impact on animal density, manure management and fertiliser use, which also positively affects the emissions of methane and nitrous oxide. Information on NH<sub>3</sub> reduction potential and potential associated costs may thus also be indicative for the potential greenhouse gas mitigation effect.

Member States have reported a relatively wide range of policies and measures aimed at reducing NH<sub>3</sub> emissions from agriculture (Entec 2005). The most commonly reported policies and measures are those aimed at:

- Reducing livestock density and numbers, and changes in their feed;
- Improving the management of manure and slurry; and
- Improving, and ultimately reducing, the use of fertilisers.

Several Member States have also reported a series of action plans and best practice recommendations.

Over half of the 14 Member States that have submitted national programmes under the NECD have reported the quantitative impact on emissions of NH<sub>3</sub> of one or more of their policies and measures aimed at the agricultural sector, but only two have reported information on the associated costs (cost effectiveness). Based on the available information, a total reduction in NH<sub>3</sub> emissions of up to 138 kilotonnes (kt) is possible. Estimates of the impact on emissions of improved manure management between Member States vary from

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<sup>5</sup> Eamonn bates europe – issue tracker ENVIRONMENT. March 2007.

1.31 kt (Denmark) to 6 kt (Netherlands). The maximum costs per kilogram of NH<sub>3</sub> abated that have been reported are 1 €/kg in the Netherlands based on improved application of slurry to soil and 3.5-3.9 €/kg in Denmark based on increased grazing of dairy cows and improved manure management. None of the large EU-15 countries (DE, IT, UK, FR) has provided cost estimates.

The majority of policies and measures reported by Member States for agriculture are national measures that have been or will be adopted by the central governments, but which will be implemented at the individual farm level. (Entec 2005).

**Revision of the NEC Directive:** The preparatory work for a legislative proposal to revise the NECD has started. The new proposal will set new emission ceilings to be respected by 2020 in line with the objectives of the Thematic Strategy on Air Pollution. Although some other aspects of the NECD will be revised too, the proposal will not affect the national emission ceilings for 2010. A proposal from the Commission is foreseen for adoption by July 2007 (Fuentes 2007).

## 2.6 Integrated Pollution Prevention and Control Directive

The Integrated Pollution Prevention and Control (IPPC) Directive was issued in 1996. It aims at minimizing environmental pollution and nuisance from large operations/installations in the European Union. In the agricultural sector, the IPPC Directive covers large pig and poultry farms with more than 2000 fattening pigs and/or more than 750 sows and/or more than 40,000 chickens. Measures that must be applied on IPPC farms are mainly ammonia (NH<sub>3</sub>) emission abatement measures (e.g. covered storage of animal manure, improved housing systems, air purification, manure handling and treatment, low-emission manure application). As in the case of the NEC Directive, greenhouse gas emissions are not directly targeted, but positively influenced by the Directive, since measures concerning manure treatment also influence methane and nitrous oxide emissions.

Across the EU-25 Member States, the intensive rearing of poultry and production pigs represents over 30% of the total number of IPPC installations. Progress in the pig and poultry sector towards full implementation of the IPPC directive is slower than in other sectors. The total number of IPPC farms is less than 1% of the total number of farms. However, on these farms 16% of the total number of production pigs, 22% of the total number of sows, and around 60% of the total number of poultry is kept (Fuentes 2007).

In 2006, the Commission launched a **review process** of the IPPC Directive that aims to improve some legal and technical elements to further improve its implementation. In the context of the implementation of the Thematic Strategy on Air Pollution (adopted by the Commission in 2005), the review also examines a possible extension of the scope of the IPPC Directive to intensive cattle rearing installations and a possible revision (lowering) of the thresholds for intensive rearing installations of pigs and poultry. A proposal from the Commission is foreseen for adoption by the end of 2007 (Fuentes 2007).

Under the IPPC Directive a reference document for Best Available Techniques (BAT) in intensive livestock farming has been drafted that describes in detail the recommended measures (European Commission 2003). This document also includes estimates of the NH<sub>3</sub> emission factor per animal category (kg per animal place and year), and assessments of the cost-benefit ratio of measures.

For PICCMAT, only some of the BAT measures identified under the IPPC process will be relevant – mainly those relating to **storage and application of manure**. The BREF document describes measures in the following categories:

- Good Agricultural Practice (Nitrate Directive)

- Manure Storage (technical/design/location details concerning manure stacks/heaps, storage tanks, storage lagoons)
- On-farm manure processing
- Techniques for spreading manure.

Detailed descriptions of measures can be found in the BREF document (European Commission 2003).

In addition, there are BAT concerning nutritional techniques, air emissions from housing, water and energy. These, however, are considered to be of minor relevance in the context of PICCMAT, since animal feeding and housing are likely to be excluded from the selection of mitigation measures analysed in the project.

## 2.7 Water Framework Directive

The overall purpose of the Directive is to establish a framework for the protection of European inland surface water, transitional waters, coastal waters and groundwater. The environmental objective of the WFD is to achieve 'good status' for all ground waters and surface waters by 2015 at the latest.

The WFD introduced the principle of **river basin management**, i.e. water resources have to be managed at river basin level, rather than according to administrative, geographical or political boundaries. This will enable assessment of all activities that may affect the watercourse, and their control by measures which may be specific to the conditions of the river basin. **River basin management plans** (RBMPs) are required to be drawn up for each river basin.

A central element of the RBMPs are the **Programmes of Measures** (PoMs) to ensure that all waters achieve good water status. This will require, at least, the full implementation of all national and Community legislation on water and related issues. If this basic set of measures is not sufficient to reach the goal of good water status, then the programmes must be supplemented by additional measures, such as **stricter controls on pollution from agriculture** or industry or from urban waste sources. This may also require consideration of land use planning measures. PoMs may thus indirectly also affect agricultural greenhouse gas emissions. Furthermore, the Water Framework Directive may influence the relationship between water managers and agriculture: in France, for instance, water management agencies are becoming increasingly active in the agricultural field, providing financing to farmers for implementing measures such as intercropping and reduced fertilisation, and even buying arable land and converting it back to permanent grassland.

Another important principle introduced by the WFD is that of recovery of the costs of water services, including environmental and resource costs, in accordance with the polluter pays principle. Costs will therefore have to be considered for the consumer/user of water, whether domestic, industry or agriculture. These costs could include construction, financing and maintenance of such measures as drinking water treatment and supply, the collection, treatment and discharge of waste water and water used for irrigation purposes.

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## Annex I: Summary of standards implemented in the MS under different policies

**Table 2 Synthesis of environmental impacts of AEM-related agricultural measures by type**

	<b>AEM by type of practice</b>	<b>Most frequent environmental effects in scientific studies identified during the evaluation</b> <b>In bold: potential impact on CC mitigation</b>	<b>Number of AEM</b>	<b>%</b>	<b>%</b>	<b>Related objective</b>
1	Reduction of agricultural inputs	Plant and animal diversity increased or maintained Reduction of phosphates and nitrates in the soil Improvement of water quality, but not always <b>Reduction of nitrogen oxide and of greenhouse gas emissions into the atmosphere by reducing nitrate input</b>	289	15	32	Water
2	Reduction of the transfers of fertilizers and pesticides into the water	Clear effectiveness of grass strips on the transfers of nitrates and pesticides Clear effectiveness of catch crops on reducing nitrate leaching Clear effectiveness of grass and green fallow lands on reducing nitrate and pesticide leaching	275	15		
3	Reduction of irrigated surfaces and irrigation amounts	Reduction of utilisation of water (but low implementation) Sometimes restoration of humid zones	20	1		
4	Limitation of drainage, reconversion of drained regions or other cultural practices linked to quantitative water management	Effect on the balance of water quantity in the fields (but low implementation)	13	1		
5	Control of soil erosion	Reduction of run-off and erosion with grass strips, cover crops, set-aside, <b>reduced tillage</b> without herbicide and <b>arable reversion to grassland</b> Limitation of sediment transfers to rivers and flood peaks due to small pond networks. Limitation of erosion by rehabilitation of terraces <b>Reduction of erosion and increase of carbon in the soil by hedges</b>	169	9	16	Soil
6	Maintenance of soil quality (preservation of soil organic matter content, control of acidification, salinisation, compaction, etc.)	<b>Improvement of the soil structure and the organic matter content by grass fallow and plant cover.</b> Improvement of the soil water reserves and fauna and flora activity by non ploughing of the land and the implantation of plant cover <b>Improvement of soil compaction by non ploughing or reduced tillage</b>	139	7		
7	Creation or maintenance of ecological infrastructures with a habitat role (hedge, copse, small fields, grass strip/headland, etc.) or fallow field - set aside	Biologic diversity increased or maintained by creation or preservation of ecological infrastructures Creation of habitats for fauna and flora <b>Reduction of run-off, erosion and input transfer</b> Effect on diversification and landscape structuring	168	9	40	Biodiversity
8	Conservation of rare high nature value farmland habitats and endangered species	Diversity of plant and rare animals increased or maintained Habitats mostly maintained	311	17		
9	Preservation of endangered domesticated animals and cultivated plant varieties	Alert concerning problems of species conservation Stabilisation of endangered animal species, but not always Encouraging the preservation of endangered permanent crop species	35	2		

10	Diversification of rotations, maintenance of grasslands, arable reversion to grassland and extensification	Plant and animal diversity increased or maintained particularly in prairies Creation and preservation of habitats Effectiveness of prairies on catching nitrates and against erosion <b>Reduction of greenhouse gas emissions by reducing the animal load by ha</b> Increase of diversity and quality of landscape	181	10		
11	Continued farming in zones of agricultural decline (marginal zones, mountainous zones etc.)	Plant diversity sometimes improved Mostly preservation of habitats Restoration of landscape quality, diversity and opening	50	3		
12	Other AEMs related to air quality, energy saving, control of fires in forests adjoining farmland, archaeology and historic environment and other issues	Effectiveness of AEM against fire not proven <b>Increase of carbon stocking in the soil and limitation of GHG-emissions by reduced ploughing of the soil, fallowing and catch crops</b>	45	2	12	Other
13	Maintenance and preservation of agricultural landscapes	Effect on landscape diversification and structuring Preservation of cultural identity of rural landscapes Strong link of these measures with the preservation of the biodiversity and habitats	128	7		
14	Cross-cutting programme	Plant and animal diversity mostly increased or maintained Increase of the diversity of habitats	34	2		
14bis	Horizontal measures including organic farming	<b>Reduction of the utilisation of input and therefore corresponding pollution</b> <b>Reduction of the utilisation of energy (by reducing the utilisation of fertilizers) and GHG-emissions</b>	17	1		

Source: Oréade-Brèche 2005.

**Table 3 Clustered presentation of European AEM and ecological assessment (Source: GFA consulting, 2006)**

		Objectives										III. greenhouse gas mitigation								
		I. Soil Protection					II. Biodiversity Protection					III. greenhouse gas mitigation								
		Reduced soil erosion	Chemical status (e.g. reduced nitrates, fertilisation)	Reduced introduction of contaminants into the soil	Increased soil organic matter	Landslides protection	Conserved and improved physical properties	Reduced entry of harmful substances in bordering habitats	Conserved species rich vegetation types	Protected and maintained grasslands	Protected birds (e.g. migratory birds, wading birds) and other wildlife conservation	Enhanced habitat diversity	Improved biotop network	Conserved genetic diversity	Carbon sequestration	CH <sub>4</sub> emission reduction	N <sub>2</sub> O emission reduction	Energy efficiency	Avoided CO <sub>2</sub> emissions	Substitution of fossil fuel
<b>A Extensification of production systems (agriculture/ horticulture/ permanent culture)</b>																				
A1	Level 1: Reduced phytosanitary products and / or mineral fertiliser			1	1															
A2	Level 2: Integrated production (incl. reduced phytosanitary products and fertiliser, extended crop rotation)			1	1	1		1											1	
A3	Level 3: No application of phytosanitary products			2	2															
A4	Level 4: Organic farming according to (CEE) 2092/91 (no chemical products, organic fertiliser only)			2	2	2		2	2										1	1
A5	Agro-forestry system + livestock					2		1												
A6	Agro-forestry system (no livestock)	1				2		2												
<b>B Agricultural production techniques</b>																				
B1	Extended drilling interspace												1							
B2	Mulching/ mulch sowing	2				1		1												
B3	Undersown crops/ stubble sowing	2	1	1	1			1												
B4	Extended crop rotation			1	1			1												
B5	Solid manure application			1	2	2		2		1										
B6	Fauna friendly harvesting techniques																			2
B7	Reduced soil treatment	2				2	1	1											1	
B8	Reduce acidification			3		1				1										
<b>C Extensification of pasture management</b>																				
C1	Level 1: Conversion of crop land to pasture	3	3	1	3	1	3	1				1	2					1	1	
C2	Level 2a: Reduced mineral & organic fertiliser equivalent to 1.4 LU/ ha maximum			1	1															
C3	Level 2b: Reduced mineral & organic fertiliser equivalent to 1.4 LU/ ha maximum, no phytosanitary products, reduced mowing frequency			1	1					1		2	1	2				1	1	
C4	Level 3: Organic production according to (CEE) 2092/91 (no chemical products, organic fertiliser only)			1	1					1	2	2	1	1				1	1	
C5	Level 4a: No mineral fertiliser, organic fertiliser equivalent to 0.7 LU/ ha maximum, no phytosanitary products			2	2					1		3	2	2				2	1	
C6	Level 4b: No mineral fertiliser, organic fertiliser equivalent to 0.7 LU/ ha maximum, no phytosanitary products + deferred mowing			2	2					1		3	3	3				2	1	
C7	Deferred mowing/ usage											2	3							
<b>D Protected areas management, landscape, genetic diversity conservation/ rehabilitation</b>																				
D1	Extensive management of highly sensitive (abandoned) grassland																			
D2	10 to 20 - year set-aside for biotop construction	3	3	3	2	3	2	3	1	3		2	1	3				1		1
D3	Annual crop land boundary strips	1	1							1		1	3	2						
D4	Perennial field boundary strips	1								1		2	1	2						
D5	Perennial riparian boundary strips									3	1		2	3						
D6	No application of fertiliser and phytosanitary products in highly sensitive biotops			1	1							3							1	
D7	Management of (abandoned) perennials with high ecological value (traditional fruit orchards)																			3
D8	Construction/ management of biotops/ habitats (forest fragments/ protective belts/ biocorridors/ hedges)	2						2												3
D9	Construction / management of other individual small habitats (e.g. birds nests, stone walls etc.)																			2
D10	Conservation of genetic diversity (animal breeds/ traditional food crops)																			3
<b>E Emission reduction and carbon sequestration measures</b>																				
E1	Afforestation of multifunctional forest	3				3	3	3												
E2	Short rotation coppice for bioenergetic use	1	1	1	1	1	1	2												2
E3	Energy crop production for bioenergetic use																			3
E4	Emission reductions from manure storage & application																		2	1
E5	Forest fire prevention																			3
E6	Forest management	1				1	1													1
E7	Investment in energy saving technology																			2
E8	Investment in renewable energy technology																			2
E9	Biogas production for energetic use																			2
E10	Emission reductions from agriculture (reduced ploughing, avoided biomass burning, cover rice fields)																			3
<b>F Other measures</b>																				
F1	Maintained land management/ production	1																		
F2	Coastal protection (flood prevention, dams etc.)	2																		
F3	Environmental engineering (erosion prevention, landslide protection etc.)	3																		
F4	Monitoring or early warning systems for earthquakes, environmental pollution etc.					2		1												
F5	Water saving, aquatic resources protection			2									2							

(1) Moderate impact  
(2) Good impact  
(3) High impact

**Table 4 Cross Compliance standards related to Good Agricultural and Environmental Conditions implemented in the Member States**

Issue	Standards	National Standards	MS <sup>6</sup>
<b>Soil erosion</b>	Minimum soil cover	<ul style="list-style-type: none"> <li>• 40 % of the arable area of an agricultural holding must not be ploughed/tillaged between harvest and beginning of pre-sowing/15 February of the following year</li> <li>• In certain areas the dates of beginning of pre-sowing could be adapted to local conditions, as well as adequate tillage techniques</li> <li>• Bare fallow is not allowed, soil should be covered by vegetation (crop cover, crop residue, grass cover, stubble cover, legumes) or else ploughed. Finely tilled bare (unsown) seedbeds are not permitted over the winter</li> <li>• Arable land has to be sown with crops or the land should be laid fallow</li> <li>• On set aside-land, fallow land or non-cropped land: application of traditional cropping practices, minimum tillage practices or practices to maintain an adequate vegetation cover (either spontaneous or through the sowing of enhancing species); grass has to be cut once a year at least; Ploughing and harrowing are generally not allowed (with regional exceptions); with suitable herb or biocidal plants, green manure is permitted once a year</li> <li>• With the purpose of fertilisation, a total maximum amount of 20 t/ha of dung or 40m<sup>3</sup>/ha of slurry in a period of three years could be incorporated, provided that the soil has a vegetable cover or its immediate introduction is foreseen,</li> <li>• Crops should be sown directly after the harvest (not later than 2 weeks or before 1.10.) or cover crop should be mulched, or the soil should be covered by straw and measures minimising water run-off should be installed (ditches, canals, hedges or soil protective crops)</li> <li>• Wipe tractor tracks while sowing sugar beet or maize</li> <li>• Land that has carried a combinable crop (such as oilseeds or cereals): (1) Stubble of harvested crop to remain on land; (2) Land to be sown with a temporary cover crop; (3) Land to be sown with another crop; (4) The land is used to create stale seedbeds (5) The land is left with a rough surface to encourage infiltration of rain.</li> </ul>	DK, ES, IE, LT, NL, UK (SC), DE, FR, GR, IT, UK (ENG)
Protect soil through appropriate measures	Minimum land management reflecting site-specific conditions	<ul style="list-style-type: none"> <li>• Stocking requirements to avoid overgrazing, heavy trampling or heavy pouncing, in particular in the area of watercourses, water points and feeding areas</li> <li>• Sand dunes must be retained and must not be overgrazed or damaged</li> <li>• Soil must be cultivated and a cover crop must be sown, directly after the harvest and before 1.10. for cereals and 1.12. for other crops</li> <li>• Regulations specific to sloping ground: tillage restrictions (e.g. no tillage in vineyards, olive groves and nut groves, no tillage in the direction of the slope); cultivation of perennial crops or grass only; insertion of</li> </ul>	DK, ES, FI, IE, NL, SK, UK (SC), BE*, CZ, GR, IT, UK (ENG)

<sup>6</sup> The studies available (CIFAS 2005, CC Network 2006) cover 16 Member States.

Issue	Standards	National Standards	MS <sup>6</sup>
		<p>temporary drainage furrows on sloping ground with diffuse presence of runnels</p> <ul style="list-style-type: none"> <li>• Application of special cropping techniques: plots, crop in girdles, total cover of the ground</li> <li>• Areas prone to wind erosion: using coarse seedbeds, shelter belts or nurse crops (in spring)</li> <li>• Areas highly vulnerable to erosion: land should be sown following the contours of the land (if its longer than 100 m), maintain permanent soil cover, establish buffer zone or dyke; work soil only superficially</li> <li>• Direct sowing - no tillage; minimum tillage, where the waste of harvest is not incorporated or only partially and in very brief periods; establishment of vegetable covers between successive annual crops or rows of trees in permanent crops</li> <li>• Drainage systems must be maintained</li> <li>• Application of organic stall manure or compost or the digging in of straw in the case of low carbon content and the application of lime in the case of low acidity</li> <li>• No destruction of field banks/hedgerows, terraces, windbreaks, grasslands in alluvial plains and field paths using natural slopes</li> <li>• Unsuitable supplementary feeding must not be carried out on natural and seminatural vegetation (except for the purpose of animal welfare in periods of extreme weather)</li> </ul>	
	Retain terraces	<ul style="list-style-type: none"> <li>• Terraces must not be removed or destructed</li> <li>• Retention terraces shall be kept in working order for conservation, with necessary drainage capacity</li> </ul>	ES, CZ, DE*, GR, IT
	Soil erosion: Other standards	<ul style="list-style-type: none"> <li>• Establishment of a 60 cm, untilled verge between fields and major ditches/watercourses</li> <li>• Along watercourses, CAP set-aside land (3-m wide green fallow, buffer strips) is obligatory</li> <li>• Areas with high risk of erosion: the restrictions and guidelines for rotation of crops, including organic manuring, as well as the types of vegetable cover must be respected</li> <li>• Maintenance of set-aside land and grassland (mowing or grazing)</li> <li>• Stocking density above 3 LU/hectare must be avoided</li> </ul>	ES*, FI, NL, FR, GR, IT
<b>Soil organic matter</b>	Standards for crop rotations where applicable	<ul style="list-style-type: none"> <li>• Yearly cultivation of at least three crops on the arable land of a holding (counting set-aside and non-cultivated land as one crop, but not including permanent or multi-annual crops), each on at least 15 % of the area or growing a different crop on the holding each year for at least three years or by swapping fields with other farmers</li> <li>• Calculate the humus balance at farm level for the arable land until 31.12. or analyse the soil organic matter of the arable land with the help of scientific soil tests at least every 6 years (in case the crop rotation requirements are not met)</li> <li>• Change of system by growing a suitable break crop or by incorporating organic materials</li> <li>• Cultivate and incorporate in the ground leguminous crops, in addition to the main crop, in the 20% of</li> </ul>	IE, UK-SC, DE, FR, GR

Issue	Standards	National Standards	MS <sup>6</sup>
		cultivated area of the holding each year	
	Arable stubble management	<ul style="list-style-type: none"> <li>• Prohibition to burn stubbles, straw and other residues (with an authorised exception for phytosanitary reasons)</li> <li>• Incorporation of organic manure within 2 weeks after spreading on stubbles. In areas prone to wind erosion, incorporation of livestock manures can be delayed.</li> <li>• Plants or stubble remains are worked into soil with the purpose of fertility maintenance of the land</li> <li>• If arable stubble management is not sufficient: allowing natural regeneration of vegetation by growing a suitable break crop</li> <li>• Stubble grazing, cutting and soil cover with the remains (mulching) and their incorporation next spring</li> </ul>	ES, IE, LT, LV, UK (SC), BE, DE, CZ, FR, GR, IT, UK (ENG)
	Soil organic matter: Other standards	<ul style="list-style-type: none"> <li>• Prohibition to burn straw in the fields</li> <li>• Appropriate management of remains of harvest and pruning (in accordance with the established rules)</li> <li>• Determining the carbon content and the acidity of a number of sites which are not grassland and do not have permanent cover</li> <li>• Putting in of barnyard manure in liquid form into the soil within 24 hours after their application on fieldblocks</li> </ul>	ES*, FI, BE*, CZ, IT, NL
<b>Soil structure</b>	Appropriate machinery use	<ul style="list-style-type: none"> <li>• Driving heavy machinery (e.g. harvesting, spreading manure) on wet fields, waterlogged, flooded or snow covered soil should be avoided</li> <li>• Users of irrigated water need a water meter or appropriate machinery to measure water utilised to irrigate</li> </ul>	ES, FI, IE, BE, FR, GR, IT, UK (ENG)
	Soil structure: Other standards	<ul style="list-style-type: none"> <li>• In the case of intensive irrigation of vegetable crops: Farmer have to apply corrections of possible anomalies (e.g. in pH or salinity) in irrigated soils according to the latest soil analysis results</li> <li>• Determining the carbon content and the acidity of a number of sites which are not grassland and do not have permanent cover</li> <li>• Maintain an efficient water drainage system and clean ditches, drains and channels by removing natural vegetation, ground and sediments</li> </ul>	FR, IT, NL
<b>Minimum level of maintenance</b>	Minimum livestock stocking rates or/and appropriate regimes	<ul style="list-style-type: none"> <li>• On non-tillage land/grassland: Grazing and/or cutting management practices must be in place to avoid undergrazing; in case of undergrazing the stocking rate must be increased to sufficient level (equal or above 0.1-0.2 LU/ha) or the land must be harvested or topped at least once between 1.6. and 31.7.</li> <li>• On tillage land: Crop must be grown except to the land that is in set-aside or where natural regeneration is practised</li> <li>• Protection of permanent pasture against under- and overgrazing</li> <li>• Overgrazing should be avoided with livestock and other species</li> </ul>	EE, IE, LV, UK (SC), FR, GR, IT

Issue	Standards	National Standards	MS <sup>6</sup>
		<ul style="list-style-type: none"> <li>• Grassland has to be mown once and the hay has to be collected, shredded in small pieces and spread or the land has to be grazed before the 31.7.</li> <li>• To grow crops which has been sown or established by 15.6. or kept under black fallow</li> <li>• Grassland, meadows and perennial grasses sown on arable land are used for grazing of animals or feed production</li> <li>• Abandoned land must be sown by 15.6. or kept under black fallow or mechanical weed treatment could be carried out</li> </ul>	
	Protection of permanent pasture	<ul style="list-style-type: none"> <li>• Continuous use of permanent pasture and keeping it free from bushes, scrubs and re-growth of trees by grazing, mowing or grubbing up</li> <li>• Grass growth is to be cut or mulched at least once annually and distributed over the total surface, or to be mown at least every two years with the cut material to be removed from field concerned</li> <li>• Permanent pasture must not be burned or ploughed (except for in vegetation regeneration works)</li> <li>• To protect rough grazing and other semi-natural areas, pesticides, lime or fertiliser must not be applied, activities such as new drainage, ploughing, clearing, levelling, re-seeding or cultivating, except in certain cases specified or as approved under the EIA</li> <li>• If the total share of permanent grassland decreases by more than 10 %, farmers who have converted permanent grassland to arable land will be ordered to re-establish permanent grassland; If the total share of permanent grassland in one year decrease more than 5 % the farmer has to ask for authorisation before converting permanent pasture to arable land</li> </ul>	DK, ES, FI, IE, LT, NL, SK, UK (SC), BE, CZ, DE, FR, GR, IT
	Retention of landscape features	<ul style="list-style-type: none"> <li>• (Partial) prohibitions to remove landscape features such as trees and groups of trees, hedgerows or walled hedges, water courses and ponds, and others</li> <li>• Prohibition of the grubbing up of olive trees</li> </ul>	DK, ES*, FI, IE, UK (SC), CZ, DE, FR, GR, IT, UK (ENG)
	Avoiding the encroachment of unwanted vegetation on agricultural land	<ul style="list-style-type: none"> <li>• Stubble fallow land and untilled bare fallow land must be mown annually or noxious weeds must be prevented from spreading</li> <li>• Grassland taken out of production: mowing or crushing at least once a year; control of woody growth and weeds</li> <li>• Keeping the agricultural farming area free from invasive plant species, bushes and lignified herbage</li> <li>• Arable land taken out of production apart from set-aside entitlements: either establish grassland or mandatory annual sowing of fallow cover other than the natural cover must take place before 31.5. of the current agricultural year; maintain the area by cutting, grazing and/or mulching (before flowering of weeds); re-growth of trees and scrubs must not be older than 5 years</li> </ul>	DK, EE, ES, FI, IE, LT, LV, SK, UK (SC), BE, FR, GR, IT, UK (ENG)
	Maintenance of	<ul style="list-style-type: none"> <li>• Maintenance of olive groves in working vegetative order. The farmer must not remove olive trees and</li> </ul>	EE, ES*, FR,

Issue	Standards	National Standards	MS <sup>6</sup>
	olive groves in good vegetative conditions	<ul style="list-style-type: none"> <li>respect regulations</li> <li>Absence of scrub, maintenance in good vegetative conditions (pruning at least once every five years...)</li> </ul>	IT
	Other standards	<ul style="list-style-type: none"> <li>Prohibition of bare fallow</li> <li>Agricultural land must not be used for a profit-making purpose, which has no connection with agriculture</li> <li>Regulations for areas taken out of production: e.g. maintenance of plant cover, no use of pesticides, no mineral fertilisers, no irrigation</li> <li>Set up buffer strips (preferentially along watercourses)</li> <li>Conduct an Environmental Impact Assessment before using uncultivated land or seminatural areas for intensive agricultural purposes or construction works, before afforestation or deforestation takes place on agricultural land</li> <li>Land within 2 metres of the centre of a hedgerow or watercourse: no cultivation, no fertilisation or application of pesticides, no dredging</li> </ul>	DK, LT, LV, NL, BE*, DE, FR, UK (ENG)

Source: CIFAS 2005, CC Network 2006.

**Table 5 Nitrate Directive – standards and national implementation**

Issue	Standards	MS <sup>7</sup>
Appropriate application of fertiliser and livestock manure	<ul style="list-style-type: none"> <li>No application of fertiliser on water-saturated, flooded, frozen, snow-covered or steeply sloping ground, besides watercourses and in the winter period</li> <li>Farmers shall spread materials at doses that comply with the statutory doses and indicated periods for spreading mineral fertilisers</li> <li>Limiting the loss of nutritional elements</li> <li>Spreading of manure forbidden during certain periods</li> <li>Animal manure, silage juice and waste water must not be spread in such a way or on such areas, that there is a risk of runoff to lakes, water courses and drains (in the course of thaws or heavy showers)</li> <li>Methods for spreading of manure on non-cultivated areas: Liquid and solid manure that is spread on non-cultivated areas must be ploughed down as fast as possible and within 6 hours</li> </ul>	BE, FI, DE, NL, UK (SC), CZ, FR, GR, IT, LT, UK (ENG)

<sup>7</sup> The studies from which data were taken cover 13 Member States.

Issue	Standards	MS <sup>7</sup>
	<ul style="list-style-type: none"> <li>• Organic fertiliser that has been spread in the autumn must always be incorporated or the field must be ploughed within 24 hours</li> <li>• No surface application of animal manure on with an average slope &gt;10 %</li> <li>• Obligatory low-emission utilization of manure</li> <li>• 2 m-wide strips (protected) around natural lakes and water courses</li> </ul>	
Restriction of the quantity of livestock manure to be applied	<ul style="list-style-type: none"> <li>• Limit concerning the maximum amount of nitrogen from livestock manure applied to land each year (i.e., 170 kg N/ha, unless there is a derogation or long growing seasons, crops with high nitrogen uptake, high net precipitation in the vulnerable zone, soils with exceptionally high denitrification capacity)</li> </ul>	All (Directive provision)
	<ul style="list-style-type: none"> <li>• Limitation of application of fertilisers is to be based on a balance between nitrogen requirements of the crops and nitrogen supply from soil and fertilisation</li> </ul>	All (Directive provision)
	<ul style="list-style-type: none"> <li>• There is derogation for certain soil/crop types of 250 kg N in several Member States</li> <li>• Restriction of N application during certain periods (e.g. Finland: In autumn, no more than 30 t/ha of solid manure, 20 t/ha of cattle slurry, 15 t/ha of pig slurry or 10 t/ha of poultry or fur animal manure may be applied)</li> <li>• Restriction of N application for particular crops (e.g. Finland: winter cereals 200 kg, potatoes 130 kg, grassland, pasture, silage and horticultural plants 250 kg, spring cereals, sugar beet, oilseed crops and other 170 kg)</li> <li>• The supply corresponds to the amount of manure which is produced in the given period (as well as silage juice) based on the assumption that the livestock is kept inside</li> <li>• In the planning period, the use of nitrogen for manure purposes must not exceed the farm's nitrogen quota</li> </ul>	BE, DK, FI, DE, NL, UK (SC), CZ, FR, IT, NL, UK (ENG)
Standards for storage vessels for livestock manure	<ul style="list-style-type: none"> <li>• Capacity must exceed that required for storage throughout the longest period during which land application in the vulnerable zone is prohibited</li> <li>• Capacity and construction of storage vessels for livestock manures, including measures to prevent water pollution by run-off and seepage into the groundwater and surface water of liquids containing livestock manures and effluents from stored plant materials such as silage</li> </ul>	All (Directive provision)
	<ul style="list-style-type: none"> <li>• Tanks shall be provided with a system making it simple to check that they are leak proof</li> <li>• Manure storages and manure gutters must be watertight. No leakage must occur when the manure storage is being emptied and the manure relocated</li> <li>• Manure stacks shall not be located in groundwater areas</li> <li>• Slurry tanks must have a capacity which is large enough to ensure that the spreading takes place in accordance with the rules for manure and silage and the harmony rules</li> <li>• Obligation of sufficient storage capacity for animal manure produced in the period from September to February, sometimes quantitative requirements for storage capacity of storage vessels</li> </ul>	BE, DK, CZ, DE, UK (SC), FR, IT, NL, UK (ENG)

Issue	Standards	MS <sup>7</sup>
Land use management (crop rotation, permanent crops)	<ul style="list-style-type: none"> <li>Land use management, including the use of crop rotation systems and the proportion of the land area devoted to permanent crops relative to annual tillage crops (optional)</li> <li>Maintenance of a minimum quantity of vegetation cover during (rainy) periods that will take up the nitrogen from the soil that could otherwise cause nitrate pollution of water (optional)</li> </ul>	Nitrate Directive
	<ul style="list-style-type: none"> <li>Plant cover : a) The farm must either sow spring crops or create areas with catch crops in the autumn in order to ensure effective nitrogen uptake during autumn.; b) The area with catch crops must make up at least 6% of the catch crop area. For farms that spread an amount of manure corresponding to 0.8 LU per ha and above, the area with catch crops must be at least 10 % of the catch crop area; c) Catch crops must not be ploughed down or destroyed in any way before 20.10. and areas with catch crops must be used for spring crops in the following planning period.</li> </ul>	DK
Prevention of water pollution	<ul style="list-style-type: none"> <li>Standards applicable at farm level in relation to the prevention of water pollution from run-off and the downward movement beyond the reach of crop roots in irrigation systems (optional)</li> </ul>	Nitrate Directive
	<ul style="list-style-type: none"> <li>Prohibition of the use of animal manure or nitrogen fertiliser at the same time as irrigation takes place</li> </ul>	DK, NL
Establishment of fertiliser plans	<ul style="list-style-type: none"> <li>Establishment of fertilizer plans on a farm-by-farm basis and the keeping of records on fertilizer use</li> </ul>	Nitrate Directive
	<ul style="list-style-type: none"> <li>A Fertiliser and Manure Plan must be prepared and implemented each year and is required to: a) establish the quantities of livestock manure produced on the farm, b) demonstrate sufficient storage capacity and land available for spreading organic manure, c) contain an assessment of the amount of nitrogen available to grass and crops following application of organic manure, d) contain an assessment of the crop and grass requirements for nitrogen fertiliser in each field taking account of nitrogen supply from soil organic matter, crop residues and organic manure.</li> <li>Content of N of the soil has to be determined and documented annually through soil analyses (except on grassland)</li> </ul>	UK (SC), FR, UK (ENG), DE
Other standards	<ul style="list-style-type: none"> <li>No direct discharge of fertilisers and of seepage liquors, including those deriving from stored plant matter, into the subsoil, public sewers or surface waters</li> <li>To ensure that the agricultural holdings have a low soil impact rate (<math>SI \leq 1</math>). If not farmers have an obligation to sign a 'contracts de valorisation' [contract regulating the transfer of organic fertilisers and transactions linked to pasture] or to undertake quality controls</li> <li>Prohibition on exceeding the manure production of poultry beyond the designated amount (expressed in poultry permits)</li> </ul>	BE, FI

Source: Nitrate Directive, CIFAS 2005, CC Network 2006.

**Table 6 Summary of policies and measures under the NECD aimed at reducing emissions from agriculture as reported by each Member State**

Country	Description of policies and measures reported in national programme	Estimated impacts in 2010 (kt)	Scale of implementation
<b>Austria</b>	<ul style="list-style-type: none"> <li>Regulatory &amp; financial policies &amp; measures to reduce NH3 emissions</li> </ul>	No information provided	National policy
<b>Belgium – Federal</b>	<ul style="list-style-type: none"> <li>Regulation of urea content of manure</li> </ul>	NH3 – 0.32	All policies & measures implemented by Federal Government
<b>Belgium – Flanders</b>	<ul style="list-style-type: none"> <li>Manure storage covering</li> <li>Low NH3 application</li> <li>Low NH3 housing for new &amp; existing plants</li> <li>Improved manure processing</li> <li>Livestock feed modification</li> <li>Livestock reduction</li> </ul>	- NH3 – 3.9 NH3 – 1.5 NH3 – 2.5 NH3 – 1.1 NH3 – 2.8	All policies and measures implemented by Federal and Regional Government
<b>Belgium – Walloon</b>	<ul style="list-style-type: none"> <li>Agricultural action plans to reduce NH3 emissions</li> <li>Nitrate Directive</li> <li>Improved manure management</li> </ul>	No information provided on quantitative impact of individual policies & measures	Unclear – most policies and measures are probably the responsibility of the federal and/or regional authorities implemented at a regional or national level
<b>Denmark</b>	<ul style="list-style-type: none"> <li>Ammonia Action Plan Statutory Order no. 604</li> <li>Increased grazing of dairy cows</li> <li>Improved manure management</li> </ul>	- NH <sub>3</sub> - 3.30 NH3 – 1.31	All policies and measures have been, or will be, implemented by central government
<b>Finland</b>	<ul style="list-style-type: none"> <li>Agri-environmental support system</li> </ul>	No information provided	Implemented by agricultural sector
<b>France</b>	<ul style="list-style-type: none"> <li>Reduced nitrogen content of cattle feed</li> <li>Improved manure management</li> <li>Reduced use of highly volatile fertilisers</li> <li>Provision of information for farmers</li> </ul>	No information provided	National policy implemented by individual farms
<b>Germany</b>	<ul style="list-style-type: none"> <li>Fertiliser Ordinance</li> <li>Range of measures planned for the agricultural sector including: CAP, recommendations for best practice, agri-environmental schemes, adaptation of Fertiliser Ordinance, adaptation of emission control legislation &amp; promotion of organic farming</li> </ul>	- NH3 - total impact = 40-60	All policies and measures have been, or will be, implemented by central government
<b>Ireland</b>	<ul style="list-style-type: none"> <li>Recommendations on nutrient management and code of good agricultural practice</li> <li>Farm nutrient management plans</li> <li>National Climate Strategy – reduction in fertiliser use</li> <li>Application of BAT guidance as recommended by the Gothenburg Protocol</li> <li>Fertiliser switsching</li> </ul>	- - - - -	National policy implemented by individual farms

Country	Description of policies and measures reported in national programme	Estimated impacts in 2010 (kt)	Scale of implementation
	<ul style="list-style-type: none"> <li>CAP reform</li> <li>Slurry management measures</li> </ul>	- NH3 – 3-6	
<b>Italy</b>	<ul style="list-style-type: none"> <li>Code of good agricultural practice</li> </ul>	No information provided	National measure implemented by agricultural advisors and individual farms
<b>Luxembourg</b>	<ul style="list-style-type: none"> <li>Directive 2000/25/EC – reduced emissions from agricultural machinery</li> <li>Accelerated renewal of agricultural machinery fleet</li> </ul>	No information provided	European & national policy implemented by individual farms
<b>Netherlands</b>	<ul style="list-style-type: none"> <li>Reducing NH3 emissions from fertiliser industry</li> <li>Livestock farming &amp; housing Decree</li> <li>Changes in cattle feed</li> <li>Improved slurry application to soil</li> </ul>	NH3 – 2 NH3 – 24 NH3 – 10 NH3 – 6	National policy implemented by central government & individual farms
<b>Portugal</b>	<ul style="list-style-type: none"> <li>IPPC – regulation of intensive livestock farming</li> </ul>	NH3 – 6.11	European policy implemented at a national and individual farm level
<b>Spain</b>	<ul style="list-style-type: none"> <li>CAP reform</li> </ul>	No information provided	European policy implemented at a national and individual farm level
<b>Sweden</b>	<ul style="list-style-type: none"> <li>Action programme to reduce NH3 emissions</li> <li>Improved manure management</li> </ul>	NH3 – 13% reduction from 1995 to 2010 (approx. 7 kt) -	National policy & measures to be implemented at an individual farm level
<b>UK</b>	No information provided		

Source: Adapted from Entec 2005.