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Policy Measures Addressing Agri-environmental Issues

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POLICY MEASURES ADDRESSING AGRI-ENVIRONMENTAL ISSUES

Abstract

Agricultural production affects water, air and soil quality, influences eco-systems and biodiversity and shapes rural landscapes. Many of these environmental effects – which are very diverse across OECD countries – can be considered either negative or positive externalities or as public goods, for which private markets either function inadequately or are non-existent. In response, agri-environmental policy measures have been developed in OECD countries. A range of tools have been developed to address environmental issues such as: regulations, agri-environmental payments, taxes, emission/consumption quotas, environmental cross-compliance mechanisms, The *Inventory of policies addressing environmental issues in agriculture* (Inventory) developed by OECD in collaboration with member countries, reflects this broader range of policies, as it focuses not only on agricultural policies addressing environmental issues (agri-environmental policies) but also on environmental measures (*e.g.* regulatory requirements) affecting agricultural production and practices.

This report focuses on the developments in the overall range of policies addressing environmental issues in agriculture in OECD countries in the past decade (since the mid 1990s). It is undertaken from the perspective of the environmental objectives pursued by the policies and from the perspective of the policy measures used. OECD countries use different mixes of policy instruments to achieve their various environmental objectives where markets for externalities and public goods are missing. The policy instruments applied are the reflection of the overall policy approach to the sector; the specific environmental issues and their perceived linkage to agriculture activities; the nature of property rights related to the use of natural resources (land, water); and societal concerns related to environmental issues.

Key words

Agricultural policies; Agri-environmental measures; Agri-environmental payments; Environmental regulations; Environmental policies.

Table of contents

Executive Summary 5

Introduction 10

Targeting policies to address environmental issues in agriculture 12
- Soil protection/soil quality 13
- Water quality/water protection (including reduction of pollution) 13
- Biodiversity 14
- Landscape 15
- Climate change — air pollution 16

Policy measures addressing environmental issues in agriculture 16

Economic Instruments 18
- Payments to farmers 18
- Environmental taxes/charges 30
- Tradable rights/permits 31

Community based measures 32

Regulatory measures 32
- Regulatory requirements 32
- Cross compliance approaches 36

Advisory and institutional measures 37
- Research and development 37
- Technical assistance/extension 37
- Labelling/standards/certification 38

Conclusions 38

Bibliography 41

Tables

Table 1. Measures addressing environmental issues in agriculture in OECD countries 17
Table 2. Total agri-environmental payments in selected OECD countries, 1996-2008 19
Table 3. Agri-environmental payments applied in OECD member countries in 2008 21

Figures

Figure 1. Distribution of EAFRD Expenditures by Axis and Measures in 2008 23
Figure 2. Structure of Agri-environmental payments in selected OECD countries in 1996-98 and 2005-07 30

Boxes

Box 1. Policy measures addressing environmental issues in agriculture 18
Box 2. Agri-environmental payments in the European Union 22
Box 3. How are agri-environmental payments classified in the PSE? 29
Box 4. EU Cross-compliance 36

Executive Summary

Agricultural production affects water, air and soil quality, influences eco-systems and biodiversity and shapes rural landscapes. Many of these environmental effects – which are very diverse across OECD countries – can be considered either negative or positive externalities or as public goods, for which private markets either function inadequately or are non-existent. While there are multiple factors explaining farmers' choices of what and how to produce, economic incentives have a large role in determining what farmers do individually and collectively. Indeed, agricultural production is highly responsive to market signals as farmers try to increase their revenue and decrease their costs. When markets signals for environmental goods are weak or absent the result can be that individual activities taken collectively fail to reduce environmental harm sufficiently or to supply enough environmental benefits. However, it is important to recognise that some farmers are self-motivated to undertake farm practices that are beneficial to the environment and to resource conservation.

In response, agri-environmental policy measures have been developed in OECD countries. A range of tools have been developed to address environmental issues such as: regulations, agri-environmental payments, taxes, emission/consumption quotas, environmental cross-compliance mechanisms, The *Inventory of policies addressing environmental issues in agriculture* (Inventory) developed by OECD in collaboration with member countries, reflects this broader range of policies, as it focuses not only on agricultural policies addressing environmental issues (agri-environmental policies) but also on environmental measures (*e.g.* regulatory requirements) affecting agricultural production and practices. This Stocktaking report focuses on the developments in the overall range of policies addressing environmental issues in agriculture in OECD countries in the past decade (since the mid 1990s). This stocktaking of policies is undertaken: (i) from the perspective of the environmental objectives pursued by the policies; and (ii) from the perspective of the policy measures used.

Targeting policies to environmental objectives in agriculture

The objectives of agri-environmental policy are often easy to state in general terms but difficult to define and measure precisely. Moreover, the intention of some policies is to address several objectives at the same time, either because objectives are interconnected, or because a change in a farm activity can have multiple effects. This section will try to clarify some of these issues by providing a look at the main objectives in agri-environmental policy.

Agriculture is a major user of natural resource in particular land and water. Many policies provide incentives to specific farming practices on farm land (conversion of arable land to grassland land, extensive pasture, green cover, etc.) or for land retirement (long term set-aside, land conservation, afforestation of agricultural land, etc.) and are often described as combining several environmental objectives, including improving *soil*

quality, *water quality*, *biodiversity* and *landscape*. Which objectives are most important depends on the local conditions. These types of policies also represent the most important part of agri-environmental policies in terms of either payments provided or the land area included in the programme.

Some policies target specific areas to address specific environmental issues (spatial targeting). This is, for example, the case of water-dependent ecosystems in Australia — in the Murray-Darling Basin; or the United States — Great Lakes; or the European Union where the EU Nitrate Directive is applied in areas with high levels of nitrate pollution; the project *Natura 2000* identifies areas with high biodiversity, landscape and environmental values in EU member states. To an increasing extent, agri-environmental programmes are applied under an overarching framework (at the national, EU level) which sets the main guidelines, with specific policy measures being defined and applied at lower administrative levels (at the state or provincial level). This is the case in Australia, Canada, and the United States. In the EU, policies are implemented at member-state level (under the overarching EU framework) and, in some states, at even lower administrative levels (such as provinces, regions länder, or local level). This is the case, for example, in Austria, France, Germany, Italy, Spain and the United Kingdom.

Regulations and some other policy measures such as tradable permits are generally targeted to a specific environmental (resource-use) **issue**, such as soil or water quality or biodiversity. Environmental objectives (and outcomes) are precisely defined and measurable for only a limited number of programmes providing agri-environmental payments. Most of these payments are for specific (well-defined and controlled) management **practices** which are intended to provide environmental **outcomes** over and above a reference level (defined as, for example, the minimum level of environmental performance as determined by regulations, or "good farming practices"). In most cases, outcomes of these programmes are defined by the **area** which is under a specific management practice, which may be a somewhat crude proxy as to whether the environmental quality parameter has been achieved.

Policy instruments used to address environmental issues in agriculture

The mixes of policy instruments, applied in OECD countries to achieve their various environmental objectives, reflect the overall policy approach to the sector; the specific environmental issues and their perceived linkage to agriculture activities; the nature of property rights related to the use of natural resources (land, water and vegetation); and societal concerns related to environmental issues. In addition "suasive" measures are intended to change perceptions and priorities within the farmer's decision framework by heightening the level of environmental awareness and responsibility.

Although less visible in policy analysis and policy debate, environmental regulations (**regulatory requirements**) are at the core of policies addressing environmental issues in agriculture. All OECD countries pursue policy and/or regulatory measures to prevent the negative impact of agriculture on the environment. Most of these regulations are related to the use (storage, handling, plant and animal application) of agricultural inputs (pesticides, industrial fertilisers, manure) which have the potential to cause negative environmental effects (in terms of soil, water and air pollution). These regulatory requirements range from outright prohibitions, to input standards and resource-use requirements. Most of these regulations are applied across the farm sector. However, in areas with higher environmental values (natural reserves), drinking water catchment areas, environmentally sensitive areas, or those close to densely populated areas, further

regulations may be applied. Over time, these regulatory requirements have generally been applied more broadly, and as awareness of the risks develop, they have become more stringent.

Some OECD countries (***Australia, New Zealand***) rely mostly on regulatory requirements to address environmental issues in agriculture. Besides the regulations, specific environmental issues are addressed mainly through environmental programmes targeting specific areas. In many cases farmers and landowners (grouped in local initiatives) are involved in these programmes, which may be supported by short-term financial assistance to facilitate group activities improving environmental sustainability and self-reliance of the agricultural sector. Financial support may also be provided in the form of **technical assistance and extension**, with some support going to investments in infrastructure and on-farm investments. Besides regulatory requirements, ***Canada*** also relies mainly on **extension and community-based measures** and more recently on rather limited payments for specific farming practices.

Other countries (mostly **EU countries, Norway, Switzerland** and **United States**) have also developed a wide range of ***agri-environmental payments*** within voluntary programmes providing incentives (payments) to farmers to adopt specific farming practices with positive environmental effects and/or providing public goods (such as landscape, biodiversity, etc.). Although, these programmes offer a large variety of measures, most of the payments are related to the support of extensive forms of farming (mostly on grassland – extensive management of grassland, extensive pastures). Such programmes exist in all countries and represent the most important part of spending on agri-environmental programmes. In **Japan** and **Korea** agri-environmental payments have only been introduced recently and they represent a very minor share in the total support to agriculture. However, the level of *agri-environmental payments* by themselves does not account for all of the efforts of countries to reach their environmental objectives related to agriculture.

Most OECD countries support **organic farming**. Organic production methods can contribute to improving the environmental performance of agriculture, in particular through low (or no) use of chemical inputs, although often yields are lower than with "intensive" farming systems. While in some countries the support is limited to the development of regulations concerning organic production and the setting of certification institutions, other countries grant financial support to farmers in the period of transition from conventional farming to organic farming.

Programmes providing *payments for retirement of agricultural land from production* are also implemented in a range of countries (European countries, United States). These programmes mainly provide payments for conversion of agricultural land to wetlands or forest. However, in most countries these programmes have a rather limited importance, with the exception of the **United States**, where payments for retirement of agricultural land (*Conservation Reserve Program*) account for the largest share of US agri-environmental payments.

Some OECD countries do not appear to feature prominently in the use of agri-environmental payments. For example, in **Mexico** and **Turkey**, this may be due to the fact that these countries have relatively high shares of agriculture in the economy and employment, which may impede the use of agri-environmental policy measures that would incur high budgetary costs. These countries may have other priorities for available resources.

Environmental taxes and charges are applied in some countries on the sale of inputs identified as having a potentially adverse impact on the environment. Taxes and charges are currently levied on pesticides in some provinces in **Denmark**, **France**, **Italy**, **Norway** and **Sweden**, while fertilizer levies are applied in **Italy**, **Sweden** and some states of the **United States.**

Other economic instruments, such as *tradable rights and quotas*, are used in a limited number of countries. These include tradable rights for the development of wetlands in the **United States**, tradable water extraction rights (implemented on a state/regional basis in the **United States**), and improving market mechanisms to free up trade in water rights under **Australia's** *Water for the Future* reform programme. Tradable rights based on environmental quotas, permits and restrictions do not yet appear to play a significant role in agri-environmental policy, despite the growing use of such measures for environmental policy in other sectors.

Environmental Cross-compliance are measures linking minimum environmental standards to agricultural support programmes and which are used in the **United States, Norway** and **Switzerland**, and have been implemented more recently in **Korea**. Some EU member states (*e.g.* **United Kingdom**) have been using the environmental cross compliance since the 1990s. From 2005, cross compliance (including environmental components) has become compulsory in the ***EU15.*** In the new EU member States (EU12), partial cross compliance applies already and full cross-compliance will be introduced between 2009 and 2013**.**

A number of countries, including **Australia, Canada** and **New Zealand**, place emphasis on the use of *community-based approaches* to address environmental issues, through supporting collective action to address environmental pollution. These approaches tend to target farmers' mutual self interest in environmental conservation in a specific catchment area and make use of local expertise in solving environmental problems.

A large set of policy instruments is designed to address the environmental issues at the sector level. Most OECD countries have directed greater attention towards improving the *knowledge-base* relating to environmental issues in agriculture in the past two decades, through increased spending on agri-environmental *research*, often undertaken in co-operation with private sector interests. One notable trend in this area has been the development of agri-environmental indicators in a number of OECD countries to tract environmental performance.

Greater emphasis has also generally been placed on communicating information to farmers on environmental issues via *technical assistance* and *extension*, in order to induce voluntary changes in farming practices to improve environmental outcomes. Such measures feature an increasingly comprehensive array of information, and now employ a wide range of communication tools such as the Internet.

More attention has also been directed at providing *consumer information* on the environmental attributes of products, in order to meet the demands of an increasingly well-informed and discriminating public. In particular, a range of *eco-labelling standards and certification* processes have been employed in OECD countries in the past two decades, particularly in relation to organic or integrated agricultural production processes, which indirectly influence production practices at the farm level.

Overall evaluation

OECD countries are further developing policies to address environmental issues in agriculture. However, in term of the mixes of policies used they continue to use different approaches. Some countries, such as Australia and New Zealand, continue to rely mostly on environmental regulation and economic instruments such as tradable quotas and permits rather than agri-environmental payments. However many OECD countries implement various systems of agri-environmental payments, which are intended to pay farmers for the voluntary provision of environmental services, or to contribute to the costs of reducing pollution. So far these programmes mainly focus on paying for the implementation of specific farming practices rather than for measurable environmental outcomes. The new Farm Act in the United States also gives a more prominent role to agri-environmental payments for specific practices on working lands, relative to payments for land conservation. The European Union places emphasis on payments to address environmental issues on working farms. In the EU, US and Switzerland cross-compliance, linking environmental and agricultural policy instruments is significant. Methods of evaluation of agri-environmental policies are being developed in many countries. But this is rather a longer term and difficult process particularly given the site specificity of many environmental issues ant the complexity of valuation and measurement of environmental outcomes.

Coherence of agricultural, agri-environmental and environmental policies (policy coherence) has generally improved in the past two decades. Some OECD countries have taken steps to streamline agri-environmental policies measures within over-arching frameworks or action plans addressing environmental or rural development objectives. In the broader context, however, where agri-environmental policies offset the damaging environmental effects of input-linked and production-linked policies, the opportunity costs of improving the environment are higher than would be the case in the absence of production-linked support measures in so far as domestic prices are thereby kept higher than world prices. On the other hand, a number of agri-environmental measures go beyond offsetting environmental damage caused by agriculture and provide voluntary payments for additional environmental services (more or less precisely defined and targeted) provided by agriculture. In most cases these additional environmental services are defined as specific farming practices rather than environmental results.

Introduction

Background

Agricultural production affects water, air and soil quality, influences eco-systems and biodiversity and shapes rural landscapes. Many of these environmental effects – which are very diverse across OECD countries – can be considered either negative or positive externalities or as public goods, for which private markets either function inadequately or are non-existent. While there are multiple factors explaining farmers' choices of what and how to produce, economic incentives have a large role in determining what farmers do individually and collectively. Indeed, agricultural production is highly responsive to market signals as farmers try to increase their revenue and decrease their costs. When markets signals for environmental goods are weak or absent the result can be that individual activities taken collectively fail to reduce environmental harm sufficiently or to supply enough environmental benefits. However, it is important to recognise that some farmers are self-motivated to undertake farm practices that are beneficial to the environment and to resource conservation.

Agriculture has a complex relationship with the environment as user and polluter of natural resources, and as provider of ecosystem and cultural landscapes. Overall, across the OECD area, agriculture uses roughly 40% of available land water resources. It is a major source of water pollution from nutrient and pesticide run-off. It has a significant impact on biodiversity and shapes the landscape. It creates greenhouse gas emissions but also acts as a carbon sink. An overall and comprehensive review of the environmental performance of agriculture in OECD countries since 1990 is provided in a recently published OECD report (OECD, 2008).

Agriculture is a sector in which policy plays a significant role in most OECD countries. Agricultural policies provide monetary transfers that influence — directly or indirectly and to varying extents — what and how much to produce, where and under what conditions. This, combined with environmental regulations require farmers—either at their own cost or with the aid of subsidies—to adopt certain practices or deliver particular outcomes creates a complex web of incentives and disincentives for farmers, the net environmental effect of which may be unclear. Governments in OECD countries have been increasingly interested in tracking the environmental performance of agriculture, identifying possible future environmental problems associated with agricultural activities, and trying to better understand the effects of different agricultural policy measures on the environment.

The predominant forms of agricultural support in OECD countries in the past forty years have been closely linked either to commodity outputs or the use of inputs. Support to OECD farmers (%PSE) accounted for about 23% of total farm receipts on average in 2006-08 (compared with 37% on average in 1986-88), most of which (56%) is still linked to production and input use, although this is down from 86% in 1986-88. Policies linked to production and unconstrained input use may have provided incentives to producers to increase the intensity of production (resulting in more variable inputs per hectare) and to expand farming on to environmentally sensitive land and thereby contributed to existing environmental problems, such as the pollution of water, soil and air, and the over-use of scarce resources — particularly water (OECD, 2001). However, in a number of OECD countries, policies supporting agriculture have also helped to maintain certain agricultural

production activities — such as the management of meadows, grasslands, uplands and terraces — that are associated with environmental benefits, such as biodiversity, flood and drought control.

To correct for (or take into account) these externalities or public goods, a range of agri-environmental policy measures have been developed in OECD countries, and their size and importance has increased over time. In addition to providing policy transfers to producers to achieve environmental goals the measures applied also include regulations and directives, taxes, emission/consumption quotas and requirements, such as keeping land in good agricultural and environment condition under cross-compliance. The *Inventory of policies addressing environmental issues in agriculture* (*Inventory*) developed by the OECD in co-operation with Member countries, provides an account of this broad range of policies, focusing not only on agricultural policies addressing environmental issues (agri-environmental policies) but also on environmental measures (*e.g.* regulatory requirements) affecting agricultural production and practices.

Objectives and structure of the report

This report takes stock of developments in the use of agri-environmental policy measures in OECD countries, drawing at both similarities and differences in the approaches adopted. The report also reviews which environmental objectives are targeted by these policies and how these objectives are defined. It also relates the agri-environmental policies to the context of the whole set of agricultural policies applied and resulting overall support to agriculture. The stocktaking does not attempt a comprehensive evaluation of the measures outlined in terms of their environmental effectiveness or economic efficiency. However, the information contained in the report will be drawn upon as part of ongoing OECD work on policy evaluation (*e.g.* the Monitoring and Evaluation reports) and will contribute to "making greater use of the tools (indicators, inventory, modelling) in analytical policy studies in OECD work, in particular the study on developing *Guidelines for the design and implementation of cost-effective agri-environmental policy measures* (*forthcoming*).

The report is divided into two parts. The first part provides an overview of environmental objective pursued by these policies and how these objectives are defined in the various policy measures. The second part provides an overview of developments in the use of policy measures to address environmental issues in agriculture in OECD countries. In this part, policy measures are examined in terms of the type of policy measure used, drawing on the classification of measures in the *Inventory of Policy Measures Addressing Environmental Issues in Agriculture* (Inventory) and the OECD PSE/CSE database and its documentation. The Executive Summary highlights the general policy trends and similarities and differences in the approaches adopted by OECD member countries.

Targeting policies to address environmental issues in agriculture

The objectives of agri-environmental policy are often easy to state in general terms but difficult to define and measure precisely. Moreover, the intention of some policies is to address several objectives at the same time, either because objectives are interconnected, or because a change in a farm activity can have multiple effects. This section will try to clarify some of these issues by providing a look at the main objectives in agri-environmental policy.

Agriculture is the dominant user of land and water in most OECD countries. As a result, many policies provide payments that are directed towards specific farming practices on farmland (input use, technology), land allocation to specific use (conversion of arable land to grassland, extensive pasture, green cover) or for land retirement (long-term environmental set-aside, land conservation, afforestation of agricultural land). Such policies can have the objectives of improving for example **soil quality, water quality, biodiversity** and **cultural landscape**. Which of these are the most important and relevant often depends on local conditions. Addressing these objectives represents the most important part of agri-environmental policies in terms of either payments provided or the land area included in the programme.

Some policies target specific **areas** to address specific environmental issues (spatial targeting). This is, for example, the case of water-dependent ecosystems in Australia — in the Murray-Darling Basin; or the United States — Great Lakes; or the European Union where the EU Nitrate Directive is applied in areas with high levels of nitrate pollution and areas with high biodiversity, landscape and environmental values identified in EU member states within the project *Natura 2000*. To an increasing extent, agri-environmental programmes are applied under an overarching framework (at the national, EU level) which sets the main guidelines, with specific policy measures being defined and applied at lower administrative levels (at the state or provincial level). This is the case in Australia, Canada, and the United States. In the EU, policies are implemented at member-state level (under the overarching EU framework) and, in some states, at even lower administrative levels (such as provinces, regions or länder, or even local level). This is the case, for example, in Austria, France, Germany, Italy, Spain and the United Kingdom.

Regulations and some other policy measures such as tradable permits are generally targeted to a specific environmental (resource-use) **issue**, such as soil or water quality or biodiversity.

Environmental objectives (and outcomes) are precisely defined and measurable for only a limited number of programmes providing agri-environmental payments. Most of these payments are for specific (well-defined and controlled) management **practices** which are intended to provide environmental **outcomes** over and above a reference level (defined as, for example, the minimum level of environmental performance as determined by regulations, or "good farming practices"). In most cases, outcomes of these programmes are defined by the **area** which is under a specific management practice, which may be a somewhat crude proxy as to whether the environmental quality parameter has been achieved.

Soil protection/soil quality

The main issue of soil protection is the risk of **soil erosion**. The soil erosion risk comes from natural forces (water erosion, wind erosion) and from soil cultivation practices (cultivation of fragile soils, overgrazing, poor uptake by farmers of soil conservation practice, etc.). The main issue of soil quality is soil organic matter content and soil contamination, resulting from excessive or inadequate applications of chemical inputs used in agriculture and from industrial pollution deposits in soils – such as contamination by heavy metals (the latter issue is beyond the scope of agri-environmental policies and is addressed by environmental legislation).

Soil erosion is primary addressed by basic environmental regulations concerning soils, including **good farming practices**[1] outlined by most OECD Member countries. Many OECD Member countries have also developed programmes promoting practices specifically targeted at reducing the risk of soil erosion. More specifically, the main farming practices promoted to reduce the risk of soil erosion are: transfers of arable land to grassland, extensive use of pastures, green cover (mainly in the winter period), or no-tillage or low-tillage practices. Some countries use programmes promoting the long-term retirement of vulnerable land from agricultural production. Afforestation of agricultural land is promoted in some OECD countries. However, in term of land transferred, afforestation is of minor (or local) importance. The *Conservation Reserve Program* (CRP) is the most important agri-environmental programme in the United States, in terms of budgetary expenditure and area covered. The main purpose of the CRP was initially to combat soil erosion, but, as the programme evolved, other objectives were added, including amelioration of habitat and water quality, carbon sequestration and air quality improvements.

Other soil degradation processes (compaction, acidification, toxic contamination, sodicity and salinisation) largely relate to specific regions in some countries and are addressed both by regulatory requirements and policies designed and implemented at regional (local) levels. Apart from financial incentives provided to farms, budgetary support is also provided to finance technical assistance to farmers attempting to address soil erosion problems.

Water quality/water protection (including reduction of pollution)

Across all OECD countries a large number of policies addressing environmental issues in agriculture are related to water quality and resource availability. The issue of water quality is addressed by a wide set of *regulations*. These regulations concern not only the use of water and management of water resources, but also strict regulations on the use of potentially polluting inputs such as pesticides, industrial fertilisers and manure (storage, management and field application) and land management measures to prevent the polluting agents from reaching surface waters and/or groundwater.

Water quality and reduction of **water pollution** are a dominant issue in most OECD countries. Apart the above-mentioned regulatory requirements, a range of policy measures are applied to address this issue. The most common are payments for agricultural production conditional upon reduced use (or no use) of pesticides and fertilisers (such as **extensive production, integrated production, organic farming**),

1. *Good farming practices* also address other environmental issues, such as water pollution and biodiversity.

green cover and buffer strips. These measures are applied mainly in European countries and, more recently, in Japan and Korea.

The *EU Nitrate Directive* defines areas vulnerable to nitrates in its member states, and sets guidelines to establish the maximum permitted level of nitrates in water. Moreover, the action programmes developed to implement the directive, establish the necessary measures to ensure that the annual amount of total nitrogen of animal origin spread on the land (manure fertilisation) does not exceed 170 kg per hectare. It also makes it mandatory for farmers to ensure that fertiliser use is well balanced to supply the needs of crops. EU member states have designed and implemented some agri-environmental measures to further reduce nitrogen losses in water that go beyond the statutory obligations. Reduced use of fertilisers, converting arable land to extensive grassland (pasture), green cover and crop rotation are the main instruments implemented by member states to reduce nitrates in water. In addition, the *Water Framework Directive* imposes the objective of achieving good water status by 2015. More specifically the Water Framework Directive stipulates that Plans for each river basin must be established by 2009 and includes pressures and impacts from human activities; environmental objectives; and specifies measures to reach these objectives, including territorial instruments and animal manure management.

Also in areas with higher nature values (such as catchment areas for drinking water, natural reserves) or environmentally vulnerable zones (Environmentally Sensitive Areas – ESAs), many OECD member states apply stricter regulations concerning the use of agricultural inputs and farming practices. Some countries provide compensation to farmers (for income foregone) in these areas. As mentioned above, many of the policy measures designed to address the issue of water quality and water pollution may also have positive effects on soil quality, biodiversity and landscape.

In many OECD countries there are regulations to determine how much water is available to irrigators (agriculture) and how much must be retained for environmental purposes. In addition to **regulatory requirements**, a wide set of policy instruments related to water are used across OECD countries. Irrigation accounts for a major share of water use in most OECD countries and excessive groundwater extraction levels are a concern in many areas, particularly in the drier regions of Australia, southern Europe and parts of the United States. Some countries (*e.g.* Australia, some states in the United States) manage a system of water abstraction rights and a system of **tradable quotas and permits** for water use.

Biodiversity

Biological diversity (**biodiversity**) is the variability among living organisms and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. This variability is naturally caused by the evolution of living organisms in the context of the biotic and abiotic factors in their environment. Human intervention can have a significant effect upon biodiversity.

In countries such as Australia, New Zealand and North America, valued habitats are predominantly associated with natural areas that include grasslands, wetlands, native forests and bush. In some cases such areas have been placed at risk by the development of agriculture. For example, in the United States, the conversion of grasslands and wetlands to cropland has been attributed with contributing to the decline of a number of rare species. Some of the currently applied policies are designed to correct this trend, and are mostly applied in specific localities.

Agricultural biodiversity is largely created, maintained and managed through a range of farming systems. OECD countries employ a variety of policies and approaches to reconcile the need of agricultural production, drawing on plant and livestock genetic resources, and yet reduce harmful biodiversity impacts, especially on wild species and habitats.

Policies addressing objectives such as wild species diversity and ecosystem diversity are prominent in the European countries. Indeed, in Europe, many of the most valued wildlife areas tend to be semi-natural habitats, where species have co-evolved with traditional agricultural practices over many centuries. Such habitats have come under increasing pressure from changes in farming practices – including increased field size, reduced crop rotations and increased fertiliser and pesticide use or from agricultural land abandonment.

Policies applied to enhance or preserve agricultural biodiversity can be grouped according to the three levels of agricultural biodiversity: (i) genetic diversity; (ii) species diversity; and (iii) ecosystem diversity.

- **Genetic diversity** – most OECD countries carry plant and livestock genetic resource conservation activities either in the form of *in situ* (on-farm, in-field) or *ex situ* (gene bank) conservation. Under the Rural Development Regulation, most EU member states provide payments for conservation of endangered crop and livestock species or per head of endangered livestock species. In the United States, the *in situ* conservation is primarily a private-sector activity and no financial assistance is provided.

- **Species diversity** – policies in this area typically target wild species that use agricultural land as primary habitat – for example, populations of selected bird species that are dependent on agricultural land for nesting and breeding. Farmers are remunerated for voluntary adoption of farming practices which contribute to preserve wild species on agricultural land (such as reduced use of chemical inputs, extensive management of grassland with late mowing, creation and maintenance of field strips, hedges, shrubs).

- **Ecosystem diversity** – policies aimed at achieving the objectives related to ecosystem diversity promote a specific land-use pattern (in most cases, the extensive use of grassland). Some of these policies require a transfer of agricultural land to other use (such as changing arable to grassland, or the creation of wetlands and ponds), while other policies promote the creation of semi-natural habitats on agricultural land (such as farm woodlands, fallow land). These activities are often considered as also contributing to addressing Landscape objectives.

Landscape

Landscape objectives can vary from site-specific to very generic ones, and are subject to various sets of policies. They are implemented mainly in European countries, Japan and Korea, where the cultural landscape has been shaped by agriculture over many centuries. EU member states and Switzerland provide payments to construct, improve and/or maintain specific (fixed) landscape elements such as: trees (individual or ranges), hedges, stonewalls, ponds and marshes. In most cases, these elements also contribute to other environmental objectives, such as soil and water protection and biodiversity.

Landscape objectives are also associated with payments supporting changes in land use either in the form of exit from agricultural land (afforestation, agricultural woodland, creation or restoration of wetlands and ponds) or changes in agricultural land use (transfer from arable land to extensively used grassland, green fallow, and floral fallow). Norway associates the landscape objective with a general payment to all agricultural land, provided that farmers comply with good farming practices.

Climate change — air pollution

Farming accounted for about one-quarter of total OECD acidifying emissions, 8% of the use of potential ozone-depleting substances and 8% of greenhouse gases (GHGs) in 2002-04, OECD (2008). Shares are higher for specific air pollutants: 90% of anthropogenic ammonia emissions; nearly 75% of methyl bromide emissions and for GHGs about 70% of nitrous oxide and over 40% of methane. The contribution of agriculture to greenhouse gas emissions varies considerably across OECD countries; in New Zealand nearly 50% of the country's GHGs arise from pastoral agriculture.

Many countries are adopting policies to motivate farmers to alter their farming practices, such as changing livestock manure disposal methods and soil tillage practices, which can lower GHGs emission rates per unit of output volume and which can also have co-benefits in reducing ammonia emissions and increasing soil carbon stocks. The uptake of these practices is in some cases enforced by regulations and supported by investment subsidies (manure storage and management) or encouraged through government farm extension services and financial assistance to farmers. On the other hand, these practices may also increase pesticide use, with negative impacts on the environment.

Programmes providing incentives for less intensive use of agricultural land, lower and better-managed use of fertilisers (see above) also contribute to reduced air pollution, ammonia and GHG emissions, as well as the programmes taking land out of agricultural production (afforestation, land conservation programmes, extensive use of grassland). The latter also contribute to carbon sequestration.

Policy measures addressing environmental issues in agriculture

All OECD countries share the goal of moving toward a path of long-term sustainability in which improving the environmental performance of agriculture has become a high policy priority. The mixes of policy instruments, applied in OECD countries to achieve their various environmental objectives, reflect the overall policy approach to the sector; the specific environmental issues and their perceived linkage to agriculture activities; the nature of property rights related to the use of natural resources (land, water and vegetation); and societal concerns related to environmental issues. In addition "suasive" measures are intended to change perceptions and priorities within farmer's decision framework by heightening the level of environmental awareness and responsibility. Such measures can be delivered in the form of training or knowledge and information sharing, as well as forms of "moral suasion" such as social pressure, negotiation, the threat of regulatory action or retaliation by others whether customers or society in general. Hence, they may encourage farms to develop and abide by voluntary codes of conduct.

Increasing public awareness, together with the availability of more research and information, has heightened the demand to improve the environmental performance of agriculture in OECD countries over the past decades. In response, since the mid-1980s, a large number of policy measures have been introduced addressing environmental issues in agriculture. Some of these policy measures have been specific only to the agricultural sector, while others have been part of broader national environmental programmes affecting many sectors including agriculture. In this report all such policy measures are broadly categorised as agri-environmental policy measures. Other policies that may affect environmental outcomes but are introduced primarily for other reasons – such as supply control measures – are beyond the scope of this stocktaking.

This part of the report outlines some of the major developments in agri-environmental policy measures across OECD countries. In compiling this information extensive use was made of the OECD Inventory of Policy Measures Addressing Environmental Issues in Agriculture (hereafter the *Inventory*) and other available sources such as the country chapters in the agri-environmental indicators report (OECD, 2008) and the Database on instruments used for environmental policy of the OECD Environment Directorate. The Inventory was established to collect information and data on agri-environmental policy measures in OECD countries (Box 1), and classifies this information, inter alia, according to the type of policy measure. Table 1 summarises in broad terms the main types of policy instruments used in OECD countries.

Table 1. Measures addressing environmental issues in agriculture in OECD countries

Measure/Country	AUS	CAN	EU	JAP	KOR	MEX	NZL	NOR	SWI	TUR	US
Regulatory Requirements	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Environmental cross-compliance	NA	NA	XXX	X	X	NA	NA	XX	XXX	NA	XXX
Payments based on farming practices	X	X	XXX	X	X	X	X	XX	XXX	X	XX
Payments based on land retirement	NA	NA	X	NA	NA	X	NA	NA	X	NA	XXX
Payment based on farm fixed assets	X	X	X	X	X	X	X	X	X	X	X
Environmental taxes/charges	NA	NA	X	NA	NA	NA	NA	X	NA	NA	X
Tradable rights/permits	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	X
Technical assistance/extension	XX	XX	X	X	X	X	XX	X	X	X	XX
Community based measures	X	X	NA	NA	NA	NA	X	NA	NA	NA	NA

NA – not applied or marginal; X – low importance; XX – medium importance; XXX – high importance.

The importance of the policy instruments in this table is related to the mix of the specific country. It is not designed to compare the importance of specific measures across countries.

The original version of this document contained an error: for Canada in the line "Payments based on land retirement," there was an X instead of an NA. This error has now been corrected.

Box 1. Policy measures addressing environmental issues in agriculture

The *Inventory* has to be seen in the context of the OECD work on agricultural policy reform and sustainable development and therefore as a complement of the OECD databases on agricultural support policies and agri-environmental indicators. The policy measures included in the Inventory cover a broad range of policy measures addressing environmental issues in agriculture, namely:

- Agricultural policy measures where environment outcomes are the primary objective;
- Mechanisms tying general agricultural support programmes to environmental conditions; and
- General environmental policy measures which have a significant impact on agriculture.

It should be stressed that other agricultural and economy-wide policy measures also influence the overall impact (positive or negative) of agriculture on environment - either directly or indirectly - but such policy measures are beyond the scope of the Inventory, although they are relevant for the evaluation of policies. The whole scope of agricultural policies providing transfers to farmers is described and analysed in the annual Monitoring and Evaluation of Agricultural Policies, and available in the PSE database

Economic instruments

Economic instruments affect the costs and benefits of alternative actions open to farmers, with the intended effect of influencing behaviour in a way that improves environmental outcomes. These instruments typically involve either a monetary transfer – *i.e.* payments (including credit subsidies or tax relieves) and charges/taxes; or the creation of new markets – *i.e.* tradable rights or permits for the purpose of environmental protection.

Payments to farmers

Most OECD countries offer monetary payments (including implicit transfers such as tax and interest concessions) to farmers and other landholders to address environmental problems (*e.g.* to reduce pollution) and/or to promote the provision of environmental amenities associated with agriculture. However, the relative amounts of those payments (*i.e.* their share on total budgetary spending on agriculture or in total transfers to farmers varies. Most of these payments are provided within programmes applied on voluntary basis. However, there are also payments (mainly investment subsidies) provided to farmers to assist them to comply with environmental regulations. In practice, many agri-environmental payments tend to be linked to land or other factors of production. However, while payments directly tied to broad environmental outputs – such as "improved landscape" or 'more diversity' – are rare, some countries begin to develop payments based on environmental outputs more linked to farmers practices (*e.g.* in France a payment tied to the objective to reduce the amount of pesticide used).

Table 2. Total agri-environmental payments[1] in selected OECD countries, 1996-2008

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU27[2]	EUR million	3004	3817	3931	4390	5623	5828	5250	5133	5527	6118	6525	5620	6809
	1996=100	100	127	131	146	187	194	175	171	184	204	217	187	227
Norway	NOK million	923	922	994	1 043	1 071	1 001	1 198	683	695	712	874	966	998
	1996=100	100	100	108	113	116	108	130	74	75	77	95	105	108
Switzerland[3]	CHF million	605	721	689	177	184	193	203	213	224	231	233	239	245
	1996=100	100	119	114	29	30	32	34	35	37	38	39	40	40
United States	USD million	2 690	2 731	3 030	2 676	2 751	2 964	3 501	4 093	4 550	4 911	4 946	4 524	4 876
	1996=100	100	102	113	99	102	110	130	152	169	183	184	168	181

1. Agri-environmental payments used in this table provide support to farmers for undertaking farming practices designed to achieve specific environmental objectives that go beyond what environmental regulation require. Farm support related to respecting regulations (environmental cross-compliance) and payments to less favoured areas are not included here as agri-environmental payments. Discussion on which payments to less favoured areas can be considered as agri-environmental payments is ongoing in the OECD in the context of the Inventory project).

2. EU15 in 1996-2003; EU25 in 2004-06; EU27 from 2007.

3. In Switzerland up to 1998 the most important part of agri-environmental payments was those for *integrated production*. Since 1999, these payments have been abolished and the regulatory requirements for integrated production became compulsory for all direct payments (environmental cross-compliance). However, these payments are not included as part of "agri-environmental payments". This change in policy is reflected by the sharp drop in "agri-environmental payments" in 1999.

Source: OECD PSE, CSE database, 2009.

There are also differences concerning how the level of payments is established: *i.e.* as a result of a competitive tender (auction), based on fixed rates for a region or whole country, fixed share of the investment costs. The intention is generally to reimburse farmer compliance costs on the principle of profit forgone, sometimes with the addition of an incentive element. In many cases programmes also include the provision of training and technical advice to assist farmers in carrying out targeted activities.

Many OECD countries have made payments available to farmers, on a voluntary basis, to encourage them to implement more environmentally-friendly farming practices. In particular, the **European Union**, **Norway**, **Switzerland** and the **United States** have used agri-environmental payments in their policy mixes.

Table 2 shows the trends of indexed nominal agri-environmental payments in the European Union, Norway, Switzerland and the United States. It should be stressed that these data only include those agri-environmental measures that provide payments to farms. As the mix of policy instruments to address environmental issues in agriculture varies from one country to another, the analysis of the level and structure of agri-environmental payments should be considered in this wider perspective. This means that the level of *agri-environmental payments* by themselves does not account for all of the efforts of countries to reach their environmental objectives related to agriculture. In countries such as Norway and Switzerland, there are significant regulatory requirements to achieve improved performance. The implementation of these stricter regulatory requirements is also related to the sensible reduction of agri-environmental payments as illustrated in the table. For example, in Switzerland up to 1998 the most important part of agri-environmental payments was those for integrated production. Since 1999, these payments were abolished and the regulatory requirements for integrated production are compulsory for all direct payments (environmental cross-compliance). However, these

payments are not included as part of "agri-environmental payments". This change in policy is reflected by the sharp drop in agri-environmental payments in 1999.

The main types of agri-environmental programmes providing payments to farms, classified according to the categories used in the *Inventory* are outlined below.

Payments based on farming practices

Payments based on farming practices are policy measures granting annual monetary transfers (including implicit transfers such as tax and credit concessions) to farmers to provide incentives to implement more environmentally friendly farming practices going beyond those required by regulation and/or defined as *good farming practices*.

Such payments have been applied in most of the OECD European countries (All EU countries, Norway and Switzerland) and the United States. More recently such payments were introduced in Canada, Japan and Korea. Table 3 provides a general overview of agri-environmental payments applied in OECD member countries in 2008.

The **European Union** co-finances with **EU member states** a wide range of agri-environmental payment programmes based on farming practices under a policy first established in 1985 under the regulation No 797/85, later in 1992 under the *Agri-environment Regulation (No 2078/92)*, and later included under the *Rural Development Regulation (No 1257/99)* and from 2007 the *Commission Regulation (EC) No 1698/2005* (Box 2).

Prominent among these measures are payments to support the adoption of less input-intensive farming practices. By the mid 1990s most EU member states had introduced a variety of national or regional programmes to support *organic agricultural production*. These schemes generally provide area-based support to farmers for at least five years to encourage the conversion from conventional to organic farming. Most-member countries provide also regular annual payments to organic farming beyond the initial conversion period.

EU member states also implement a variety of programmes providing payments to encourage other forms of less input-intensive and/or more environmentally friendly farming practices. This includes, for example, integrated production, and programmes to promote the *extensive crop production* (low use of fertilisers and pesticides) and *extensive management of grassland* (livestock grazing with restricted uses of fertilisers and low stocking densities, extensive meadows with restricted mowing practices).

Most EU member states also offer agri-environmental payments based on farm practices to target biodiversity and cultural landscape objectives. These programmes are either applied in the whole country or targeted to specific areas with a high potential to provide the desired outcomes. For example in the **United Kingdom**, under the *Environmentally Sensitive Areas Scheme (ESA)*, incentive payments per hectare are offered under 10-year contracts to farmers who adopt agricultural practices to safeguard and enhance in areas of particularly high landscape, wildlife or historic value. In **Sweden** some of these programmes are available in specific regions and moreover due to budgetary limits the support goes to projects with most environmental benefits.

Table 3. Agri-environmental payments applied in OECD member countries in 2008

Programme/Country	AUT	AUS[1]	BEL[2]	CAN	CZE	DNK	FIN[3]	FRA	GER	GRC[3]	HUN	IRL	ITA	JAP	KOR	MEX	NLD[3]	NZL[1]	NOR	POL	PRT	SPA	SVK	SWE	SWI	TUR	USA	UK[4]
Payments for farming practices																												
Land improvement (liming, soil erosion prevention)	X	X	X	X			X	X	X				X		X	X		X	X	X	X	X	X	X		X	X	X
Payments for nitrate reduction	X	X	X			X	X	X	X	X			X		X				X	X	X	X	X	X	X	X		X
Nutrient management plan		X		X		X					X	X	X									X		X			X	X
Extensive crop production	X							X	X		X		X	X						X	X	X		X	X			X
Organic farming	X		X		X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Integrated production wine, fruits&vegetables	X		X		X			X			X		X			X						X	X					X
Integrated farming			X		X	X		X			X		X								X	X		X				X
Traditional methods of cultivation	X							X			X					X			X	X	X	X		X				
Reduced tillage/Mechanic weed control	X	X	X	X			X		X		X	X	X						X		X	X			X	X	X	X
Crop rotation				X				X	X		X		X			X				X		X					X	
Biological plant protection measures									X																			
Green manure crops		X																										
Green set asside/fallows	X	X		X		X		X			X		X		X		X					X			X		X	X
Catch crops, green/winter cover	X		X	X	X	X	X	X	X			X			X				X	X		X		X			X	
Extensive management of all land							X	X			X				X					X		X		X				
Extensive grassland management (pastures/meadows)			X	X	X	X		X	X		X	X	X		X		X		X	X	X	X	X	X	X	X	X	X
Conversion of arable land into grassland (pastures/meadows)				X	X	X		X	X		X		X									X	X		X		X	X
Grassland/biodiversity/habitat schemes	X	X	X	X	X		X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X
Biodiversity - local breeds	X		X				X	X	X		X	X	X		X	X			X	X	X	X	X	X	X			X
Biodiversity - local species and varieties of crops	X		X			X	X	X	X				X		X	X				X		X		X	X			X
Maintenance of wetlands and ponds[5]		X	X		X	X		X			X		X		X	X	X		X			X		X	X	X		X
Protected environmentaly sensitive areas/vulnerable zones		X	X		X	X		X			X	X	X		X	X			X			X			X	X	X	X
Shelter belts/buffer strips	X	X	X	X	X	X	X	X	X		X	X	X		X			X	X	X	X	X		X	X		X	X
Landscape elements/Amenities	X		X				X	X			X		X		X		X		X	X	X	X		X	X			X
Maintaining and improving groundcover		X																									X	
Water conservation																											X	
On-farm Energy Conservation																												
Payments for land retirement																												
Long term set-aside	X	X				X			X	X		X	X									X				X	X	
Afforestation		X	X		X	X		X		X	X	X	X	X	X	X	X	X		X	X	X	X			X	X	X
Conversion of farm land land int wetland and ponds						X	X						X				X							X			X	X
Converting pasture to perennial vegetation		X																										

1. In Australia, Canada and New Zealand there is a very limited use of payments to farmers (and, where payments are made, this is in the form of one-off or transitional payments) and support to agri-environmental programmes is provided mostly through general services.

2. In Belgium only programmes used in Flanders region are reported.

3. In Finland, Greece and Netherlands, the information for 2008 is not available and the programmes in the table correspond to programmes applied in 2000-06.

4. In United Kingdom only programmes used in England are reported.

5. In Spain the payments for water quality in wetlands is included in this line.

Box 2. Agri-environmental payments in the European Union

In 1992, EU member states were required to implement agri-environmental payment programmes under the *Agri-environmental Regulation (No 2078/92)*. These regulations have provided the over-riding framework within which the European Union's agri-environmental payment programmes have been shaped within each member state. Although implementation of programmes is obligatory at the member state level, farmers may choose whether to continue their normal farming practices or to join – usually by contract – particular programmes developed by member states.

In 2000 agri-environmental payments were integrated with other rural development measures under the *Rural Development Regulation (No 1257/99).* The *Rural Development Regulation (No 1257/99)*, developed further the framework for the implementation of agri-environmental programmes in the EU member states, however the main principles for developing those programmes remained broadly unchanged. EU member states have adopted a wide range of agri-environmental programmes which were often established at different administrative levels (national, sub-national, and regional).

Agri-environmental programmes are required to achieve environmental benefits that go beyond those obtained through the application of '*good farming practices'* (which are defined as levels of environmental quality that should be achieved at the farmer's own expense). Often farmers may select particular activities from a complementary 'menu' of programmes. The payment rates are calculated based on the additional costs and income foregone by farmers as a consequence of entering into these activities. Payments are made to farmers in relation to the environmental obligations taken on, with support based on the area of the holding to which agri-environmental commitments apply. In general, the programmes were for a minimum duration of 5 years, except for long-term set-aside, which is for a period of at least 20 years. The Community co-funds up to 75% of the cost of programmes in Objective 1 areas (defined as less-developed regions), and up to 50% in other regions.

For the period 2007-13, the *Commission Regulation (EC) No 1974/2006 of 15 December 2006* is laying down detailed rules for the application of *Council Regulation (EC) No 1698/2005* on support for rural development by the European Agricultural Fund for Rural Development (EAFRD). In its axis 2 the regulations defines under part (a) measures targeting the sustainable use of agricultural land through:

(i) Natural handicap payments to farmers in mountain areas;

(ii) Payments to farmers in areas with handicaps other than mountain areas;

(iii) Natura 2000 payments and payments linked to *Directive 2000/60/EC;*

(iv) Agri-environmental payments;

(v) Animal welfare payments

(vi) Support to non-productive investments.

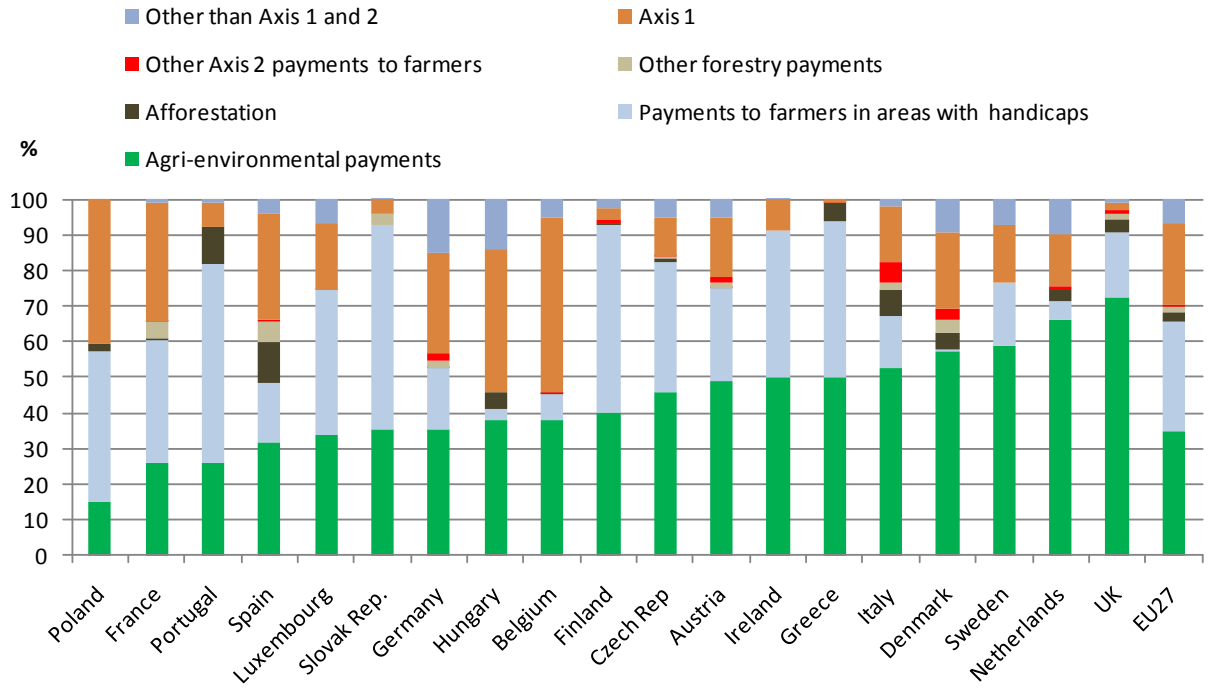
Under its part (b) for sustainable use o forestry land the regulations provides for payments for:

(i) First afforestation of agricultural land; and

(ii) First establishment of agroforestry systems on agricultural land.

Figure 1 provides the information on the distribution of the EARDF expenditures in EU member countries and notably the role of agri-environmental payments.

Figure 1. Distribution of EAFRD Expenditures by Axis and Measures in 2008



EU27: the 27 members of the EU from 2007.
Source: EU Commission, *EAFRD expenditures in 2008*.

A variety of payment programmes also exist under the *Rural Development Regulation* in a number of EU countries to encourage farm practices to preserve specified cultivated areas (*e.g.* **Portugal, Sweden, Italy**), rare (endangered) animal breeds/crop varieties or other flora and fauna (most of EU countries). To prevent soil erosion some countries support conversion of arable land to extensively used grassland (pastures or meadows). Other countries (**Belgium**, **France**, **Finland, Italy, and Sweden**) provide payments for catch crops or green/winter cover.

In most EU member countries the programmes providing payments based on specific farming practices are available on a voluntary basis to farmers who may select an appropriate combination of those practices and receive relevant payments. However, some countries (*e.g.* **Finland, Ireland**) have set *basic scheme* programmes requiring farmers to comply with a set of practices required by these schemes (five basic measures + one optional in Finland; 11 measures in Ireland) to obtain the payment.

The above mentioned policies refer mostly to agri-environmental policies applied under the rural development programmes applied in the period 2000-06. In 2007, implementation started for the rural development programme for the period 2007-13 (although payments were provided for programmes adopted in the earlier period), with all Rural Development Plans (RDPs) agreed by November 2008. The programmes to provide agri-environmental payments to farms (under the Axis 2 of the RDR) were developed in all EU Member States, although the importance of the agri-environmental payments in the RDP varies across countries (see Figure 1). EU member states continue to develop measures in place during the previous programming period and to introduce new measures, in particular in new member states where agri-environmental measures were

not compulsory during 2004-06. In addition to agri-environmental payments per se, Axis 2 also offers specific funding to co-finance *Natura 2000* measures that aim to preserve biodiversity in most valuable and threatened sites; and measures linked to the Water Framework Directive (Directive 2000/60/EC), as well as support for non-productive investments for improving the environment and the countryside.

Payments based on farming practices have also been implemented in other European countries. In ***Switzerland*** the *Federal Agricultural Law* adopted in 1996 (amended regularly in a four-year period) offers a range of payments based on different standards of agricultural practices. Most of these payments continue to be applied under the agricultural policy for the period 2008-11. Under voluntary programmes, payments are provided to farmers for specific biotypes, such as extensive grasslands, floral fallows, high-stem fruit trees, and hedges. Payments are also provided to support the extensive cultivation of grains and oilseeds, and for organic farming. ***Norway*** introduced payments to support organic farming in 1991, and currently offers an organic conversion payment, which is paid per hectare, together with on-going area and headage payments for organic farmers. In the period 1994-2001 payments were also granted to support mountain dairy farming in order to contribute to the maintenance of the cultural landscape through summer animal grazing in mountain areas. From 1994 under **payments for changed soil conservation** a per-hectare payment is granted for not cultivating erodible soils in autumn and for planting cover crops in cereal fields and grass strips around water courses. In 2004, Norway introduced a general **landscape payment** under which a fixed-rate payment is granted per hectare of all agricultural land, provided that the farmer complies with good farming practices. In ***Iceland*** payments are provided to farmers who qualify to participate in soil conservation and forestry schemes designed to prevent desertification and soil erosion (sand encroachment) and the restoration of degraded land.

The ***United States*** provides payments to support voluntarily adopted, environmentally friendly farming practices, based on a cost share and incentive basis, through a wide range of programmes. Some of these programmes are applied throughout the US, while others target specific areas where there are specific environmental or natural resource concerns. Most of these programmes also finance the technical assistance necessary on farms to develop and implement those programmes. The *Environmental Quality Incentives Program (EQIP)* was established by the *1996 Farm Act* (amended under the *2002 FSRI Act* and continued in the *2008 FCEA Act)* to provide financial and technical assistance to farmers to promote the adoption of environmentally-friendly practices in environmentally sensitive areas, mainly to reduce soil and water resource problems. *EQIP* provides assistance of up to 75% (but more typically 50%) of the costs of certain conservation practices, such as nutrient management, manure management, integrated pest management, irrigation water management, and wildlife habitat management (60% of the fund's budget is spent on livestock-related concerns). Farmer contracts are for 1 to 10 years. The *Conservation Security Program (CSP)*, (part of the *2002 FSRI Act)*, has been implemented since 2004. This voluntary programme provides payments to producers for adopting or maintaining a wide range of farm practices that address one or more areas of concern, such as soil, water or wildlife habitat. It provides equitable access to benefits for all producers, regardless of size of operation, crops produced, or geographic location. In contrast to other conservation programmes, CSP focuses on operations that already have addressed environmental problems, while keeping land in production. Up to 2008, the programme provided three tiers of participation that differ in contract length and total payments, according to the amount of treatment and the portion of the agricultural operation being offered. Payment limits per farms are differentiated

according to the three tiers. Other programmes providing payments for farming practices are the *Ground and Surface Water Program* (GSWP), the *Farmland Protection Program* (FPP), and the *Grassland Reserve Program* (GRP).

The 2008 Farm Act (FCEA) continues the evolution of **environmental conservation programmes** begun in the 1985 Farm Act. The 2008 Farm Act re-authorizes almost all 2002 Farm Act conservation programmes, increases in spending by nearly USD 8 billion, modifies several programmes, and creates several new conservation programmes. The FCEA 2008 objectives continue to shift the conservation focus from land retirement to environmental protection of agricultural lands in production (working lands) by increasing funding for the Environmental Quality Incentives Program (EQIP) and new Conservation Stewardship Program (CSP) (successor to the Conservation Security Program).

In ***Canada***, the main agri-environmental programs were implemented under the Agricultural Policy Framework (APF) for 2003-08. These programs were financed (or co-financed) from the Federal budget. The National Farm Stewardship Program provided payments based on completing specific beneficial management practices and adopting technical standards. For the period from 2003 to 2008, expended budget was CAD 216 million and around 49 000 contracts for Beneficial Management Practices (BMPs) were signed. To be eligible for National Farm Stewardship Program funding, it is necessary to have a completed and approved agri-environmental risk assessment done. Greencover Canada also provided financial assistance to farmers and focused on the components of land conversion, critical areas, technical assistance and shelterbelts (expenditures raised from CAD 2 million in 2003/04 to CAD 27.6 million in 2007/08). The National Water Supply Expansion Program provided technical and financial assistance to Canadian producers (in the form of reimbursement of expenses based on completed activities) to help develop, protect and enhance long-term agricultural water supplies (expenditures rose from CAD 5 million in 2003/04 to CAD 32.1 million in 2007/08).

In ***Mexico***, a programme for **sustainable agriculture and productive reconversion in recurrent zones of natural disasters**, provide area and headage payments to farmers who develop a rural sustainable development project and/or a productive project of conversion. In 1999, ***Korea*** introduced direct payments to farmers eliminating or restricting the use of fertilisers and pesticides in drinking water conservation areas. The programme was revised in 2002 to extend the application of incentive payments to the whole country. Three basic schemes are available to farmers who voluntarily join the programme (**organic farming**: no pesticides, no chemical fertilisers; pesticide-free: no pesticides, limited use of chemical fertilisers; and **low agrochemical**: limited use of pesticides and chemical fertilisers). In 2004, Korea introduced payments to support environmentally friendly livestock farming to farmers applying specific manure management practices and maintaining limited stocking densities. Additional payments per farm are provided to farmers managing appropriate landscape architecture (elements) around farm livestock facilities. In 2007, ***Japan*** introduced direct payments for environmentally friendly farming to farmers committing themselves to reduce the use of chemical fertilisers and pesticides to a half of the conventional farming practice in the region.

In ***Australia***, the activities of the National Heritage Trust were extended from 2002-03 to 2006-07 and the Trust's former 23 programmes were consolidated and simplified into four overarching programmes: (i) Landcare Program — reversing land degradation and promoting sustainable agriculture; (ii) Bushcare Program — conserving and restoring

habitat for Australia's unique native flora and fauna, which underpins the health of landscapes; (iii) Rivercare Program — improving water quality and environmental condition in Australia's river systems and wetlands; and (iv) Coastcare Program — protecting coastal catchments, ecosystems and the marine environment. The Landcare, Bushcare and Rivercare programmes included measures to encourage the uptake of sustainable farm practices, implemented through collective activities.

These programmes ended in June 2008, and were replaced by a new ongoing government initiative *Caring for our Country* that aims to achieve an environment that is healthy, better protected, well-managed and resilient, and provides essential ecosystem services in a changing climate. An initial investment of AUD 2.25 billion has been provided for the first five years (1 July 2008—30 June 2013) of the Caring for our Country initiative. Strategic results should be achieved by focusing on six national priority areas:

- *National Reserve System* – helping to conserve Australia's distinctive landscapes, plants and animals by creating a comprehensive, adequate and representative system of reserves across Australia.

- *Biodiversity and natural icons* – protecting World Heritage Areas, tackling weeds and pest animals that threaten biodiversity, and better protecting nationally threatened animal and plant species and communities.

- *Coastal environments and critical aquatic habitats* – implementing the Great Barrier Reef Rescue package, protecting and rehabilitating areas for critically endangered migratory species, improving the water quality discharged into coastal environments, and protecting Ramsar wetlands.

- *Sustainable farm practices* – building on *Landcare* successes to encourage the adoption of farming practices that continue to maintain and improve production and deliver ecosystem services for the whole community.

- *Natural resource management in remote and northern Australia* – securing better environmental and natural resource outcomes in remote and northern Australia, including engaging Indigenous groups by increasing Indigenous Protected Areas and employment of additional Indigenous rangers.

- *Community skills, knowledge and engagement* – investing in the skills and knowledge of Indigenous people, volunteers and communities as a whole to enable them to form more effective partnerships with regional and other organisations to undertake landscape-scale change.

Payments based on land retirement

Programmes under this category provide incentive payments to retire land from commodity production and convert the land for environmental purposes. Such programmes have dominated agricultural conservation expenditures in the ***United States*** since the mid-1980s. The major land retirement programme is the *Conservation Reserve Program*, which was introduced under the 1985 Food Security Act. The CRP provides an annual rental payment to farmers who enrol in 10 to 15-year contracts to retire land from production. Since 1996, CRP rental payments have averaged more than USD 1.5 billion a

year, or around 95% of total expenditure spent on land retirement. As part of the 2002 FSRI Act, the maximum acreage eligible for CRP payments was increased from 14.7 million hectares to 15.8 million hectares. The *Wetland Reserve Program* in the United States provides annual cost-share payments or lump-sum payments and technical assistance to producers for implementing an approved wetland restoration and conservation plan, and providing a permanent or long-term easement. Under the 2008 FCEA land retirement programmes continue, with particular emphasis on wetlands. The maximum set-aside area under the Conservation Reserve Program, which is the largest conservation programme in terms of total annual funding, will be decreased from 15.9 million hectares down to 12.9 million hectares, beginning in 2010. However, the maximum enrolment area covered by the Wetlands Reserve Program is increased by 0.3 million hectares to over 1.2 million hectares.

In 1993, ***Switzerland*** introduced land retirement payments under its *Green Fallow and Floral Fallow* programmes, in order to promote biodiversity and habitat protection. Agri-environmental land retirement payments also exist in the ***European Union***. Most EU member states have implemented various land retirement programmes for various environmental purposes — particularly to protect water supplies and biotope reserves — under the Agri-environment Regulation (No.2078/92) and the Rural Development Regulation (No.1257/99 and No.1698/2005). For example, as part of the Rural Development Programmes, a number of EU member states implemented a range of land retirement payments targeting a variety of environmental objectives, including wetland restoration, long-term environmental set aside, *etc*.

In 1992, the ***European Union*** also introduced a forestry scheme (Council Regulation No.2080/92), later encompassed by Rural Development Regulation (No.1257/1999) and subsequently further developed in the 2007-13 RDR (No.1698/2005), which granted support towards planting costs for the *afforestation* of agricultural land. Payments supporting the afforestation of agricultural land were also provided in other OECD countries, such as ***Iceland***, ***Mexico, Japan*** and the ***United States***.

Finally, measures to reduce the negative impact on the environment of certain farming practices by financing the exit of farmers from specific activities have been recently implemented in some countries. In early 2000, the **Netherlands** and **Belgium** (Flanders Region) introduced a package of measures to buy out pig production quotas. It is anticipated that this buy-out scheme has reduced the national manure surplus and released environmental pressure.

Payments based on farm fixed assets

Payments based on farm fixed assets are policy measures granting a monetary transfer (including implicit transfers such as tax and credit concessions) to farmers to offset the investment cost of adjusting farm structure or equipment to adopt more environmentally friendly farming practices. A wide range of such payments have been implemented in OECD countries in the past twenty years.

In the **United States**, the *Environmental Quality Incentives Program (EQIP)* grants payments to farmers covering up to 75% of the investment cost of installing or implement structural changes to promote environmental objectives, with a particular emphasis on addressing environmental problems associated with the livestock sector – *e.g.* building animal waste management facilities and creating filter-strips. In 2000, *Agriculture Management Assistance (AMA)* was also made available in fifteen states to provide cost-

share payments to farmers to carry out activities to address environmental issues, including the construction or improvement of water management structures, irrigation structures, and the planting of trees for windbreaks or to improve water quality.

A number of structural payment programmes have also been implemented in the ***European Union*** under the *Rural Development Regulation (No.1257/99, and No.1698/2005)*. Member countries, which benefit of the temporary derogation, implemented programmes providing subsidies for investment in manure storage, processing and application capacities. In many cases these investments were provided to enable farmers to comply with the strengthened environmental regulatory requirements aiming to improve the environmental impact of breeding activities. This is particularly the case of the new EU member states. For the new rural development programme period 2007-13, the expected environmental impacts of the investments have been assessed before their implementation to avoid negative effect on the environment. Furthermore, support for investments in irrigation structures was granted only to replace the old installations with new water saving systems. Several investment projects have been approved with the aim of reducing ammonia emissions from stables and promoting the rapid incorporation of manure in arable land in order to limit ammonia emissions.

Tax and credit concessions are sometimes used to offset the investment cost of adjusting farm structure or equipment to promote environmental improvements. For example, since 1999, **Japan** has provided concessionary loans to farmers for capital expenditure to promote more environmentally sustainable farming. Supported projects are administered by prefecture authorities and include the purchase of agricultural machinery, such as compost storage facilities, compost spreaders, and infrastructure improvements, such as manure storage facilities. Commonwealth tax concessions were introduced in **Australia** in the 1980s in order to promote a range of environmental objectives, including the prevention of land degradation and water conservation. Payments in kind have also been introduced in some countries. For example, in **Canada**, under the *Shelterbelt Program,* trees and shrubs are distributed (free of charge) to qualifying landowners in the Prairie Provinces for shelterbelt planting in agricultural areas, in order to enhance environmental sustainability and biodiversity. This programme was supplemented in 2001 with the introduction of the *Shelterbelt Enhancement Programme*, which is aimed at improving shelterbelt planting success to promote the sequestration of greenhouse gas emissions, as part of Canada's *Action Plan 2000 on Climate Change*.

One further trend has been the introduction of structural cost-share programmes specifically to assist farmers in meeting the costs of environmental *regulatory requirements*. For example, in 2000 the **United States** introduced *Soil and Water Conservation Assistance* to help landowners comply with Federal and State environmental laws and make beneficial, cost-effective changes to cropping systems, grazing management, nutrient management, and irrigation.

How agri-environmental payments are implemented

Agri-environmental payment is a generic title and includes a wide range of characteristics of policies which may differ in many ways, in term of their:

- Spatial targeting (*e.g.* applied to a specifically defined area – mostly using environmental criteria; within an administrative region, whole country).
- Time duration (*i.e.* one-off/transitional; medium term; long term).

- Basis of the payment/implementation criteria (*e.g.* based on input use; payment per area/head, resource retirement, non-commodity outputs).
- Level of payment definition (*e.g.* valuation of a specific project, using an auction system, using fixed rates – specific region/whole country, share on investment costs).

In the *Inventory* agri-environmental payments are classified in three broad categories based on implementation criteria (*payments based on farming practices*, *payments based on farm fixed assets*, *payments based on land retirement*, see parts 2.1.1 – 2.1.3), although the policy description of each programme providing agri-environmental payments contains information on the other above mentioned characteristics to the extent that information is available. Each year the OECD also provides a *Producer Support Estimate* database (PSE database), which contains all policy measures providing transfers to farmers, including *agri-environmental payments*. This database is annually updated and used in the preparation of the annual OECD report on *Agricultural Policies in OECD countries*. The payments in the PSE database are classified according to implementation criteria. More information on the PSE method and the categories used in the PSE classification are available in the PSE manual publicly available on the OECD PSE website (www.oecd.org/agriculture/pse).

This part provides an insight on the basis of *agri-environmental payments* in various OECD countries using the implementation criteria of the PSE classification (Box 3).

Box 3. How are agri-environmental payments classified in the PSE?

The PSEs are classified according to implementation criteria (the basis on which transfers/payments are made). This means, for example, that the category "payments based on non-commodity outputs" includes only those agri-environmental policies where payments are directly related to (based on) the provision of specific non-commodity outputs such as stonewalls, hedges, individual landscape elements etc.. However, policies that are based on area or animal numbers or some other implementation criteria, although implemented with the aim of improving environmental performance, are classified according to the primary basis on which the policies are implemented. Such policies are currently classified as "payments based on area/animal numbers/receipts/incomes", or, in the case of payments financing investment, as "payments based on input use". In these cases further information concerning the nature of the policies is given through the use of labels (additional criteria). With respect to agri-environmental programmes the label based on input constraints is often the most appropriate. Such policies require farmers to reduce the use of inputs or apply specific farming practices. Work is on-going to further refine the PSE classification in order to provide comprehensive information about the content of categories and sub-categories that currently may contain rather heterogeneous measures. This should allow more attention to the fact that a significant share of support has input constraints related to environment, animal welfare, or other issues, where this is the case.

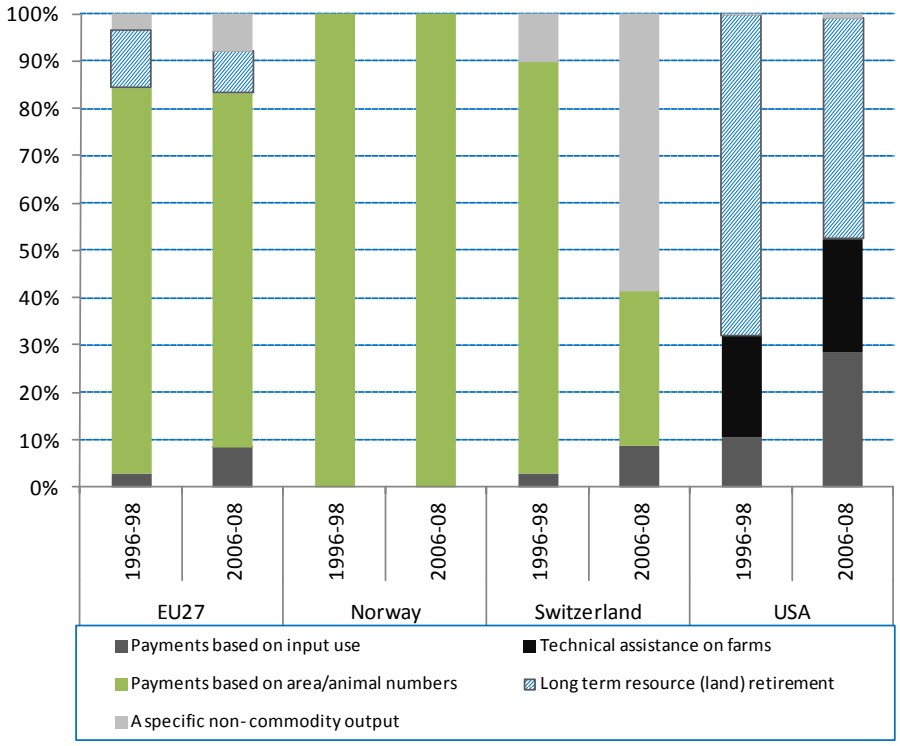
Under the current classification the agri-environmental payments are classified in the following PSE categories:

1. Payments based on input use – with input constraints (mostly payments to investments to improve environment);
2. Payments based on current area/animal numbers – with input constraints;
3. On farm technical assistance/ extension;
4. Long-term resource retirement;
5. A specific non-commodity output.

Figure 2 provides information on the share of these categories in total agri-environmental payments in selected OECD countries. Payments based on areas or animal numbers with input constraints (*e.g.* specific management practices on agricultural land) are dominant in EU, Norway and Switzerland. Land retirement programmes are the most important part of the United States agri-environmental payments, although their share has declined between 1996-98 and 2006-08. The United States also has a relatively high share on spending on technical assistance to farms.

However, it should be stressed that the analysis in figure 2 is focused only on those agri-environmental policies that provide payments to farms. As illustrated in other parts of this chapter, the mix of policy instruments to address environmental issues in agriculture vary from one country to another. Any analysis of the level and structure of agri-environmental payments should be evaluated in this wider concept.

Figure 2. Structure of Agri-environmental payments in selected OECD countries in 1996-98 and 2005-07



EU15 in 1996-98, EU26, 27 in 2006-08.

Source: OECD (2009), *PSE CSE Database*.

Environmental taxes/charges

Policy measures imposing a tax or charge relating to pollution or environmental degradation include taxes and charges on farm inputs or outputs that are a potential source of environmental damage. The implementation of taxes and charges appears to be rare in agriculture, compared to other sectors. This may at least partly reflect practical problems of measurement – unlike a factory where pollution can normally be monitored

at "point", the pollution from agriculture is much more dispersed, as it tends to originate from many different independent farms and in varying intensities.

Nonetheless, some examples of these policy measures do exist. Since 1998, the **Netherlands** has tackled the measurement problem by introducing a range of levies on off-farm nutrient emissions above a set limit. Since 2006, the system directly regulates the maximum amount of fertilizers (animal manure pus maximum amounts of nitrate and phosphate) that may be used on the farm. The former system (MINAS) regulated emissions, not usage, to comply with the EU nitrate directive. Similar taxes on the estimated on-farm generation of nutrients over set levels are also in place in **Belgium**. The **Czech Republic** applied, taxes on ammonia emissions per head of ruminants in large scale enterprises.

In agriculture, environmental taxes are more often applied on the sale of inputs identified as having a potentially adverse impact on the environment. For example, various taxes and charges are currently levied on pesticides in **Belgium** (abolished in 2007 and replaced by stricter regulation), **Denmark**, **France**, **Italy**, **Norway** and **Sweden**, while fertilizer levies are applied in **Italy**, **Sweden** and some states of the **United States**. Input-based taxes are generally inexpensive to administer, but may be less effective than a tax on pollution itself, as they do not discriminate on the basis of actual loading on the environment.

Tradable rights/permits

Tradable rights based on environmental quotas, permits and restrictions also do not yet appear to play a significant role in agri-environmental policy, despite the growing use of such measures for environmental policy in other sectors (there is already experience with tradable CO_2 permits within the energy sector). However, in the past decade the **Netherlands** has implemented systems of tradable permits in relation to the volume of manure produced by farms.

There are also examples of tradable schemes that are applied across a number of sectors, including agriculture. These include tradable rights for the development of wetlands (Wetland Mitigation Banks) in the **United States**, and tradable water extraction rights, which have been implemented on a state/regional basis in the **United States**. Also, the voluntary carbon market operated by the Chicago Exchange (CCX) does accept credits for carbon sequestration by agriculture, but it is quite limited in practice. **New Zealand** is planning a nutrient surplus trading scheme.

The **Australian** water market system has been developing over the last two decades. More recently, building on the *National Water Initiative*, Australia's *Water for the Future* reform program has a strong focus on improving market mechanisms and removing trade barriers to allow water to move to its highest value use. Central to this reform is the promotion of full cost pricing for water service delivery. Under the Water Act 2007, water charge rules for the Murray-Darling Basin are expected to be introduced in 2009. The rules focus on three types of fees and charges: those payable to irrigation

infrastructure operators; bulk water operators; and government agencies for water services. The aim is to ensure that such charges are based as far as possible on full cost recovery.

Community based measures

In some countries—**Australia**, **Canada** and **New Zealand**—government-led information policies are supplemented by the growing use of community-based approaches promoting the exchange and transfer of information, variously known as *landcare groups* or *conservation clubs*. These approaches make use of local expertise in solving environmental problems that thereby enhance environmental conservation, and rely upon the self interest of farmers. Such groups seem especially well-suited to address issues that are local in nature, but which extend beyond the borders of a single farm. Some of these groups receive administrative or financial support from central or regional authorities, while others are entirely self-financed and independent.

Regulatory measures

Measures classified under this category involve a compulsory restriction on the choice of economic agents, *i.e.* they are left with no choice but to comply with specific rules or face penalties (including the withdrawal of financial support).

Regulatory requirements

Regulatory requirements are compulsory measures imposing requirements on producers to achieve specific levels of environmental quality, including environmental restrictions, bans, permit requirements, maximum rights or minimum obligations. Enforcement mechanisms, such as legal redress or fines, are used where producers are found to be in breach of regulations or other legal requirements.

Regulatory requirements play a role in addressing environmental issues in agriculture in all OECD countries. Some of these requirements are specific only to agriculture, while others are part of broader national environmental legislation affecting many sectors, including agriculture. Regulatory requirements tend to be less flexible than economic instruments, as they do not allow producers the freedom to determine for themselves the most appropriate ways of meeting environmental objectives. However, they also tend to minimize risk and uncertainty, and therefore constitute a vital element of environmental policy in most OECD countries, particularly with respect to acute environmental problems.

OECD countries have worked to implement the Polluter Pays Principle. This principle agreed and developed by the OECD in 1972, is intended to avoid distortions in international trade and investment and to allocate costs of pollution prevention and control measures to encourage rational use of scarce environmental resources. All OECD countries have applied legislative requirements to deal with problems relating to pollution, and the degradation and depletion of natural resources. The main categories of these requirements include: the availability of certain inputs to farmers, (for example, through the registration of pesticides and other agrochemicals); farm practices, (for example, the setting of limits on the spreading of manure and stocking limits); and the application of mandatory procedures, (for example, planning or consent processes

relating to land use, water extraction and the construction of livestock and manure storage facilities). Regulatory requirements are also common to protect specific valuable wildlife and habitats, and to protect agriculture and the environment from damage from invasive species and new organisms.

Over the past two decades, there has been a trend towards more regulation and binding constraints, but not always uniformly across the whole sector—such as for large animal units in the U.S., but not small ones. A significant proportion of requirements imposed in OECD countries are applied at local and regional levels. For example, in the European Union, standards are developed at a range of levels, stretching from the Union itself down to individual regions in Member States. Regulatory requirements are often applied under the framework of over-arching legislation at the national, federal (or EU-wide) level; (for example, New Zealand's Resource Management Act (1991) tasks Regional Councils with the responsibility of environmental resource-use policy). However, while the EU Nitrate Directive, which sets a benchmark limit on nitrate levels, associated with the application of manure in the European Union, it leaves Member States free to determine their own action programmes with respect to designated nitrate vulnerable zones.

Regulatory measures can tackle agri-environmental objectives in a variety of different ways, imposing differing degrees of restrictiveness on landowners. Three main categories are used below to highlight some of the most prominent policy measures.

Reducing pollution

Since the 1980s there has been a general expansion in regulatory measures to protect waterways and groundwater, and to reduce air pollution, particularly in the following areas.

- *Inputs.* An important aim in all OECD countries is to reduce pollution generated by the use of agricultural inputs is laws regarding the marketing and sale of Chemical inputs, particularly pesticides. Laws have typically been amended over time such that many countries now approve new pesticides for a limited period only (commonly five to ten years). Some requirements relating to inputs have been implemented in response to *international pressures* – for example, the phasing out of the marketing and use of methyl bromide pesticides under the *1987 Montreal Protocol on Substances that Deplete the Ozone Layer*.

- *Use of Pesticides.* All OECD countries set strict rules concerning the storage, and application of chemical fertilisers and pesticides. The aerial spraying of pesticides is now prohibited in some parts of the **European Union** and **Australia**. It is heavily controlled in many other regions and countries, with licences or permits commonly required. In many OECD, the use of pesticides is also now restricted within a certain distance of watercourses. In the **European Union** a process is underway to enhance the integrated pest management. The most relevant regulations will be probably adopted during 2009.

- *Nutrient Management.* While laws prohibiting the *direct* discharge of animal waste to surface waters have existed in most OECD countries since the early 1970s, a large number of restrictions have since been applied in relation to general farming practices associated with pollution from nutrients. In particular, OECD countries have introduced a variety of requirements relating to *manure management* in order to limit nutrient

pollution from livestock farming, including restrictions on the quantity of manure that can be spread; seasonal bans on manure application; manure storage requirements; and limitations on livestock densities and on the expansion of livestock units. Such measures have become particularly common in the **European Union**, where the *Nitrate Directive (No 676/91)* requires member states to limit the application of manure in nitrate vulnerable zones to 170kg/hectare/year. Many other OECD countries have also tightened regulatory requirements relating to the application of nutrients, either at the national or state/regional level. In **New Zealand**, Regional Councils place limits on the permissible levels of nitrogen applied in dairy effluent, such that farmers spreading effluent from milking shades are limited to 150-200 kg N/ha/year. Increasingly **Canadian** provinces are mandating manure management plans through regulatory changes.

- *Scale of production.* In some OECD countries large-scale livestock production units are controlled through permitting systems, either at the national or regional level. For example, the **European Union** *Integrated Pollution Prevention and Control Directive*, which has been applied since 1999 to new facilities (and is to be applied to existing facilities from 2007), requires member states to impose emission limits in environmental permits which are mandatory for potentially polluting plants of a given scale – in particular very large pig and poultry facilities. In **Japan**, under the *Water Pollution Control Law* and other associated legislation, upper limits are set for discharges of pollution for specified agricultural facilities, including large-scale pig and cattle facilities, and stables.

- *Buffer strips and catch crops*. Buffer strips around water courses and groundwater sources have become a common requirement to limit nutrient leaching in many OECD countries, including **Australia**, **Canada**, **France** and **New Zealand.** Some governments have also established regulations requiring farmers to maintain a minimum level of green cover during certain times of the year (catch crops). Requirements for catch crops are most stringent in **Denmark** and some parts of **Sweden**.

Use of natural resources: water and soil

Restrictions to limit the quantitative *extraction of water* for irrigation purposes are becoming increasingly common in regions where water is scarce. For example, in **Australia**, caps on water extractions in many irrigation zones were set in the 1990s, and in some cases embargoes exist on further irrigation licences to extract groundwater. Importantly a cap was set in 1996 on surface water extractions in Australia's largest irrigation zone (the Murray-Darling Basin)[2]. These caps have sometimes also been combined with the creation of tradable rights. Restrictions on water extraction are now also common in some states in the **United States** – for example, in Florida 5-10-year permits must be obtained to extract water, construct wells and install new water surface management systems. In **France** and in **New Zealand**, irrigators are required to apply for permission to use water and comply with any conditions imposed, including reductions in usage to protect minimum flows in rivers. The EU Water Framework Directive focuses on water management in river basin areas through measures such as setting farmers' abstraction rights; monitoring and control of water quality; and charges for use of water

2. A new sustainable cap for the whole Basin will be established in 2011.

resources. The Directive also requires that Plans for each river basin be established by 2010. These plans include indicators on pressures and impacts from human activities; environmental objectives; and specify measures to reach these objectives, including territorial instruments and animal manure management.

Regulatory requirements regarding *land use* have become increasingly common in relation to soil quality, either at the national or state/regional level. For example, **Switzerland**'s *Act on Soil Damages*, introduced in 1998, requires farming practices preventing long-term soil compaction and soil erosion in order to maintain the long-term fertility of soils. In Queensland, **Australia**, the *Soil Conservation Act 1986* requires land owners to apply for approval of 'property plans', which must specify soil conservation measures and can also relate to land clearing practices and other aspects of land management.

Biodiversity

Most OECD governments at federal and provincial/state level have well established legislation to protect valuable wildlife and habitats, which can influence on-farm practices. These measures have been shaped by international as well as domestic considerations, including the obligations of OECD member countries to stem the loss of biodiversity under the *International Convention on Biological Diversity* (CBD), which was agreed at the *UN Conference on the Environment and Development* in 1992.

Under the *Birds Directive (No 409/79)* and the *Habitat Directive (No 43/92)*, **European Union** member states are required to take steps to protect endangered species, as well as the habitats upon which they depend for feeding and breeding. Similarly, in the **United States**, the *Endangered Species Act* (1973) protects endangered species and their habitats, and requires federal permits for certain practices, such as filling wetlands for the purpose of agricultural production. Many OECD countries have also legislated to protect remaining valuable non-farm habitats which are often adjacent to farmland, such as wetlands, hedgerows, bush and forests. For example, in 1997, the **United Kingdom** introduced legislation administered by local authorities to protect important hedgerows bordering agricultural land from deliberate removal. In 1992, **Switzerland** introduced legislation imposing stricter limitations on farm land use, including bans or limitations on the use of agri-chemicals, in specific regions such as marshes and wetlands.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora establishes a European ecological network known as *Natura 2000*. The network comprises "special areas of conservation" designated by Member States in accordance with the provisions of the Directive, and special protection areas classified pursuant to Directive 79/409/EEC on the conservation of wild birds. Special areas of conservation are designated in three stages. Each Member State must draw up a list of sites hosting natural habitats and wild fauna and flora. On the basis of the national lists and by agreement with the Member States, the Commission will then adopt a list of sites of Community importance. No later than six years after the selection of a site of Community importance, the Member State concerned must designate it as a special area of conservation. Member States must take all necessary measures to guarantee the conservation of habitats in special areas of conservation, and to avoid their deterioration. The Directive provides for co-financing of conservation measures by the Community.

Regulatory measures to protect agriculture from invasive species are well established in OECD countries, and are particularly prominent in countries where farm production

and ecosystems are most vulnerable, such as **Australia** and **New Zealand**. In addition, measures regulating the introduction and use of new organisms – including new agricultural biotechnological products – have in many cases been further developed or strengthened.

Cross compliance approaches

Cross-compliance mechanisms are measures requiring farmers to fulfil specific environmental requirements or levels of environmental performance in order to be eligible for payments from specific agricultural support programmes. Where support payments remain relatively high, cross-compliance may be characterised as de-facto regulatory requirements for farmers that are eligible for payments.

In the past two decades, many OECD countries have made general support programmes, which provide payments to agricultural producers, conditional upon the respect of certain environmental constraints or the achievement of a particular environmental outcome. Such conditions are a significant part of agri-environmental policy in the **United States** (from 1985), where an estimated 44 million hectares of highly erodible cropland and 31 million hectares of wetlands are subject to cross-compliance provisions, reflecting the high participation rate in general farmer support programmes.

Box 4. EU Cross-compliance

The principle that farmers should comply with environmental protection requirements as a condition for benefiting from market support was incorporated into the Agenda 2000 reform. The 2003 CAP reform put greater emphasis on cross-compliance which has become compulsory.

The Agenda 2000 CAP reform introduced the requirement for Member States to take the environmental measures they consider appropriate in view of the situation of the agricultural land used or the production concerned. This requirement was incorporated in the "Horizontal Regulation" (No 1259/1999), which provides the common rules in relation to all payments granted directly to farmers.

Member States had three options for fulfilling this obligation: giving support for agri-environmental commitments, fixing general mandatory environmental requirements (based on environmental legislation), and setting out specific environmental standards. Where farmers do not respect the environmental requirements, appropriate sanctions are to be applied, which may include the reduction or even the withdrawal of direct aids. Examples of environmental conditions are adherence to maximum stocking rates for cattle or sheep, compliance with specific conditions for the cultivation of sloping land, respect of maximum permitted volumes of fertilizers per hectare, and compliance with specific rules concerning the use of plant protection products.

From 2005, all farmers receiving direct payments are subjected to *compulsory cross-compliance* (Council Regulation No 1782/2003 and Commission Regulation No 796/2004, later replaced by regulation 73/2009). 19 legislative acts applying directly at the farm level in the fields of environment, public, animal and plant health and animal welfare have been established and farmers will be sanctioned in case of non-compliance (partial or entire reduction of direct support). Beneficiaries of direct payments are also obliged to keep land in good agricultural and environmental conditions. These conditions are defined by Member States, and should include standards related to soil protection, maintenance of soil organic matter and soil structure, maintenance of habitats and landscape, including the protection of permanent pasture, and water protection and water management. In addition, Member States must also ensure that there is no significant decrease in their total permanent pasture area, if necessary by prohibiting its conversion to arable land.

Since the late 1990s, most general direct payments offered to farmers in **Switzerland**, including area and headage payments, and payments based on historical entitlements, have also been made conditional on farmer compliance with environmental standards and farm-management practice requirements (*integrated farming*). **Norway** offers various forms of area-based payments and headage support for livestock on the condition that farmers meet environmental requirements.

Some EU member states (*e.g.* the ***United Kingdom***) have been using environmental cross compliance since the 1990s. From 2005, cross compliance (including environmental components) has become compulsory in the ***EU15*** (see Box 4)**.** In the new EU member States (EU12), part of cross compliance applies already and full cross-compliance will be introduced between 2009 and 2013**.**

Advisory and institutional measures

Research and development

Across all OECD countries, governments fund research into the relationship between agriculture and the environment. This research is often undertaken in order to establish best management practices to be communicated to farmers through on-farm technical assistance, or to establish the most appropriate regulations or other policy measures. It covers a broad range of scientific enquiry including ecology, engineering, farm management practices, farmer behaviour, and economics.

Technical assistance/extension

These measures provide farmers with on-farm information and technical assistance to plan and implement environmentally friendly farming practices. Most OECD countries have long-established programmes for assisting farmers to adopt technology and improve agricultural practices. These programmes have traditionally focussed on improving on-farm productivity, but in the past two decades much greater emphasis has been placed on increasing farmers' understanding of resource and environmental issues, in order to induce voluntary changes in farming practices to improve environmental outcomes.

In some OECD countries such as **Australia, Canada, New Zealand**, and the **United States**, a part of financial expenditure for agri-environmental programmes are spend to finance technical assistance o farms related to the implementation of the practices required by the various programmes. In some programmes (mainly in **Australia** and **New Zealand**) the financing of technical assistance is more important than the direct financial assistance to farms. Also in the **EU countries** technical assistance is part of some agri-environmental programmes, but it is difficult to estimate the share of spending on technical assistance from direct financial assistance.

Some programmes are focused specifically on technical assistance to farms. For example in **Canada**, under the *Environmental Farm Planning Program* assistance is provided to farmers to develop their Environmental Farm Plan (EFP) to systematically identify environmental risks and benefits from their own farming operation, and to develop an action plan to mitigate the risks (expenditures rose from CAD 1 million in 2003/04 to CAD 21 million in 2007/08, and as of March 31, 2008, 76,900 producers and ranchers had participated in the National EFP Initiative with 56,700 reviewed EFPs completed). **Canada** also develops a *National Land and Water Information Service* (NLWIS), an Internet-based service to provide on-line access to agri-environmental

information to help Canadians make responsible land-use decisions (2006-09 phased approach to develop the system due to be operational in 2009).

Labelling/standards/certification

In the past decades, greater attention has also been directed at providing information on the environmental attributes of commodity outputs in order to meet the demands of an increasingly well-informed and discriminating public. In particular, standards for "eco-labels" have been established in many OECD countries, backed-up by certification processes to verify their authenticity, in order to assist customers in distinguishing commodities grown without chemical fertilizers or pesticides from conventionally-produced agricultural commodities. Products from such commodities tend to command discernible price premiums in many markets.

Some of these eco-labelling schemes are entirely market-based, often introduced by producer groups at the behest of supermarkets or other retailers. Others are government-backed. For example, a large number of OECD countries—including the **European Union**, **Canada**, **Norway**, the **United States** and **Switzerland**—have introduced government-enforced national organic labelling standards.

Conclusions

OECD countries use different mixes of policy instruments to achieve their various environmental objectives where markets for externalities and public goods are missing. The policy instruments applied are the reflection of the overall policy approach to the sector; the specific environmental issues and their perceived linkage to agriculture activities; the nature of property rights related to the use of natural resources (land, water); and societal concerns related to environmental issues. Although less visible in policy analysis and policy debate, environmental regulations (regulatory requirements) are the core of the policies addressing environmental issues in agriculture. All OECD countries impose a complex set of regulations to prevent the negative impact of agriculture on the environment. Most of these regulations are applied generally. However, in areas with higher environmental values (natural reserves), drinking water catchment areas, environmentally sensitive areas, or close to population dense areas, stricter regulations are applied. Over time, these regulatory requirements have generally broadened in scope and become more stringent. Some OECD countries (Australia, New Zealand) rely mostly on regulations to address environmental issues in agriculture, but voluntary, self-motivating aims are also important.

Many other OECD countries (EU countries, Norway, Switzerland and United States) have also developed a wide range of voluntary programmes providing payments to farmers to adopt specific farming practices on producing land, with positive environmental effects and/or providing public goods (such as landscape, biodiversity, etc.). Although, these programmes offer a large variety of measures, most of the payments are related to the support of extensive forms of farming (mostly on grassland — extensive management of grassland, extensive pastures). For most of those payments targets are defined in the form of a specific farming practice rather than a specific (measurable) environmental outcome. Programmes providing payments for retirement of agricultural land from production for environmental and resource conservation purposes are also implemented in a range of countries, but, with the exception of the United States, they are of minor importance in terms of area covered.

Other economic instruments, such as tradable rights and quotas, are used in a limited number of countries. These include tradable rights for the development of wetlands in the United States, tradable water extraction rights (implemented on a state/regional basis in the United States), and improving market mechanisms to free up trade in water rights under implementation of tradable water rights in Australia. Tradable rights based on environmental quotas, permits and restrictions do not yet appear to play a significant role in agri-environmental policy, despite the growing use of such measures for environmental policy in other sectors.

Most OECD countries have also directed greater attention towards improving the knowledge-base relating to environmental issues in agriculture in the past two decades, through increased spending on agri-environmental research, often undertaken in co-operation with private sector interests. One notable trend in this area has been the development of agri-environmental indicators in a number of OECD countries to track environmental performance. Greater emphasis has also generally been placed on communicating information to farmers on environmental issues via technical assistance and extension, in order to induce voluntary changes in farming practices to improve environmental outcomes.

Coherence of agricultural, agri-environmental and environmental policies (policy coherence) has generally improved in the past two decades. Some OECD countries have taken steps to streamline agri-environmental policies measures within over-arching frameworks or action plans addressing environmental or rural development objectives. In the broader context, however, where agri-environmental policies offset the damaging environmental effects of input-linked and production-linked policies, the opportunity costs of improving the environment are higher than would be the case in the absence of production-linked support measures in so far as domestic prices are thereby kept higher than world prices (this might change under a scenario of higher world prices in future). On the other hand, a number of agri-environmental measures go beyond offsetting environmental damage caused by agriculture and provide voluntary payments for additional environmental services (more or less precisely defined and targeted) provided by agriculture. In most cases these additional environmental services are defined as specific farming practices than environmental results.

OECD countries are further developing policies to address environmental issues in agriculture. However, in term of the mixes of policies used they continue to use different approaches. Some countries, such as Australia and New Zealand, continue to rely mostly on environmental regulation and economic instruments such as tradable quotas and permits rather than agri-environmental payments. However many OECD countries implement various systems of agri-environmental payments, which are intended to pay farmers for the voluntary provision of environmental services, or to contribute to the costs of reducing pollution. However, the level of *agri-environmental payments* by themselves does not account for all of the efforts of countries to reach their environmental objectives related to agriculture. So far programmes providing payments have been mainly focus on paying for the implementation of specific farming practices rather than for measurable environmental outcomes. The new Farm Act in the United States also gives a more prominent role to agri-environmental payments for specific practices on working lands, relative to payments for land conservation. The European Union places emphasis on payments to address environmental issues on working farms. In the EU, US and Switzerland cross-compliance, linking environmental and agricultural policy instruments is significant.

Methods of evaluation of agri-environmental policies are being developed in many countries. But the actual evaluation is likely to be a long-term and difficult process particularly given the site specificity of many environmental issues and the complexity of valuation and measurement of environmental outcomes. More specifically, evaluation is made more difficult by data limitations and the identification of the type of information required within the evaluation process (see also the proceedings from the OECD workshop on evaluating agri-environmental policies – December 2004). Some countries have developed their own set of agri-environmental indicators to track the environmental performance of agriculture. In this respect, the OECD reports on *Agri-environmental indictors for agriculture* (volumes 1-4) and in particular the latest report in 2008, the *Environmental Performance of Agriculture in OECD Countries Since 1990* are valuable sources of methodological and empirical information. Also the work on the OECD Secretariat work on developing *Guidelines for the design and implementation of cost-effective agri-environmental policy measures* may contribute to identify the information necessary for the evaluation of efficiency and effectiveness of agri-environmental policies."

Bibliography

OECD (2001), *Environmental Indicators for Agriculture: Volume 3, Methods and Results,* Paris, France

OECD (2008), *Environmental Performance of Agriculture in OECD Countries Since 1990*, Paris, France

OECD (2009), *Agricultural Policies in OECD Countries: Monitoring and Evaluation 2009*, Paris, France