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**OECD Member Country  
Questionnaire Responses  
on Agricultural Water  
Resource Management**





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## OECD MEMBER COUNTRY QUESTIONNAIRE RESPONSES ON AGRICULTURAL WATER RESOURCE MANAGEMENT

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### *Note*

This questionnaire, *OECD Member Country Questionnaire Responses on Agricultural Water Resource Management*, provides background information to the OECD study (2010) *Sustainable Management of Water Resources in Agriculture*, which is available at [www.oecd.org/water](http://www.oecd.org/water).

The questionnaire was carried out under the auspices of the OECD Joint Working Party on Agriculture and the Environment of the Committee for Agriculture and the Environment Policy Committee. The information provided here gives only some of the more important examples used at different levels of government and the tables do not attempt to provide comprehensive coverage of all information across OECD countries. The questionnaire responses were provided to the OECD Secretariat over 2009.

**Table 1. Policy targets for the future use of water resources by agriculture**

Quantified Targets		Commentary on policy targets
<b>AUSTRALIA</b>	<b>YES</b>	Under the 2007 <i>Water Act</i> a Basin Plan will be in place by early 2011 that will include sustainable limits on the quantity of surface/groundwater that can be diverted from the Murray Darling Basin <sup>1</sup>
<b>AUSTRIA</b>	<b>NO</b>	No quantified future targets in place because of abundant water resources and no major drought problems
<b>BELGIUM</b>	<b>YES</b>	Surface water and groundwater targets being specified in River (sub-)Basin management plans (Flemish and local level)
<b>CANADA</b>	<b>YES</b>	Potential increase of 0.8 million ha irrigated (no date specified) or +70% increase over area of 2001-03. Provinces usually establish targets under overarching water strategy plans, while watershed and local water management groups attempt to estimate future water resource needs by agriculture
<b>CZECH REP.</b>	<b>NO</b>	
<b>DENMARK</b>	<b>NO</b>	
<b>FINLAND</b>	<b>NO</b>	No targets as water withdrawals by agriculture less than 5% of total withdrawals and agricultural groundwater use minimal
<b>FRANCE</b>	<b>YES</b>	No targets available at national level, but planning targets are set at the local level, such as within the framework of the Water Development and Management Plans (SAGE).
<b>GERMANY</b>	<b>NO</b>	No targets as water withdrawals by agriculture less than 1% of total withdrawals, but irrigated area likely to increase
<b>GREECE</b>	<b>YES</b>	Increase of 105 000 ha irrigated ( 450 million) by 2013 or 7% increase over area of 2001-03, under 3 <sup>rd</sup> and 4 <sup>th</sup> Rural Development Programme, to include irrigation infrastructure upgrade and artificial recharge works for groundwater.
<b>HUNGARY</b>	<b>NO</b>	No targets, but 37 000 km of public water facilities serving drainage and irrigation systems and 312 public pumping stations are in poor condition and require upgrading.
<b>ICELAND</b>		Information not available
<b>IRELAND</b>	<b>NO</b>	Climate change research is underway and further projects are planned, but this is not especially focused on water
<b>ITALY</b>	<b>YES</b>	Investment of 1.1 million by Ministry of Agriculture over 2004-2014 for improving water management efficiency, modernizing irrigation infrastructure, and reducing agricultural water pollutants from irrigated areas.
<b>JAPAN</b>	<b>NO</b>	

Quantified Targets		Commentary on policy targets
<b>KOREA</b>	<b>YES</b>	The Ministry for Food, Agriculture, Forestry and Fisheries has a <i>Long term integrated water resources plan</i> every 5 years. Latest plan 2006 to 2020 projects a high demand for agricultural water (irrigated area in brackets) by+ 4% (-4%) or low demand with a decrease of -11% (-18%).
<b>LUXEMBOURG</b>		Information not available
<b>MEXICO</b>	<b>YES</b>	The National Hydrological Programme (2007-2012) aims to modernise and technically improve 1.2 million hectares of irrigated land (out of a total of about 6.5 million hectares, of which 2.1 million hectares was already up-graded by 2006). Over this period the up-grading of irrigated land will cost 24 billion pesos (USD 1.6 billion). This programme, based on the National Water Law, is prepared every 6 years.
<b>NETHERLANDS</b>	<b>NO</b>	No target specified, but reducing groundwater extraction by agriculture in areas with vulnerable ecosystems.
<b>NEW ZEALAND</b>	<b>NO</b>	No specific targets, but water policy and climate change policy are becoming more inextricably linked
<b>NORWAY</b>	<b>NO</b>	No targets are specified, but sustainable use of water is main approach to water resource planning.
<b>POLAND</b>	<b>NO</b>	No target specified, but planned investments included in sub-basin 'Voivodeship' <i>Small Water Retention Programmes</i>
<b>PORTUGAL</b>	<b>YES</b>	The <i>PRODER Rural Development Programme</i> over the period 2007-2013 provides 812 million for irrigation projects aiming to reduce water consumption in public irrigation schemes to under 6600 m <sup>3</sup> /ha in new projects and by 5-10% in existing projects.
<b>SLOVAK REP.</b>		Information not available
<b>SPAIN</b>	<b>YES</b>	Two plans to modernize irrigation infrastructure, include: first the period 2009-2015 to cover 660 000 ha with 2.2 billion private and public investment (50% each); and, second, the period 2007-2013 under the National Framework for Regional Rural Development Plans, 1 million ha with 1.062 billion private and public investment (50% each). In total these plans cover nearly 50% of the irrigated area (2001-03), with a total budget of almost 3.2 billion.
<b>SWEDEN</b>	<b>NO</b>	
<b>SWITZERLAND</b>	<b>NO</b>	No targets specified, but Swiss Federal Office for Agriculture study on future irrigation water demand
<b>TURKEY</b>	<b>YES</b>	Under the Ninth Development Plan (2007-2013) the aim is to increase by 0.55 million hectares between 2006 to 2013, and also to improve the efficiency of water use, improve institutional arrangements, and expand investment in irrigation infrastructure.



Quantified Targets		Commentary on policy targets
<b>UNITED KINGDOM</b>	<b>NO</b>	No targets specified, but the Environment Agency 2001 Water Resources for the Future – a Strategy for England and Wales (currently working on a New Strategy) considers future water resource strategies but mainly for public supplies rather than agriculture, although agricultural demand expected to increase in absolute terms due to predicted effects of climate change.
<b>UNITED STATES</b>	<b>NO</b>	No planning targets at either the Federal or State level, but there is extensive research underway and published on the impact of climate change on agriculture and water resources. Federal efforts also provide technical and financial assistance as well as investments in science and technologies that support future water use decisions.
<b>EU</b>	<b>NO</b>	There are no quantitative targets for EU as a whole, but there is a timetable for the implementation of the EU Water Framework Directive (WFD), introduced in 2000, of which the key dates include: 2003 - transposition in national legislation; 2006 - establish a monitoring network; 2009 - finalise river basin plans; 2010 – introduce pricing policies; 2015 – meet environmental objectives; 2027 final deadline to meet objectives of the WFD

1. Australia's Murray Darling Basin accounts for around 40% of all farms and total value of agricultural commodity production, and two-thirds of total irrigated land area and over 50% of national water consumption, see Australian Bureau of Statistics (2008), *Water and the Murray-Darling Basin: A Statistical Profile 2000-01 to 2005-06*, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/4610.0.55.007>

Source: OECD Secretariat, 2009.

Table 2. On-farm water drainage management and related policies

	Main policy objectives to encourage/discourage on-farm drainage <sup>1</sup>	Policies related to on-farm drainage		
		Support payments	Limits to support	Other policies
		Payments to assist drainage investment	Limits to support payments for drainage	Other policy instruments for drainage
<b>AUSTRALIA</b>	Not available			Limits placed on drainage where it affects wetland conservation
<b>AUSTRIA</b>	Land improvement, but policy ceased since 1993	NONE, all support for drainage has ceased since 1993		Drainage is forbidden in order to protect aquatic ecosystems
<b>BELGIUM</b>	Discouraging drainage to help replenish groundwater in upstream areas and prevent downstream flooding	Drainage support, as such, does not exist, but drainage investment can be part of a wider support package (management) contract that targets water management		Farm advisory services related to drainage. Limits placed on drainage where it affects wetland conservation.
<b>CANADA</b>	Mainly to avoid soil waterlogging, but in some localities to help flood control and reduce soil salinity.	Support provided but declining in recent years	One- to two-thirds of eligible drainage investment costs, and limits on funding where drainage may impact wetlands	Limits placed on drainage where it affects wetland conservation
<b>CZECH REPUBLIC</b>	Mainly to avoid soil waterlogging	NONE, payments stopped in 1990		Drainage is forbidden in order to protect aquatic ecosystems
<b>DENMARK</b>	Mainly to avoid soil waterlogging and improve land quality	NONE		
<b>FINLAND</b>	To avoid soil waterlogging, nutrient leakage and soil erosion	Support for investment and maintenance	Upper limit is 20-70%, but is case and support type specific	Limits placed on drainage where it affects wetland conservation

	Main policy objectives to encourage/discourage on-farm drainage <sup>1</sup>	Policies related to on-farm drainage		
		Support payments	Limits to support	Other policies
		Payments to assist drainage investment	Limits to support payments for drainage	Other policy instruments for drainage
<b>FRANCE</b>	No policy, other than discouraging drainage where it impacts aquatic ecosystems	NONE		Limits placed on private drainage investment where it affects wetland conservation
<b>GERMANY</b>	No policy, other than discouraging drainage where it impacts aquatic ecosystems	NONE, since 1997		Limits placed on private drainage investment where it affects wetland conservation
<b>GREECE</b>	Land improvement	Support to assist drainage investment	Not available	
<b>HUNGARY</b>	Flood control and lower soil waterlogging risk	Support to assist drainage investment	Discussion of a National Drainage Strategy now underway, within context of National Climate Change Strategy	Limits placed on drainage where it affects wetland conservation
<b>ICELAND</b>	Not available			
<b>IRELAND</b>	No policy, other than discouraging drainage where it impacts aquatic ecosystems	NONE, since the 1980's		Limits placed on private drainage investment where it affects wetland conservation

	Main policy objectives to encourage/discourage on-farm drainage <sup>1</sup>	Policies related to on-farm drainage		
		Support payments	Limits to support	Other policies
		Payments to assist drainage investment	Limits to support payments for drainage	Other policy instruments for drainage
<b>ITALY</b>	Avoid soil waterlogging, and on hill land to avoid soil erosion and help with flood control	Support for sub-surface and surface drainage, including maintenance, such as cleaning existing water channels	Limits on funding where drainage may impact wetlands, and standards used for ditch maintenance.	Limits placed on drainage where it affects wetland conservation
<b>JAPAN</b>	Reducing flood damage to maintain food production	NONE		
<b>KOREA</b>	Flood control	No direct policies but regional policies undertake collective drainage projects that benefit agriculture		Drainage projects are evaluated where they might impact wetlands area
<b>LUXEMBOURG</b>	Not available			
<b>MEXICO</b>	Avoid soil waterlogging and soil salinisation and for flood control	Support of 50% of drain investment costs, including up-grading drainage infrastructure and developing plot drainage	Government payments only up to 50% of investment costs	Limits are established through environmental regulations to protect wetlands and other eco-systems
<b>NETHERLANDS</b>	Avoid soil waterlogging	NONE		Transfer of knowledge on drainage through advisory services

	Main policy objectives to encourage/discourage on-farm drainage <sup>1</sup>	Policies related to on-farm drainage		
		Support payments	Limits to support	Other policies
		Payments to assist drainage investment	Limits to support payments for drainage	Other policy instruments for drainage
<b>NEW ZEALAND</b>	No policy, other than limits to drainage where it impacts aquatic ecosystems	No direct policies for farmers but regional policies undertake collective drainage projects that benefit agriculture, for which farmers contribute to the expense through a property tax		Limits placed on drainage where it affects wetland conservation
<b>NORWAY</b>	To improve crop yields, reduce losses of nutrients and soil erosion to reduce water pollution	Support for drainage was ended in 1991, briefly re-introduced in 1999 and 2000: while some Rural Development Funds can be provided for drainage they are rarely used for this purpose		Wetlands are protected under the Nature Conservation Act
<b>POLAND</b>	Land improvement, better use of production inputs, enhance crop stability and quality, improve farm technology efficiency, and flood control	Support to assist drainage investment	Share of the investment support concerned	Limits placed on drainage where it affects wetland conservation
<b>PORTUGAL</b>	In conjunction with irrigated areas avoid soil salinity and localised effects of soil waterlogging	Drainage facilities, both individual and collective, funded through on-farm investment programme (PRODER) although this is not specific to just drainage	Limits, but unspecified	Limits placed on drainage where it affects wetland conservation, and also environmental impacts assessments made for drainage projects prior to approval.

	Main policy objectives to encourage/discourage on-farm drainage <sup>1</sup>	Policies related to on-farm drainage		
		Support payments	Limits to support	Other policies
		Payments to assist drainage investment	Limits to support payments for drainage	Other policy instruments for drainage
<b>SLOVAK REPUBLIC</b>	Avoid soil waterlogging and flood control	Support for the renewal and maintenance of drainage facilities	No limits specified	The construction of major drainage infrastructure was stopped after 1990
<b>SPAIN</b>	No relevant policies			
<b>SWEDEN</b>	Land improvement	NONE		Limits placed on drainage where it affects wetland conservation
<b>SWITZERLAND</b>	Land improvement	Support for maintaining and upgrading drainage facilities	Limits, but unspecified	
<b>TURKEY</b>	Reduce soil waterlogging in irrigated areas.	Collective drainage facilities funded by the government provide benefits for farmers, and farmers play a role in maintaining the facilities.		Limits placed on drainage where it affects wetland conservation
<b>UNITED KINGDOM</b>	Flood control management	Support provided for flood management	Environmental conditions can limit funding	Limits placed on drainage where it affects wetland conservation

	Main policy objectives to encourage/discourage on-farm drainage <sup>1</sup>	Policies related to on-farm drainage		
		Support payments	Limits to support	Other policies
		Payments to assist drainage investment	Limits to support payments for drainage	Other policy instruments for drainage
<b>UNITED STATES</b>	Land improvement	Support for drainage installation costs	Limits up to USD 450 000 per farmer or property over a 5-year period, with payments between 50-75% of installation costs	Limits placed on drainage where it affects wetland conservation, in particular, through the Wetland Reserve Program and the Swampbuster provisions
<b>EU</b>	Within the context of the EU's Water Framework Directive support for drainage is possible (a fixed payment per hectare), but only in the context of taking into consideration environmental costs and benefits, such as on aquatic ecosystems.			

1. Drainage covers both sub-surface drainage and surface drainage in terms of open ditches, channels, etc.

Source: OECD Secretariat, 2009.

Table 3. Water resources, agriculture and environmental conservation of ecosystems

	Standards for minimum instream or ecological river flows	Policy objectives and instruments used for conservation of ecosystems associated with agriculture <sup>1</sup>			
		Policy objective	Support payment	Regulations	Other policy instruments
<b>AUSTRALIA</b>	Varies between jurisdictions, but mainly regulatory approach that places limits on quantities of surface water and groundwater that be diverted for other uses	Conservation of wetlands and other ecosystems	✓	✓	
<b>AUSTRIA</b>	Regulatory approach in compliance with the EU Water Framework Directive (WFD)	Conservation of wetlands, other ecosystems, and waterscapes	✓	✓	
<b>BELGIUM</b>	Targets for minimum flows not yet established	Conservation of aquatic ecosystems, waterscapes, flood protection and development of riparian buffers for pollution control	✓	✓	Land bank to facilitate land trade between farmers
<b>CANADA</b>	Varies between jurisdictions, but typically there are not set standards, as the science and knowledge is changing	Conservation of ecosystems, development of riparian buffers for pollution control, and promotion of cultural and aesthetic values	✓	✓	Property tax exemptions for landowners protecting wetlands. Limits for draining land in some Provinces where wetland conservation is a priority
<b>CZECH REPUBLIC</b>	✓	Conservation of ecosystems	✓	✓	Pollution charges
<b>DENMARK</b>	Standards exist for some rivers, and it expected more rivers will be subject to standards as the EU Water Framework is implemented	Conservation of ecosystems	✓	✓	



	Standards for minimum instream or ecological river flows	Policy objectives and instruments used for conservation of ecosystems associated with agriculture <sup>1</sup>			
		Policy objective	Support payment	Regulations	Other policy instruments
<b>FINLAND</b>	For most regulated rivers standards set, but not for 'natural' rivers (although some limits can be imposed on these rivers)	Conservation of wetlands, maintain ditches and restore natural water channels	✓	✓	Support for recreational value of aquatic ecosystems
<b>FRANCE</b>	Various standards are set: Low-Water Flow Standard (covers all water uses); Drought Flow Standards (below which triggers water restrictions).	Conservation of wetlands, other ecosystems, and waterscapes	✓	✓	Land tax exemption for land designated as wetland
<b>GERMANY</b>	Minimum flow standards vary across river basins, but this does not have implications for agricultural abstraction licenses	Conservation of wetlands and other ecosystems	✓	✓	
<b>GREECE</b>	Minimum flow standards linked to environmental impact assessment of major water abstraction activities	Conservation of wetlands and other ecosystems	✓	✓	
<b>HUNGARY</b>	No formal minimum standard is established, but ecological water flows are determined by the water management authorities	Conservation of extensive fish ponds, reed management in wetlands and other ecosystems	✓	✓	
<b>ICELAND</b>	Not available				
<b>IRELAND</b>	No standards apply	Conservation of wetlands, other ecosystems, waterscapes, and recreational fishing value of rivers	✓	✓	

	Standards for minimum instream or ecological river flows	Policy objectives and instruments used for conservation of ecosystems associated with agriculture <sup>1</sup>			
		Policy objective	Support payment	Regulations	Other policy instruments
<b>ITALY</b>	Minimum instream flow defined for all rivers, but values vary between river basins, but regulation can be suspended in times of drought	Conservation of wetlands, other ecosystems, and waterscapes.	✓	✓	
<b>JAPAN</b>	Minimum river flow defined for major river districts for all rivers	Conservation of wetlands, other ecosystems, waterscapes, and development of water purification and groundwater recharge capacity of paddy rice system.	✓	✓	
<b>KOREA</b>	River Law includes need for minimum flow rate for river maintenance, but there is no quantified standard	Conservation of wetlands, other ecosystems, and development of water purification and groundwater recharge capacity of paddy rice system.	✓	✓	
<b>LUXEMBOURG</b>	Not available				
<b>MEXICO</b>	There are no minimum ecological river flows, although since 2005 every new project requires assurance of providing for ecological flows	Conservation of wetlands	✓	✓	All new irrigation infrastructure projects require an environmental impact assessment
<b>NETHERLANDS</b>	No standards exist, but polders are subject to flushing during hot dry periods to prevent stagnant water	Conservation of wetlands and other ecosystems. Some waterboards pay farmers to store water on their land during periods of peak flows.	✓	✓	Pollution tax to protect aquatic ecosystems

	Standards for minimum instream or ecological river flows	Policy objectives and instruments used for conservation of ecosystems associated with agriculture <sup>1</sup>			
		Policy objective	Support payment	Regulations	Other policy instruments
<b>NEW ZEALAND</b>	No standards at present, but proposed National Environmental Standard for Ecological Flows and Water Levels(NES) will apply to all waterbodies, although standards will vary according to existing regional plans	Conservation of wetlands and other ecosystems.	✓	✓	
<b>NORWAY</b>	Minimum ecological flow standards exist for all major river systems, including rivers used for hydro-electric power. But for smaller rivers there are no standards.	Support is provided for assisting practices that benefit wetlands and ecosystems in farmed landscapes, and for establishing ponds and constructed wetlands	✓	✓	
<b>POLAND</b>	Minimum standards exist for rivers where major water storage or abstraction facilities exist.	Conservation of wetlands and other ecosystems.	✓	✓	Pollution tax to protect aquatic ecosystems
<b>PORTUGAL</b>	Minimum environmental flow is ensured for surface water and is part of licensing system for dams	Conservation of wetlands, other ecosystems, and cultural waterscapes, such as traditional extensive irrigation systems.	✓	✓	
<b>SLOVAK REPUBLIC</b>	Not available				
<b>SPAIN</b>	Minimum ecological flows are a requirement under the national water law. The river basin plans define specific requirements for ecological flow in certain parts of the river system.	Conservation of wetlands, other ecosystems, and cultural waterscapes, such as traditional extensive irrigation systems.	✓	✓	

	Standards for minimum instream or ecological river flows	Policy objectives and instruments used for conservation of ecosystems associated with agriculture <sup>1</sup>			
		Policy objective	Support payment	Regulations	Other policy instruments
<b>SWEDEN</b>	No standards exist, although in some drought prone regions unofficial standards can be legally enforced.	Conservation of wetlands, other ecosystems, and cultural waterscapes.	✓	✓	
<b>SWITZERLAND</b>	The Federal Water Protection Law requires minimum ecological flows.	Conservation of wetlands, other ecosystems, and cultural waterscapes	✓	✓	
<b>TURKEY</b>	No standards exist	Conservation of wetlands and other ecosystems, and conservation of historic sites prior to inundation by new reservoir projects		✓	
<b>UNITED KINGDOM</b>	Abstraction licences are set with reference to minimum flow standards.	Conservation of wetlands and other ecosystems.	✓	✓	
<b>UNITED STATES</b>	There is no Federal legislation but States have regulations for minimum instream flows, which vary in emphasis and specific requirements across States	Conservation of wetlands, other ecosystems, development of water purification and groundwater recharge capacity of agricultural land, and enhancement of aesthetic quality of waterbodies	✓	✓	Enforcement of the U.S. Endangered Species Act, to protect habitat for protected aquatic species.
<b>EU</b>	The EU Water Framework Directive will involve member states revising national legislation to seek an integrated and coordinated approach to water management, including “no deterioration” in ecological status of waterbodies by 2015		✓	✓	

For most countries national ecosystem conservation policies are also linked to meeting obligations under International Environmental Agreements (e.g. Ramsar Convention on Wetlands, UNESCO World Heritage Sites).

Source: OECD Secretariat, 2009.

**Table 4. Main tools used to guide water resource policy decision making in agriculture**

	Data collection and monitoring	Research, models and forecasting	Planning decision support systems
<b>AUSTRALIA</b>	Regular survey of irrigators. Water balance (volume)	Projections of climate change impacts on water resources	✓
<b>AUSTRIA</b>	Network of monitoring sites to measure surface water flows and groundwater tables	Projections of climate change impacts on water resources	✓
<b>BELGIUM</b>	Monitoring groundwater levels and collection of data from metered agricultural water use	Groundwater availability modelling. Research on different water application technologies; and research on use of alternatives to groundwater and drinking water in agricultural practices (which alternatives can be used for which practices).	✓
<b>CANADA</b>	Federal and Provincial governments use streamflow monitoring and numerous other databases.	Federal drought reporting, mapping and forecasting	Planning process includes public consultation at all levels of government to examine water programmes, targets, etc.
<b>CZECH REPUBLIC</b>	Seasonal and inter-annual precipitation monitoring	Research focus on quantifying future climate change impacts on agriculture, including water resources	✓
<b>DENMARK</b>	Water balances usually collected by farmers	Projects to begin on the impact of climate change on agriculture	
<b>FINLAND</b>	Water quantity monitoring data	Real time flood forecasts; numerical models of water quantity flows; and research on water technology application in agriculture	✓

	<b>Data collection and monitoring</b>	<b>Research, models and forecasting</b>	<b>Planning decision support systems</b>
<b>FRANCE</b>	Monitoring soil-moisture tension, and use of farm surveys. Water balance usually every 10 days. Some data collection and monitoring are done at the farm level; some are done at government level.	Modelling rotation and water input potential for irrigable land, and complex hydrological national models to serve possible changes to water licenses	✓
<b>GERMANY</b>	Collection of data from metered agricultural water use		✓
<b>GREECE</b>	Seasonal and inter-annual water balances	Projections and hydro-geological studies, and models of aquifer recharge	
<b>HUNGARY</b>		A National Climate Change Programme for next 2 years is being prepared	
<b>ICELAND</b>	Not available		
<b>ITALY</b>	Information support system for water management in agriculture (SIGRIA). Agro-hydrological balance model	Decision Support System (MEGRIA) to assist planning choices and management activities for water use in agriculture	✓
<b>JAPAN</b>	Monitoring of precipitation and agricultural demand volume at each intake point in the reference year	River administrator permits water rights and volume of water for each agricultural area based on monitoring data, with renewal of rights assessed every 10 years	
<b>KOREA</b>		Modelling of water demand projections, as part of Long Term Integrated Water Resource Plan (LTIWRP)	10 year LTIWRP renewed every 5 years
<b>LUXEMBOURG</b>	Not available		

	<b>Data collection and monitoring</b>	<b>Research, models and forecasting</b>	<b>Planning decision support systems</b>
<b>MEXICO</b>	Collection of physical and monetary data on hydrological balances and on irrigation districts by National Commission of Water (CONAGUA)	Impact evaluation of some irrigation programmes	✓
<b>NETHERLANDS</b>	Water balance (volume terms)	Modelling of flood impacts	In times of shortage of supply for main rivers a planning process is undertaken
<b>NEW ZEALAND</b>	Water budgeting for some farm sectors	Modelling of crop specific water needs.	Development of water resource connecting national plans to regional and district plans
<b>NORWAY</b>	Soil survey and soil mapping, and water pollution monitoring		
<b>POLAND</b>	Seasonal and inter-annual water balances	Projections of annual and multiannual plans and investment needs	
<b>PORTUGAL</b>	National water monitoring network	Use of models and projections	✓
<b>SLOVAK REPUBLIC</b>	Not available		
<b>SPAIN</b>	Surveys of irrigators. Water balance	Analysis, water use efficiency calculations, and projections to help policy makers and irrigators	✓
<b>SWEDEN</b>	National water monitoring network	Analysis and assessment undertaken by different government agencies	✓
<b>SWITZERLAND</b>	Water balance	Projections of water demands by irrigated agriculture and impacts of climate change	

	<b>Data collection and monitoring</b>	<b>Research, models and forecasting</b>	<b>Planning decision support systems</b>
<b>TURKEY</b>	Water balance	Analysis of agricultural water demand, and environmental impact assessments of irrigation projects.	✓
<b>UNITED KINGDOM</b>	Metered agricultural water use	Environment Agency conducts analysis of water use, and projections over 25 years	✓
<b>UNITED STATES</b>	Extensive monitoring of water by various government agencies, for example, the Geological Survey's 5 yearly report on water use in the US. Also farm surveys are conducted of irrigators' water use and management practice, such as the Department of Agriculture's Farm and Ranch Irrigation Survey. Additional data/information collection is provided by the National Water Quality Inventory Report (the "Section 305" reports), which guide the Environmental Protection Agency's water quality decisions, and the "Section 404" permit process and background data collected by the U.S. Army Corps of Engineers, which guide wetlands policy (both "sections" refer to titles of the Clean Water Act).	Different Federal agencies provide research and analysis to assist water policy makers and users, for example, the Bureau of Reclamation's Evapotranspiration Toolbox, which links GIS land use data to crops, irrigated areas and rainfall data.	Various government agencies provide decision support systems and data for water managers and users, for example, the Bureau of Reclamation's Agricultural Water Resources Decision Support



	<b>Data collection and monitoring</b>	<b>Research, models and forecasting</b>	<b>Planning decision support systems</b>
<b>EU</b>	Some monitoring functions conducted by Eurostat (EU statistical office), and the European Environment Agency (EEA). Member States had to establish a water monitoring network under the Water Framework Directive by 2006.	Analysis and projections of water use across the EU by variously the Eurostat, the EEA and the Joint Research Centre (EU science research centre)	Enforcement through the EU Commission of the Water Framework Directive

Source: OECD Secretariat, 2009.

**Table 5. Institutional Organisation for Water Governance<sup>1</sup> as it Relates to the Agricultural Sector**

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>AUSTRALIA</b>	Promotion of water reform through <i>National Water Initiative</i>	Regulation, planning and allocation of water resources	Management of water quality	Irrigation trusts and private businesses, distribute and deliver bulk water entitlement; and provide and maintain water infrastructure
<b>AUSTRIA<sup>2</sup></b>	<i>Water Act</i> oversees water management policies	Legal powers are rather limited at this level ( <i>Länder</i> ), instead act on behalf of national government	Management in terms of political units rather than water basin and includes authorisation of licences, etc.	Some cooperative association of farmers provide for flood protection, abstractions for irrigation, water treatment, etc
<b>BELGIUM<sup>2</sup></b>	None, other than EU <i>Water Framework Directive</i>	Groundwater policies and navigable rivers managed by regional governments. Un-navigable rivers and channels are managed by regional government, municipalities and polder authorities.		For un-navigable rivers use right for riparian owners with sometimes permits from the municipalities or polder authorities.
<b>CANADA</b>	Main concern with environmental protection of water resources and transboundary issues (US)	Primary authority for management of water resources	Some water planning and management	Local water user groups (e.g. rural water cooperative) typically set rates and regulations for water supply services provided to farms.
<b>CZECH REPUBLIC<sup>2</sup></b>	<i>Water Act</i> provides overarching strategy	Regional and local government manage water rights		

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>DENMARK<sup>2</sup></b>	Co-ordination across national Ministries, and coordination with municipalities	Water management, inspection and control by local municipalities		Different water groups and farmer unions participate in water administration
<b>FINLAND<sup>2</sup></b>	<i>Water Resources Strategy</i> sets the goals: ministries and other national authorities are responsible for water legislation, planning, monitoring, research, management and performance guidance	Regional Environment Centres responsible for promoting water services, flood prevention, water management and regulation	Municipal authorities are responsible for providing water services and promote environmental protection locally. Regional authorities grant/enforce environmental permits and financial support.	Users apply environmental and water use permits. In rural areas, households or co-operatives provide water services. Territorial waters are generally jointly owned by landowners.
<b>FRANCE<sup>2</sup></b>	Co-ordination across national Ministries, Committees, etc., and control of regulatory arrangements	Enforcement of water policy and regulations at <i>Département</i> level	Catchment Area Committees represent water stakeholders, and adopt local management schemes.	Farmers grouped into joint irrigation structures for management of joint irrigation infrastructure
<b>GERMANY<sup>2</sup></b>	Federal Water Act provide overall policy framework	Performance responsibility ( <i>Länder</i> )	Under EU Water Framework Directive River Basin Plans will require changes to existing legislation	

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>GREECE<sup>2</sup></b>	Central Water Directorate coordinates across national Ministries, Agencies, etc., and implements policies	13 Regional Directorates of Water implement national policies, and mainly finance irrigation infrastructure	River Basin Districts manage water allocation, collect farmers fees and manage collective facilities.	
<b>HUNGARY<sup>2</sup></b>	Water Management Acts governs water rights and regulations	Water users require a license from the Regional Inspectorate for Environmental Protection		
<b>ICELAND</b>	Not available			
<b>IRELAND<sup>2</sup></b>	Water Services Act provides for supervision of rural water supplies and conservation	The Rural Water Programme, for smaller schemes that supply water locally, devolves responsibility to County Councils.		

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>ITALY<sup>2</sup></b>	Programming of national funding for irrigation within several Ministries (mainly Agriculture, Environment, Infrastructures).	Link with 18 Inter-Regional River Basin Authorities (RBAs), with responsibility for irrigation planning, and management	11 River Basin Authorities, linked to regional RBAs.	Public and private local agencies for water management (Land Reclamation Consortia)
<b>JAPAN</b>	River Act provides overarching classification and management of rivers. Responsibilities for water management, especially large facilities (dams, reservoirs). These facilities are under public ownership.	Prefectures and Municipalities have responsibilities for managing medium to large facilities (dams, large headworks, canals)	Water rights usually permitted at the level of one of the 6 000 Land Improvement Districts	

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>KOREA</b>	Responsibilities for water management, especially large facilities (dams, reservoirs) split between several Ministries (mainly Agriculture, Environment, Land, Construction), while River Law and Civil Law govern water rights.	The semi-public Korea Rural Community Corporation (KRC) operate and manage irrigation facilities over 50 ha, and in 2005 managed around two-thirds of the total irrigated area.		Irrigation Associations (farmer groups with under 50 ha of irrigated land) are under the supervision of the local government, and covered nearly 20% of the total irrigated area in 2005.
<b>LUXEMBOURG<sup>2</sup></b>	Not available			
<b>MEXICO</b>	Overall management and planning under the Water Law guided by the National Water Commission (CONAGUA), with involvement of other Federal Ministries (mainly Agriculture, Environment and Irrigation Agency)	National Water Commission devolve water management to 85 Irrigation Water Basin Districts located in 30 States, with main responsibility to manage and operate irrigation infrastructure, and cooperate with local Water User Associations		Nearly 500 Water User Associations control water delivery to cooperatives and farmers.

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>NETHERLANDS<sup>2</sup></b>	Bureau of Water Management (Rijkswaterstaat) operates under the Ministry of Transport and Water Management, and has overall responsibility for water management, with particular focus on flood control	Provincial ranking of water supply for several land uses in times of shortage, and authority to restrict water withdrawals in times of shortage.	Water boards are responsible for the inlet and outlet of surface water	
<b>NEW ZEALAND</b>	Resource Management Act (RMA) is the key legislation governing water management	Regional and unitary councils are responsible for making decisions on the allocation and use of water within their boundaries, under the overall guidance of the RMA.	Water user groups have autonomy to allocate water among themselves	
<b>NORWAY</b>	Not available			
<b>POLAND<sup>2</sup></b>	Water Law provides guidance for use of aquatic resources and their conservation, managed through several Ministries (mainly Agriculture, Environment, and National Water Authority)	Land and water improvement decisions is devolved to 7 Regional Water Management Boards	17 sub-basin 'Voivodeship' Offices have management responsibility for water resources	Water delivery through water companies or by individual farmers.
<b>PORTUGAL<sup>2</sup></b>	The National Institute of Water (INAG) has responsibility for water management	River Basin Districts (ARH) cover several river basins and grant water use entitlements and have responsibilities for the management and financial control of irrigation areas.	Managers of public irrigation companies ensure daily management of water supply to farmers	

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>SLOVAK REP.<sup>2</sup></b>	Not available			
<b>SPAIN<sup>2</sup></b>	The Water Law and National Hydrological Plans provide policy framework for water management and planning	The responsibilities for water resources planning and management in river basins located within one region lie with regional government. River basins which run through several regions are managed by river basin bodies under the authority of the national government.		
<b>SWEDEN<sup>2</sup></b>	Environmental Code provides policy framework for water management.	County Boards perform inspection and management functions under Environmental Code	5 Environmental Courts responsible for providing water use permits across river basins	Voluntary involvement of water users in policy process
<b>SWITZERLAND</b>	The Confederation has the competence to issue specific regulations through the Water Protection Law (e.g. water abstractions, minimum river flow requirements).	Cantons, and communities within Cantons, have the main responsibility for management and can confer water rights, entitlements, and authorizations to use and abstract water resources.		
<b>TURKEY</b>	Overall operation and maintenance of irrigation networks is the responsibility of the General Directorate of State Hydraulic Works (DSI)	Water User Organisations are responsible for water delivery to farmers and managing irrigation finance.		



Level of Governance:	National	Province/State	Water Basin	Water Users
<b>UNITED KINGDOM<sup>2</sup></b>	Overall policy and regulation set under the Water Act and Water Industry Act, which set out the responsibilities of the water regulator, the Environment Agency	Responsibility for water regulation and policy implementation is devolved to England and Wales, Scotland and Northern Ireland	Regional Offices of the Environment Agency have management control at the level of river basins	
<b>UNITED STATES</b>	Water resource management is essentially managed at the State level, except some large-scale irrigation projects. Federal agencies provide technical and financial assistance to improve water use efficiency	Most water allocation decisions made at State level or districts within States. Few States have coordinated surface water and groundwater regulation.	Water management is often at district administrative level rather than water basin.	Some local entities have responsibility for water management.

Level of Governance:	National	Province/State	Water Basin	Water Users
<b>EUROPEAN UNION</b>	EU Water Framework Directive (WFD) came into force December 2000, with most Member States transposing the Directive into national law by 2003 and 2004	WFD applies across all EU Member States and covers surface water, groundwater, estuaries, coastal water (out to 2km), and also related aquatic ecosystems		Under the WFD water management is based on a river basin approach, including objectives for: ecological status, quantitative status, chemical status, and protected area objective. See also Table 1 for the schedule of the implementation of the EU Water Framework Directive

1. Unless otherwise stated water governance covers surface water and groundwater.
2. For EU Member countries their national water policies are implemented with regard to compliance with the broader EU wide Water Framework Directive, see entry for EU.

Source: OECD Secretariat, 2009.

Table 6. Water Rights as they apply to the Agricultural Sector

	Surface Water	Groundwater
<b>AUSTRALIA</b>	Water rights differ between States, but in the main water rights are split into a water entitlement, a delivery rights and a site use approval which provides for a specific use of water at a particular location. The entitlement is a general right to access a certain maximum volume of water annually, is issued in perpetuity and can be traded within or between irrigation areas/States.	Water rights regimes generally less developed with sometimes landholders requiring minimal or no licensing to access water. Some states have more advanced regimes involving water entitlement licensees (which might only be issued for 5-10 year periods), annual allocations, and trading.
<b>AUSTRIA</b>	Under Water Act water resources are strongly regulated irrespective of public or private ownership, and authorization for water abstraction is issued at district level.	Usually water rights are exclusively with landholders, with authorisation for water abstraction issued at the district level.
<b>BELGIUM</b>	For navigable rivers, abstraction is unlicensed or licensed (depending on the quantity). For un-navigable rivers use right for riparian owners, others need in some cases a permit from the municipality or polder authority.	Unlicensed, or licences for use issued by province and local councils (depending on quantity).
<b>CANADA</b>	Prior allocation system used for water licensing, i.e. a licensee acquires rights to water from the first time that owner puts water to some use (except in one Province where it is unregulated). In some Provinces a riparian rights system operates. Most Provinces have thresholds over which licences are required for use.	
<b>CZECH REPUBLIC</b>	Rights owned by the State, and permission for use of water issued by regional and local government	
<b>DENMARK</b>	Private property rights	
<b>FINLAND</b>	Under Water Act water permits needed for all water using activities as water is a common property (over minimum threshold)	
<b>FRANCE</b>	Authorisation for abstraction is issued by the <i>Préfets</i> (state representatives at the “ <i>département</i> ” level) after an impact assessment has been made, and can be limited or revoked in situations of water shortage.	
<b>GERMANY</b>	As water is a public good users require a time limited licence	
<b>GREECE</b>	A system of use rights and licences.	
<b>HUNGARY</b>	Under Water Management Act water licences needed for all water using activities, and approval for building any irrigation infrastructure	
<b>ICELAND</b>	Not available	
<b>IRELAND</b>	Public owned rights, water users require an abstraction licence	

	Surface Water	Groundwater
<b>ITALY</b>	System of licences for water withdrawals	
<b>JAPAN</b>	River Administrator authorizes use rights	Right belongs to the landowner, although in designated areas central and local government regulations restrict exploitation
<b>KOREA</b>	Customary use right under the Civil Law, based on licences under the River Law (Provided by Ministry of Land). The Korea Rural Community Corporation (KRC) manages the water rights of farmers, for non-KRC farmers the rights belong directly to the farmer	Licences provided by Ministry of Land, and KRC manages the water rights of farmers, for non-KRC farmers the rights belong directly to the farmer
<b>LUXEMBOURG</b>	Not available	
<b>MEXICO</b>	Water rights for surface and groundwater are allocated by the National Water Commission.	
<b>NETHERLANDS</b>	Water withdrawals require a licence, but individual farmers have historical rights to extract water (up to a certain threshold for groundwater).	
<b>NEW ZEALAND</b>	Under the Resource Management Act water users require a permit or consent (limited use right), excluding water used for drinking or livestock. Water permits may contain a number of conditions (e.g. volumetric controls, land titles, location of use).	
<b>NORWAY</b>	Not available	
<b>POLAND</b>	Permits required from sub-basin 'Voivodeship' for withdrawals as surface water is in public ownership.	Groundwater is also under public ownership, but land owner is entitled to 'normal' use within their property.
<b>PORTUGAL</b>	River Basin Districts (ARH) issue use rights	River Basin Districts (ARH) issue licences
<b>SLOVAK REPUBLIC</b>	Not available	
<b>SPAIN</b>	The competent authority issues entitlement and use rights.	
<b>SWEDEN</b>	Private property rights	
<b>SWITZERLAND</b>	The Cantons and communities have sovereignty on water abstract rights and in dry periods can limit or prohibit abstractions. The use of permits will vary depending on whether the irrigation installations are fixed or mobile.	
<b>TURKEY</b>	General Directorate of State Hydraulic Works (DSI) with Water User Associations determines use licences and quantity of irrigation water allocated.	

	Surface Water	Groundwater
<b>UNITED KINGDOM</b>	Water abstraction licence for quantities above 20m <sup>3</sup> /day. Licence usually for 12 years and carries with it environmental conditions. The Environment Agency considers the impact the licence has on other users and the environment	Same as for surface water, but requires a consent from Environment Agency before pumping licence is granted.
<b>UNITED STATES</b>	Water rights systems are State laws, except for Federal reserved rights. Essentially, water allocations are governed by riparian rights, which mainly apply to the 29 eastern “wet” states, with land ownership along a waterway determining the right to use that water. Water use may be subject to regulations in times of shortage. In western states, however, they typically rely on a prior appropriation system, where the date of first appropriation of water from a river establishes a user’s priority (“seniority”) over the water. Where appropriative water rights systems exist, water rights are generally independent from land ownership and may be sold or transferred. In times of shortage, “senior” rights have priority over “junior” rights to the use of water. Non-use may result in loss of rights. Some states have a mixture of both riparian rights and appropriative rights systems.	There is no national set of groundwater rights, and few states have co-ordinated surface water and groundwater user right systems. Typically the rule of capture has given landowners the right to extract from an aquifer beneath their property. Most groundwater is withdrawn under a permit system. The permit may not be binding, but when well interference becomes an issue, the permits guide well spacing and may limit withdrawals. Where groundwater is being over-extracted, some states and municipalities have brought in regulations to limit private extraction.
<b>EU</b>	Water rights system reflects national legislation of each Member State	

Source: OECD Secretariat, 2009.

Table 7. Ownership of water allocation entitlements in the agricultural sector

	Surface water			Groundwater			Comments
	Farmer	Water Supplier <sup>1</sup>	Mix <sup>2</sup>	Farmer	Water Supplier <sup>1</sup>	Mix <sup>2</sup>	
<b>AUSTRALIA</b>			✓	✓			For surface water a mix of water right ownership patterns across States, but Policy Reforms are moving toward individually held water entitlements.
<b>AUSTRIA</b>			✓	✓			For surface water authorization to abstract water is regulated
<b>BELGIUM</b>			✓			✓	Abstraction licenses can be granted to farmers or to other suppliers.
<b>CANADA</b>		✓		✓			Generally water entitlements are issued by provinces to individuals or recognised water suppliers (private and public)
<b>CZECH REP.</b>	✓			✓			Farmers apply for water use permission, as there are no water companies.
<b>DENMARK</b>	✓					✓	Permits required for water abstractions
<b>FINLAND</b>			✓			✓	Both landowner and other users have equal rights to use water
<b>FRANCE</b>			✓			✓	Abstraction licenses can be granted to farmer or other suppliers
<b>GERMANY</b>			✓			✓	Abstraction licenses can be granted to farmer or other suppliers
<b>GREECE</b>	✓			✓			Use right to individual farmer
<b>HUNGARY</b>			✓			✓	Both landowner and other users have equal rights to use water
<b>ICELAND</b>							Not available
<b>IRELAND</b>		✓			✓		Public owned water rights
<b>ITALY</b>			✓			✓	Nationally about 50% of the irrigated area makes use of water supplied by water companies (mostly public, but some private), with the other 50% directly supplied by farmers.
<b>JAPAN</b>		✓		✓			Water rights for surface water are usually allocated to Land Improvement Districts, not individual farmers. Water rights concerning groundwater use belong to the land-ownership right.

	Surface water			Groundwater			Comments
	Farmer	Water Supplier <sup>1</sup>	Mix <sup>2</sup>	Farmer	Water Supplier <sup>1</sup>	Mix <sup>2</sup>	
<b>KOREA</b>			✓			✓	The Korea Rural Community Corporation (KRC) manages over two-thirds of irrigated area, remainder by farmers.
<b>LUXEMBOURG</b>							Not available
<b>MEXICO</b>		✓			✓		National Water Commission allocates water rights.
<b>NETHERLANDS</b>	✓			✓			Occasionally water boards deliver water to a group of farmers
<b>NEW ZEALAND</b>			✓			✓	Ownership depends on who applies for water consent (permit) (i.e. regional council, individual farmer or irrigation supply company).
<b>NORWAY</b>							Not available
<b>POLAND</b>			✓			✓	Rights of abstraction and supply of water for irrigation are granted to both individual farmers and water supply companies.
<b>PORTUGAL</b>			✓			✓	River Basin Districts (ARH) grants use licences for a given quantity of water over a certain period of time to individual land owners or public and private water supply companies.
<b>SLOVAK REP.</b>							Not available
<b>SPAIN</b>	✓			✓			Usually, water ownership in agriculture is with farmers. Only on the Canary Islands and in the case of non-conventional resources (desalinated seawater and recycled wastewater) can ownership be with water supply companies.
<b>SWEDEN</b>			✓			✓	Water use permits are allocated to individual farmers or a private company
<b>SWITZERLAND</b>	✓			✓			Usually ownership is by individual farmers, but it is possible for water companies to supply water.
<b>TURKEY</b>		✓			✓		Water only allocated to water supply companies and Water User Associations not individual farmers
<b>UNITED KINGDOM</b>			✓			✓	Water supply companies supply water for all purposes not just irrigation

	Surface water			Groundwater			Comments
	Farmer	Water Supplier <sup>1</sup>	Mix <sup>2</sup>	Farmer	Water Supplier <sup>1</sup>	Mix <sup>2</sup>	
<b>UNITED STATES</b>			✓			✓	In general water entitlements are allocated to individual farmers, but this not always the case where Federal or State entities allocate water to irrigation water supply companies. In these cases the ability of farmers to participate in a water market might be limited to transactions among irrigators within the same irrigation district.
<b>EU</b>	Water rights system reflects national legislation of each Member State						

1. Water supplier usually involves a water supply company, which might be owned publicly or privately, such as a cooperative of farmers.

2. 'Mix', means here a mixture of water entitlement ownership involving in some sub-national regions farmers and others water suppliers.

Source: OECD Secretariat, 2009.



**Table 8. Separation of water from land entitlements in the agricultural sector**

	Surface water and Groundwater		Comments
	No	Yes	
<b>AUSTRALIA</b>		✓	Most surface water entitlements separated from land and can be traded. For most States groundwater rights have been separated to the extent that water can be traded between properties using the same aquifer.
<b>AUSTRIA</b>	✓		Surface water abstraction only possible with government authorization and no water markets or trading. Groundwater is the property of the landowner
<b>BELGIUM</b>		✓	Surface water abstraction from navigable rivers is unlicensed or licensed (depending on quantity). For un-navigable rivers there is the use right for riparian owners, while others need in some cases a permit from the municipality or polder authority. Groundwater extraction is only possible through a license system.
<b>CANADA</b>	✓		Licences typically attached to a parcel of land, except in one Province, although it is possible for transfers of water between owners within an irrigation district.
<b>CZECH REPUBLIC</b>		✓	All producers can apply for permission to use water
<b>DENMARK</b>		✓	Anyone can extract water with a licence
<b>FINLAND</b>		✓	Anyone can extract water (with a permit) but land owner has primary entitlement
<b>FRANCE</b>		✓	Farmers must obtain a licence to use water, and government can revoke water right.
<b>GERMANY</b>		✓	Right of access to the point of abstraction may be required
<b>GREECE</b>		✓	Anyone can extract water (with a licence) but land owner has primary entitlement
<b>HUNGARY</b>		✓	Anyone can extract water with a licence
<b>ICELAND</b>			Not available
<b>IRELAND</b>		✓	Public owned water rights
<b>ITALY</b>		✓	Mix of private and public owned water rights
<b>JAPAN</b>	✓		River Administrator permits surface water rights based on farmland. The water rights concerning groundwater use belong to the landownership right.
<b>KOREA</b>		✓	Public owned water rights, for two-thirds of the irrigated area
<b>LUXEMBOURG</b>			Not available
<b>MEXICO</b>		✓	Land rights are in perpetuity, are bound for a specified time to grant titles to surface water irrigation.
<b>NETHERLANDS</b>		✓	Mix of public and privately owned water rights
<b>NEW ZEALAND</b>		✓	Water entitlement (permit of consent) usually registered against a particular property title.
<b>NORWAY</b>			Not available

	Surface water and Groundwater		Comments
	No	Yes	
<b>POLAND</b>		✓	Only the right to 'normal' use combines with land use rights.
<b>PORTUGAL</b>	✓		Landownership cannot be separated from existing water rights, and water rights cannot be traded
<b>SLOVAK REPUBLIC</b>			Not available
<b>SPAIN</b>	✓		Existing water rights are attached to land ownership. Water rights cannot be traded, but can be transferred under certain conditions, with the approval of the competent authority.
<b>SWEDEN</b>		✓	You do not have to own land where the water is abstracted, but right of access is necessary from landowner or enforced by Environmental Court
<b>SWITZERLAND</b>	✓		Water rights in areas with traditional irrigation are usually connected to the irrigated parcel of land.
<b>TURKEY</b>		✓	Public owned water rights
<b>UNITED KINGDOM</b>		✓	The ownership of land is not a precondition to obtain an abstraction licence, but right of access to the point of abstraction is required
<b>UNITED STATES</b>	Mixed system exists.		Where riparian water rights apply the water right is usually tied to the land, and it is forbidden to transfer water right to non-riparian lands, except in a few cases. Where appropriative water right systems exists water rights are independent from land ownership, with these rights, unlike riparian rights, in general sold or transferred, and long-term storage is permissible and common, although non-use may result in right being loss.
<b>EU</b>	Water rights system reflects national legislation of each Member State		

Source: OECD Secretariat, 2009.

Table 9. Policy instruments used to encourage improvements in on-farm water use efficiency

	Subsidies	Water supply cost recovery	Taxes	Farm advice, research	Comments and Other Policy Instruments
<b>AUSTRALIA</b>	✓	✓		✓	Subsidies mainly cover upgrades of on-farm irrigation equipment and major irrigation infrastructure projects. States undertake some on-farm extension services, but these are generally provided by private sector.
<b>AUSTRIA</b>	✓	✓		✓	Benchmarking is used among water suppliers to limit losses in distributional channels
<b>BELGIUM</b>	✓		✓	✓	Fees paid to regional governments for extraction from surface water from navigable rivers and groundwater, plus a water pollution tax. Using the Rural Development Programme to fund the capture and use of rainwater.
<b>CANADA</b>	✓			✓	Provinces usually develop overarching water strategies to improve water efficiency, e.g. set targets
<b>CZECH REPUBLIC</b>	✓	✓		✓	
<b>DENMARK</b>			✓		Green tax on water to encourage more efficient groundwater use
<b>FINLAND</b>	✓			✓	
<b>FRANCE</b>	✓	✓	✓	✓	Support for both water saving technologies and under agri-environmental measures to reduce area of irrigation.
<b>GERMANY</b>	✓	✓	✓	✓	Abstraction charges over minimum threshold. Pollution taxes are applied
<b>GREECE</b>	✓			✓	Studies underway to examine implementing water supply cost recovery
<b>HUNGARY</b>	✓	✓		✓	Subsidies for construction and renewal of irrigation infrastructure is conditional on meeting energy saving criteria
<b>ICELAND</b>					Not available
<b>IRELAND</b>					Water Conservation Allocations scheme allows Councils to plan their water supplies.
<b>ITALY</b>	✓			✓	Limited support for new irrigated areas, and improvement in water use efficiency in other irrigation districts
<b>JAPAN</b>	✓	✓		✓	

	Subsidies	Water supply cost recovery	Taxes	Farm advice, research	Comments and Other Policy Instruments
<b>KOREA</b>	✓	✓		✓	Farmers operating under the Korean Rural Community Corporation (KRC) are exempt from water supply cost recovery charges, excluding labour costs.
<b>LUXEMBOURG</b>					Not available
<b>MEXICO</b>	✓	✓		✓	Support provided, up to 50% of total investment costs to improve water use efficiency, plus training for farmers to improve irrigation skills.
<b>NETHERLANDS</b>		✓		✓	Some Provinces allow groundwater withdrawals only on condition that farm has a water plan
<b>NEW ZEALAND</b>				✓	Development of industry codes of practice, such as for irrigation design and use.
<b>NORWAY</b>				✓	
<b>POLAND</b>	✓	✓		✓	Support provided for construction of small-scale irrigation, upgrading existing irrigation facilities, and installations for rainwater storage.
<b>PORTUGAL</b>	✓	✓		✓	Recovery of supply costs of water is being implemented. National drought warning system has been developed.
<b>SLOVAK REPUBLIC</b>					Not available
<b>SPAIN</b>	✓	✓		✓	Support for upgrading irrigation infrastructure, and increasing water storage capacity
<b>SWEDEN</b>		✓		✓	Support is provided for irrigation ponds where they provide an environmental amenity value but not to promote water use efficiency
<b>SWITZERLAND</b>		✓		✓	Upgrading irrigation facilities
<b>TURKEY</b>	✓	✓		✓	Farm advisory services during drought periods advise farmers which low water demanding crops to cultivate.

	Subsidies	Water supply cost recovery	Taxes	Farm advice, research	Comments and Other Policy Instruments
<b>UNITED KINGDOM</b>	✓	✓		✓	Support for adoption of water use efficient technologies is also provided to encourage energy saving in use of technologies
<b>UNITED STATES</b>	✓	✓		✓	Policy instruments to encourage improvements in water use efficiency are embedded in a range of environmental conservation programmes
<b>EU</b>	Water pricing policies will be introduced by 2010 under the Water Framework Directive				

Source: OECD Secretariat, 2009.

**Table 10. Surface Water and Groundwater: Cost recovery and water charging instruments for water deliveries to the agricultural sector**

	Surface water from a service provider: Cost recovery <sup>1</sup>			Surface water from a service provider: Type of water charging instrument		Regulation and charging system for groundwater supplied by water service provider <sup>4</sup>
	Operation and maintenance (O&M)	Capital costs <sup>2</sup>	Other costs <sup>3</sup>	Mixed system of fixed charge and a variable volumetric charge	Per hectare (flat rate) water charge	
<b>AUSTRALIA</b>	Nearly all water basins cover O&M costs, some share of renewal & new capital costs, and environmental externality costs, and by 2010 some States expect to reach full cost recovery (e.g. New South Wales)			✓	✓	% of planning and management costs
<b>AUSTRIA</b>	100%	100%		✓		Usually water rights are exclusively with landholders, the authorisation for water abstraction is issued at the district level.
<b>BELGIUM</b>				Navigable rivers: fixed charge and a volumetric charge above a threshold of 500cm <sup>3</sup> /year. Un-navigable rivers: free of extraction charge. All water: pollution tax fee/m <sup>3</sup>		Fixed charge or volumetric charge above a threshold of 500cm <sup>3</sup> /year Price varies according to the aquifer/pollution tax fee/m <sup>3</sup> .
<b>CANADA</b>	100%	⅔ of total costs			✓	

	Surface water from a service provider: Cost recovery <sup>1</sup>			Surface water from a service provider: Type of water charging instrument		Regulation and charging system for groundwater supplied by water service provider <sup>4</sup>
	Operation and maintenance (O&M)	Capital costs <sup>2</sup>	Other costs <sup>3</sup>	Mixed system of fixed charge and a variable volumetric charge	Per hectare (flat rate) water charge	
<b>CZECH REP.</b>				Fixed charge and a volumetric charge above a threshold level		
<b>DENMARK</b>	100%	100%		Not applicable		
<b>FINLAND</b>	100% of O&M and capital costs as irrigation system farmer operated			✓		Fixed fee and volumetric charge
<b>FRANCE</b>	100%	15% -95% of total capital costs depending on the water basin		In 2005 71% of farms and 85% of irrigated area equipped with volumetric devices.	Flat rate for gravity fed irrigation systems	Volumetric charge with metering now mandatory.
<b>GERMANY</b>				✓		Fixed fee and volumetric charge.
<b>GREECE</b>	The average level of full cost recovery (O&M, capital costs, environmental and resource (opportunity) costs) in 2007 was 22% for agriculture and 57% for all water users.				✓	Volumetric charge
<b>HUNGARY</b>	Unspecified % of O&M costs	Unspecified % of capital costs	Under evaluation	✓	✓	Fixed fee and volumetric charge
<b>ICELAND</b>	Not available					

	Surface water from a service provider: Cost recovery <sup>1</sup>			Surface water from a service provider: Type of water charging instrument		Regulation and charging system for groundwater supplied by water service provider <sup>4</sup>
	Operation and maintenance (O&M)	Capital costs <sup>2</sup>	Other costs <sup>3</sup>	Mixed system of fixed charge and a variable volumetric charge	Per hectare (flat rate) water charge	
<b>IRELAND</b>	Unspecified % of O&M costs	Unspecified % of capital costs		✓		Fixed fee and volumetric charge
<b>ITALY</b>	20% - 30% of O&M and capital costs in the South and 50% - 80% in the North			✓	✓	Permit required for groundwater use
<b>JAPAN</b>	100%	Unspecified % of capital costs		Less than 1% of the 6000 Land Improvement Districts use volumetric charges	✓	No charge
<b>KOREA</b>	0% for those irrigators within the Korea Rural Community Corporation (KRC) government operated districts (about ⅓ of the irrigated area) and 35% of O&M costs for other irrigators					No charge
<b>LUXEMBOURG</b>	Not available					



	Surface water from a service provider: Cost recovery <sup>1</sup>			Surface water from a service provider: Type of water charging instrument		Regulation and charging system for groundwater supplied by water service provider <sup>4</sup>
	Operation and maintenance (O&M)	Capital costs <sup>2</sup>	Other costs <sup>3</sup>	Mixed system of fixed charge and a variable volumetric charge	Per hectare (flat rate) water charge	
<b>MEXICO</b>	60% of O&M and capital costs on average and 80% in the most technically advanced irrigation districts			✓		
<b>NETHERLANDS</b>	Unspecified % of O&M costs	Unspecified % of capital costs			✓	Volumetric charge
<b>NEW ZEALAND</b>	100%	100%				Permit required for groundwater use
<b>NORWAY</b>	100%	100%		Volumetric charge		
<b>POLAND</b>	Unspecified % of O&M costs	Unspecified % of capital costs		✓	✓	Volumetric charge
<b>PORTUGAL</b>	In 2002 agriculture covered 23% of O&M and capital costs compared to 82% for urban users		From 2008 a Water Resources Tax to cover economic and environmental externalities	✓	✓	Fixed fee and volumetric charge
<b>SLOVAK REP.</b>	Not available					
<b>SPAIN</b>	90% costs	Unspecified % of capital costs		✓	✓	Fixed fee and volumetric charge

	Surface water from a service provider: Cost recovery <sup>1</sup>			Surface water from a service provider: Type of water charging instrument		Regulation and charging system for groundwater supplied by water service provider <sup>4</sup>
	Operation and maintenance (O&M)	Capital costs <sup>2</sup>	Other costs <sup>3</sup>	Mixed system of fixed charge and a variable volumetric charge	Per hectare (flat rate) water charge	
<b>SWEDEN</b>	100%	100%		Not relevant due to insignificance of irrigation, largely an on-farm operation		
<b>SWITZERLAND</b>	Unspecified % of O&M costs	Unspecified % of capital costs		Flat rate charge plus volumetric charge, but in some cases no charge		Flat rate charge plus volumetric charge, but in some cases no charge
<b>TURKEY</b>	Unspecified % of O&M costs	Unspecified % of capital costs			✓	Per hectare charge
<b>UNITED KINGDOM</b>	100%	100%	Unspecified % of environmental costs	Two part tariff where half of abstraction charge is based on licensed quantity and other half a volumetric charge		
<b>UNITED STATES</b>	100%	Unspecified % of capital costs		✓	✓	Fixed permit fee

	Surface water from a service provider: Cost recovery <sup>1</sup>			Surface water from a service provider: Type of water charging instrument		Regulation and charging system for groundwater supplied by water service provider <sup>4</sup>
	Operation and maintenance (O&M)	Capital costs <sup>2</sup>	Other costs <sup>3</sup>	Mixed system of fixed charge and a variable volumetric charge	Per hectare (flat rate) water charge	
<b>EU</b>	Under the EU Water Framework Directive (WFD) Member states from 2010 will be required to ensure that the water prices charged to all consumers reflects the full costs (O&M, capital costs, environmental and resource (opportunity) costs), although derogations will be possible for less-favoured areas or on grounds of social welfare to ensure all consumers have a basic service					

1. Cost recovery here largely applies to publicly owned irrigation schemes, as usually farmers receiving water from privately owned companies normally pay the full supply cost of the water service.
2. Capital costs can include renewal costs to upgrade existing water delivery infrastructure and new capital infrastructure investment.
3. Other costs can include opportunity costs, economic and environmental externalities.
4. Groundwater charging systems usually only involve the annual cost of a permit or licence to pump groundwater, with the actual costs of pumping covered by the farmer, except in some countries costs of energy for pumping are subsidized.

Source: OECD Secretariat, 2009.

Table 11. Focus of government research concerning future impacts of climate change (CC) on agriculture's use of water resources

	Assessing regional impacts of precipitation and water availability	Evaluating soil conditions and land use suitability	Analysing implications for agricultural production	Developing (drought resistant) new crop varieties	Examining efficiency of different farm management practices	Improving water use efficiency	Comments
AUSTRALIA	✓	✓	✓		✓	✓	Extensive research being undertaken
AUSTRIA	✓		✓		✓		
BELGIUM			✓			✓	Concerning groundwater, future research will also include the possible impact of CC on groundwater availability, but will not be specifically focussed on agriculture.
CANADA	✓	✓	✓	✓	✓	✓	Extensive research ongoing, especially regarding agricultural adaptation to CC
CZECH REP.	✓		✓				Research focus on quantifying future CC impacts
DENMARK	✓		✓				The Danish Climate and Energy Ministry, established in 2007, will begin research on climate change impacts on agriculture, e.g. issues related to flooding, drainage, and production impacts.

	Assessing regional impacts of precipitation and water availability	Evaluating soil conditions and land use suitability	Analysing implications for agricultural production	Developing (drought resistant) new crop varieties	Examining efficiency of different farm management practices	Improving water use efficiency	Comments
<b>FINLAND</b>			✓	✓	✓		CC could overall be favourable for crop yields, but need for irrigation could increase
<b>FRANCE</b>	✓	✓	✓		✓		Research is also examining the impact of CC on whole farm sub-sectors rather than just individual farms
<b>GERMANY</b>	✓						
<b>GREECE</b>	✓	✓	✓			✓	
<b>HUNGARY</b>	✓		✓				A Committee of Drought has been established to study the effects of climate change on production.
<b>ICELAND</b>	Not available						
<b>IRELAND</b>	✓	✓	✓				Research is underway and further projects planned, but is not especially focused on water
<b>ITALY</b>	✓		✓	✓	✓	✓	Ministry of Agriculture has recently financed multidisciplinary research, including, for example, examining CC and water price models to improve water use efficiency
<b>JAPAN</b>	✓		✓		✓		Research also on CC impacts on agriculture from pests and disease

	Assessing regional impacts of precipitation and water availability	Evaluating soil conditions and land use suitability	Analysing implications for agricultural production	Developing (drought resistant) new crop varieties	Examining efficiency of different farm management practices	Improving water use efficiency	Comments
KOREA	✓		✓				Focus to date has not been on CC, water resources and agriculture
LUXEMBOURG	Not available						
MEXICO	✓	✓	✓			✓	The National Hydrological Programme is evaluating the impacts of CC on agriculture, including research of using recycled wastewater.
NETHERLANDS	✓		✓		✓		Main focus of CC research on adaptation strategies
NEW ZEALAND	✓	✓	✓		✓	✓	Research includes adapting to increasing drought risk from CC
NORWAY							Water availability for agriculture under CC has not been examined as a separate issue, but CC could bring an increase in irrigation in some parts of the country.
POLAND	✓		✓		✓		Focus of CC research concerns flooding and ways to expand water retention
PORTUGAL	✓		✓		✓	✓	An EU funded project PLEIADES will aim to research irrigation adaptation to CC

	Assessing regional impacts of precipitation and water availability	Evaluating soil conditions and land use suitability	Analysing implications for agricultural production	Developing (drought resistant) new crop varieties	Examining efficiency of different farm management practices	Improving water use efficiency	Comments
<b>SLOVAK REP.</b>	Not available						
<b>SPAIN</b>	✓		✓			✓	Focus on the impact of CC on available resources and on irrigation water demand
<b>SWEDEN</b>	✓		✓		✓		Information research projects concern CC and drainage, irrigation and flood protection
<b>SWITZERLAND</b>	✓	✓	✓	✓	✓	✓	CC research includes specification of need for additional irrigation, and shifts in regional water balances
<b>TURKEY</b>	Not available						
<b>UNITED KINGDOM</b>	✓		✓	✓		✓	Environment Agency new strategy will research the impact of CC on water availability

	Assessing regional impacts of precipitation and water availability	Evaluating soil conditions and land use suitability	Analysing implications for agricultural production	Developing (drought resistant) new crop varieties	Examining efficiency of different farm management practices	Improving water use efficiency	Comments
<b>UNITED STATES</b>	✓	✓	✓	✓	✓	✓	Extensive research is underway and published on the impact of CC on agriculture and water resources, as well as adaptation strategies.
<b>EU</b>	EU funds projects in member states on climate change impacts on water, and also research undertaken by the European Environment Agency and the EU Joint Research Centre (Science). The EU Commission is also publishing research on adaptation to climate change. Also, EU research projects have and are being conducted by the European Environment Agency and the Joint Research Centre (Science).						

Source: OECD Secretariat, 2009.



Table 12. Extent to which climate change (CC) is factored into water resource management policy considerations related to agriculture

	Ranking: 0 = not at all to 5 extensively	Comments
<b>AUSTRALIA</b>	3.5	CC and water identified as a priority issue at all levels of government (Dec. 2007). Taking action on CC is one of the four key priorities of the Federal Government's new national plan (2008) <i>Water for the Future</i>
<b>AUSTRIA</b>	1.5	CC is considered to have an overall low impact on agriculture and water resources, based on current models
<b>BELGIUM</b>	1	The measures of the recent River Basin Management Plans (RBMP) have been reviewed to see whether they could aggravate the effects of CC. Also it was verified whether the measured efficiency would decline significantly as CC progresses. For some areas of the water system (surface water) CC measures have been defined in the RBMP.
<b>CANADA</b>	2	Emphasis of research has been to raise awareness, but increasingly CC is being reflected in resource management decisions
<b>CZECH REP.</b>	0	Research focus on quantifying future CC impacts
<b>DENMARK</b>	0	This is now under review as projects on CC have begun
<b>FINLAND</b>	1	
<b>FRANCE</b>	2	The need to adapt to CC was one of the new key water management policies introduced under the (2006) Water Act, but to date there has been no practical applications into policy
<b>GERMANY</b>	1	CC could overall be favourable for crop yields, but need for irrigation could increase, hence, no special policy focus at present
<b>GREECE</b>	Not estimated	
<b>HUNGARY</b>	Not estimated	A CC Strategy has been developed for 2008-2025, and a National Climate Change Programme for next 2 years is being prepared.
<b>ICELAND</b>	Not available	
<b>IRELAND</b>	1	CC research is underway and further projects planned, but is not especially focused on water

	<b>Ranking: 0 = not at all to 5 extensively</b>	<b>Comments</b>
<b>ITALY</b>	<b>3</b>	CC is now a key policy issue with regard to water resources, but emphasis differs regionally, in the North on building dams for addressing droughts and in the South on water use efficiency and recycling.
<b>JAPAN</b>	<b>Very important</b>	Research on CC impacts on agriculture from pests and disease
<b>KOREA</b>	<b>0</b>	CC research only just begun, so there are no results to suggest policy changes, Ministry for Food, Agriculture, Forestry and Fisheries has a <i>Long term integrated water resources plan</i> every 5 years, with latest plan 2006 to 2020.
<b>LUXEMBOURG</b>	Not available	
<b>MEXICO</b>	<b>3</b>	CC impacts are considered in annual irrigation plans, as well as plans to improve infrastructure to reduce flood and drought costs.
<b>NETHERLANDS</b>	<b>3</b>	CC projections indicate a considerable increase in drought and flood damage for agriculture
<b>NEW ZEALAND</b>	Not estimated	Water policy and CC policy are becoming more inextricably linked, for example, the Community Irrigation Fund aims to build-up resilience to water shortages in agriculture
<b>NORWAY</b>	Not available	
<b>POLAND</b>	<b>2</b>	Increasing support from government to address protection against flooding and drought
<b>PORTUGAL</b>	<b>2 to 3</b>	Focus of policy strategy is to combat desertification (in the South) and develop policy measures to improve irrigation water use efficiency
<b>SLOVAK REP.</b>	Not available	
<b>SPAIN</b>	<b>3 to 4</b>	The impact of CC and water policy requirements are analysed in the river basin plans and in the national water plan.
<b>SWEDEN</b>	<b>0</b>	
<b>SWITZERLAND</b>	<b>3</b>	Swiss Federal Office for Agriculture is preparing a study on future irrigation water demand
<b>TURKEY</b>	Not available	
<b>UNITED KINGDOM</b>	Not estimated	The new Environment Agency policy Strategy will factor in the likely increase demand for irrigation due to expected higher temperatures and drier summers

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	<b>Ranking: 0 = not at all to 5 extensively</b>	<b>Comments</b>
<b>UNITED STATES</b>	Not estimated	Explicit factoring of CC into water use policy considerations is new, however, long term strategies are being developed to update institutions and agricultural policies to adapt to CC
<b>EU</b>	EU funds projects in Member States on climate change impacts on water, and also research undertaken by the European Environment Agency and the EU Joint Research Centre (Science). The EU Commission also publishes research on adaptation to climate change.	

Source: OECD Secretariat, 2009.

Table 13. Drought management and related policies in the agricultural sector<sup>1</sup>

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>AUSTRALIA</b>	Severe droughts have occurred several times over the past 10 years. Projections (2008) indicate that increase incidence and frequency of droughts will be widespread, and will disrupt the performance of agriculture	Indirect support through upgrades of on-farm irrigation equipment and major irrigation infrastructure projects	Developing risk management strategies with farmers Farm advisory and educational programmes	A comprehensive review of national drought policy was started in 2008, examining economic, social and climatic aspects of drought and drought support
<b>AUSTRIA</b>	No clear trend over recent decades, but climate change projections indicate increasing incidence and severity of droughts		Raise farmer awareness and benchmarking among water suppliers to limit losses in distributional channels	Due to abundant water resources no specific policy approaches to address drought mitigation
<b>BELGIUM</b>	Some evidence of increasing trend and impact of hot dry summers on agriculture	Grants for investment in rainwater capture and storage, water use efficiency and re-use of wastewater. See also the measures in Table 2.	Farm advisory, educational and research activities	

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>CANADA</b>	Evidence of the costs of drought increasing and spreading to areas not normally affected by drought	Support for construction of on-farm water storage dams	A number of ad hoc climate related risk management and extension programmes, and technical guidance, such as building small ponds to store water and advantages of conservation tillage to retain soil moisture	A National Drought Strategy is under discussion to address drought concerns.
<b>CZECH REPUBLIC</b>	No evidence			Support provided for a range of farming practices although mainly directed at reducing soil erosion, but also help retain soil moisture
<b>DENMARK</b>	No evidence			Some farmers are increasing investment in groundwater abstraction to protect against droughts
<b>FINLAND</b>	No evidence			Support for wetland indirectly helps address drought risks, while controlled drainage, changes to irrigation systems, and altering crop husbandry practices are helping farmers prepare for drought.

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>FRANCE</b>	In south-west France there is evidence of an increase in the maximum number of days over a growing season without rain, but no reduction in monthly rainfall.	Investment support for creation of substitute reservoir storage to replace existing withdrawals from the environment	Reduction of abstraction charges for hillside lakes	Adapting to droughts mainly involves changes in farming practices and systems (eg. Replace irrigated crops by dryland crops)
<b>GERMANY</b>	No evidence			
<b>GREECE</b>	The decrease in rainfall is leading to the growing incidence and severity of droughts	Farmers can be supported to reduce drought risks within farm improvement plans	There are central planning infrastructure works for water storage and artificial recharge for agriculture and other sectors impacted by drought	Support for wetland indirectly helps address drought risks, while restoration of terraces and soil conservation practices help to retain soil moisture
<b>HUNGARY</b>	Recent years has seen a distinct rise in the incidence and severity of droughts, with a steady overall rise in the national Drought Index	In conjunction with flood support measures, support for irrigation reservoirs	Farm advisory services on irrigation and farm practices that help increase soil moisture	A Committee of Drought has been established to study the effects of climate change on agricultural production. Key elements of the National Climate Strategy (2008-2025) include retaining water storage on farmland, and wetland and aquatic ecosystem protection

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>ICELAND</b>	Not available			
<b>IRELAND</b>	No evidence	Farm Improvement Scheme (temporarily suspended) provides grants for constructing concrete tanks for rainwater collection and rainwater distribution pumps.		Water scarcity and drought are a rare occurrence
<b>ITALY</b>	There is evidence of an increase in drought events and their severity leading to higher costs on agriculture and need for higher irrigation volumes	Limited support for new irrigated areas, and improvement in water use efficiency in other irrigation districts	Promotion of water saving practices, both on-farm and in water infrastructures	
<b>JAPAN</b>	The number of areas affected by drought has been declining.	The compensation system for agricultural disasters provides payments, funded by farmers' insurance premiums.		The management systems used in paddy rice fields play an important role in maintaining water flows in dry periods, such as recycling water in paddy fields

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>KOREA</b>	No evidence			The management systems used in paddy rice fields play an important role in maintaining water flows in dry periods, such as recycling water in paddy fields
<b>LUXEMBOURG</b>	Not available			
<b>MEXICO</b>	Historical records suggest more prolonged drought periods in the arid and semi-arid areas of the country (north-central Mexico).			The Adequacy of Water Rights Programme (PADUA), seeks to promote improvements in water use efficiency.
<b>NETHERLANDS</b>	No evidence, but climate change projections indicate a considerable increase in drought damage for agriculture			Some Provinces allow groundwater withdrawals only on condition that farm has a water plan



	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>NEW ZEALAND</b>	No clear evidence, but climate change projections raise concerns that drought events could become a problem.	The On-farm Adverse Events Recovery Framework, managed by Regional Councils, provides support for farm advisory services that promote a shared understanding of risk, readiness, response and recovery from droughts, including, for example, the use of mixed land use (forestry/agriculture), and soil conservation practices that retain soil moisture	The Community Irrigation Fund (established in 2007) is a contestable fund providing half the costs for appropriate activities that limit risks from water shortages. The Sustainable Farming Fund provides support for feasibility studies of water storage for irrigation.	
<b>NORWAY</b>	No evidence.			Some farmers are establishing ponds to obtain water for irrigation.

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>POLAND</b>	Data since 1951 reveals the frequency and severity of droughts has increased, while the area of the country affected also rose	Support is provided for construction of small-scale irrigation schemes, upgrading existing irrigation facilities, and installations for rainwater storage. These measures are developed in conjunction with flood risk reduction measures.	Other measures to reduce drought risks include promoting farm management practices that retain soil moisture	
<b>PORTUGAL</b>	There has been an increase in the frequency and intensity of drought episodes, which is projected to continue under climate change, but it is difficult to determine a trend in terms of increase costs for agriculture	Support for improving irrigation water use efficiency is the principal measure to combat drought risks, including the National Programme for the Efficient Use of Water	Other measures to reduce drought risks include promoting farm management practices that retain soil moisture; and providing farm advisory services and educational programmes	Various Rural Development Programmes are also providing support to agriculture and rural areas to address drought risks, such as investment in dams and irrigation facilities.
<b>SLOVAK REPUBLIC</b>	The increasing incidence of drought are leading to higher costs for agriculture	Support for irrigation infrastructure		
<b>SPAIN</b>	There is evidence of an increase in the number and severity of drought events	Support for upgrading irrigation infrastructure, and increasing water storage capacity	Development of a system of water scarcity indicators	Encouraging development of drought wells, and other water resources, e.g. desalinization, recycled treated sewage

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>SWEDEN</b>	No evidence			Farmers are beginning to construct irrigation ponds, but this reflects change in cropping systems (e.g. more fruit and vegetables) requiring a secure supply of water rather than water scarcity
<b>SWITZERLAND</b>	No evidence, but recent drought events has triggered investment in irrigation infrastructure, with studies underway on future irrigation demand.	Support for irrigation facilities to address water scarcity problems		Some farmers are adapting cropping systems to grow less water demanding crops.
<b>TURKEY</b>	The increasing incidence and severity of droughts is imposing rising costs for agriculture.	Support for irrigation infrastructure to address water scarcity problems	Regional government warns Water User Associations and other agricultural water users of pending drought so that plans can be made to alter cropping patterns and irrigation water distribution.	The Agricultural Drought Strategy and Action Plan is under preparation and will provide models of drought at the river basin level.
<b>UNITED KINGDOM</b>	Records over 200 years reveal an increasing frequency of drought events	Regional Development Agencies provide support for rainwater harvesting equipment	Water abstraction charges for farmers are increased in the dry (summer) months. Regulations exist to ban irrigation in times of drought	The Environment Agency Drought Plans (mandatory and regularly updated) are not specific to agriculture, instead agriculture is considered one among other competing water users in times of drought

	Trends in incidence and severity of droughts	Drought adaptation and mitigation policies in agriculture		Comments
		Support Payments	Other policy instruments	
<b>UNITED STATES</b>	Over the last 15 years, multi-year droughts have occurred at intervals over large expanses of California and the Mountain West.	Support for irrigation infrastructure to address water scarcity problems	Other measures to reduce drought risks include promoting farm management practices that retain soil moisture; and providing farm advisory services and educational programmes. Drought risk reduction is also achieved as a secondary benefit of other agri-environmental programmes	Agriculture benefits from Federal and State level flood protection programmes, for example the US Army Corps of Engineer's various flood protection works.
<b>EU</b>	In addition to addressing issues of drought within the context of the Water Framework Directive, the EU has begun (2007) the process of the developing a medium to long term work programme that addresses water scarcity and drought, with a review of EU strategy planned for 2012, with agriculture a key sector to be covered by the Strategy.			

1. This table does not include programmes or other policies that seek to compensate farmers for drought disaster relief.

Source: OECD Secretariat, 2009.

Table 14. Flood management and related policies in the agricultural sector<sup>1</sup>

	Trends in incidence and severity of floods	Flood adaptation and mitigation policies in agriculture	Comments
<b>AUSTRALIA</b>	Not available		
<b>AUSTRIA</b>	No clear trend over recent decades	Development of flood maps and flood hazard maps to highlight areas of flood risk	Since 1994 no flood protection measures were funded, in line with efforts to maintain natural retention areas (including on farmland) and approach to “more space to rivers”
<b>BELGIUM</b>	Rainfall quantity increased by 6.6% over 20 <sup>th</sup> century and rainfall extremes have increased over recent decades above normal cyclic variations, leading to higher frequency of local flooding and soil erosion events, and resulting in higher costs for agriculture (although costs not quantified)	Water assessment of any initiative (e.g. drainage) that may cause detrimental change in water flows. Compensation for water retention projects and river restoration on farmland.	Increasingly, water is kept upstream to improve groundwater percolation and reduce flood risk, while agricultural land is also increasingly being used as a buffer to manage flood risk. On a voluntary basis, farmers can enter contracts for erosion management that are stricter than the mandatory level. Flood maps and flood hazard maps are developed to highlight areas of flood risk. Support for floodwater storage reservoirs which also serve for irrigation. There are also regulations on urban development which specifies requirements for rainwater collection, infiltration, etc.
<b>CANADA</b>	Frequency of flooding appears to be increasing, based on anecdotal evidence of damage to infrastructure and increase in flooding of unseeded acres due to spring floods		Some best management practices, such as riparian management, contribute to slowing water flow and flooding, although are mainly aimed at soil erosion and pollution control

	<b>Trends in incidence and severity of floods</b>	<b>Flood adaptation and mitigation policies in agriculture</b>	<b>Comments</b>
<b>CZECH REPUBLIC</b>	Incidence and severity of floods is imposing an increasing cost on agriculture		Investment in major polder and other flood protection works were last made in the mid-1990s. Support provided for a range of farming practices although mainly directed at reducing soil erosion, but also help slow water flows across farmland
<b>DENMARK</b>	No evidence, but expected increase in flood events due to climate change		Field drainage may help mitigate against expected climate change impacts
<b>FINLAND</b>	No statistically overall change, but some evidence that seasonal distribution of run-off has slightly changed	Support for multipurpose wetlands is helping to reduce flood risks, as well as meet other environmental objectives.	Most flood protection activities are off-farm, and since 1990 agriculture's role in watercourse development has been reduced. As flood damage is not fully compensated this is helping farmers to reduce risk
<b>FRANCE</b>	No detailed information relating specifically to agriculture, but to date no clear evidence of increased frequency of flooding but in terms of severity costs of damage have risen	Flood easements entitle landowners to compensation for areas designated to become flooded; and support for flood meadows. Local regulations in areas at risk to ensure land use is compatible with the need to stock water or to let it flow.	Risks and costs of flooding are being eased by: allowing large areas of farmland to become flooded as a means to store water and slow water flows; encouraging conservation tillage and hedge rebuilding.
<b>GERMANY</b>	No clear evidence	There are no direct measures but many farmers benefit from increased investment in flood risk reduction.	Changes in farm practices affect flood management, but rarely are these practices adopted directly to reduce flood risks and damage. Advisory services seek to improve farm management of flood risks

	<b>Trends in incidence and severity of floods</b>	<b>Flood adaptation and mitigation policies in agriculture</b>	<b>Comments</b>
<b>GREECE</b>	There is an increase in the incidence and severity (measured by rising costs) of flood damage on agricultural land	Farmers can be supported to reduce flood risks within farm improvement plans	There is a central planning infrastructure works for flood prevention, affecting agriculture and others implicated by flood risks
<b>HUNGARY</b>	The incidence and severity of flooding has increased	Support for flood water storage reservoirs (and irrigation) on low value agricultural land; and support for wetland ecofarming and extensive pasture in the flood plain area	National programme for developing infrastructure works for flood prevention, affecting agriculture and others implicated by flood risks.
<b>ICELAND</b>	Not available		
<b>IRELAND</b>	There are indications that the incidence and severity of flooding has been increasing, while climate change projections indicate this trend is likely to continue		The Flood Policy Review Group (2003) has recommended that land management practices should change to contribute to flood mitigation by, for example, improving drainage, restoring wetlands, developing buffer zones, and developing flood plain storage.
<b>ITALY</b>	While Italy is highly susceptible to landslides and floods, in recent years there has been a decrease in damage by these events, while evidence of increasing costs on agriculture is only anecdotal and qualitative		Reorganisation of the National Protection Agency that addresses floods, and increased cooperation with relevant agricultural authorities.
<b>JAPAN</b>	Increasing severity of rainfall, but the costs on agriculture are unknown	Flood hazard maps to indicate areas of potential damage in the event of floods damaging agricultural water retaining facilities	The management systems used in paddy rice fields play an important part in flood risk reduction, especially through the water retaining capacity of paddy fields

	<b>Trends in incidence and severity of floods</b>	<b>Flood adaptation and mitigation policies in agriculture</b>	<b>Comments</b>
<b>KOREA</b>	Flood events have shown great variability but recent trends suggest increasing severity of these events, especially in terms of economic losses in agriculture		The management systems used in paddy rice fields play an important part in flood risk reduction, especially through the water retaining capacity of paddy fields
<b>LUXEMBOURG</b>	Not available		
<b>MEXICO</b>	The incidence of flooding appears to be increasing as a result of growing urbanisation.	Encouragement of farm management practices, such as afforestation, especially in the upper part of river basins, but also protection of wetlands in lower reaches of the river basin.	The policy focus is on flood prevention measures, mainly focusing on urban areas.
<b>NETHERLANDS</b>	Some evidence of an increase in the severity of floods	Farmers have a legal obligation to create water retention on their land, with an acceptable level of inundation specified by land use, e.g. grassland more frequent than arable land, arable more frequent than urban areas	Increasing emphasis and future plans to support farm management practices that directly address flood risks



	<b>Trends in incidence and severity of floods</b>	<b>Flood adaptation and mitigation policies in agriculture</b>	<b>Comments</b>
<b>NEW ZEALAND</b>	No clear evidence, but a number of recent flood events have resulted in substantial economic losses to farms, but climate change projections suggest a increase in the frequency and severity of floods in some areas	The On-farm Adverse Events Recovery Framework, managed by Regional Councils, provides support for farm advisory services that promote a shared understanding of risk, readiness, response and recovery from droughts, including, for example, the use of mixed land use (forestry/agriculture), soil conservation, and promotion of wetlands to reduce flood risks.	The Ministry of Environment Flood Risk Management Review was established in 2007 to examine three key topics: the role of government (at different jurisdictional levels) and communities in managing flood risks; funding of flood mitigation; and current flood risk management practices. A national policy statement following the review is expected in 2009
<b>NORWAY</b>	Some evidence of changes in seasonal rainfall, towards more rain in summer and more episodes of heavy rain, but no evidence of increased severity of flooding.	Flood risk plans have been developed, and some government investment in flood prevention infrastructure mainly for urban areas, but also for agricultural land.	
<b>POLAND</b>	Climate change projections indicate the increasing frequency and severity of flood events	Support is provided for construction of small-scale water retention structures, and afforestation and restoration wetlands to slow water flows across agricultural land	Spatial Planning activities are increasingly taking into account increasing flood risks, including the role for agricultural land

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<b>PORTUGAL</b>	Anecdotal evidence suggests a lower incidence of floods with damage to agriculture	The National Ecological Reserve programme seeks to prevent rural land use changes, especially in flood plains, that could increase the risks of flooding (e.g. banning farming on land with a high risk of erosion)	A number of measures contribute, indirectly, to reducing flood risks, in particular, the promotion of environmental farm practices such as soil conservation and afforestation to help slow water flows across land, and upgrading irrigation facilities to improve water retention
<b>SLOVAK REPUBLIC</b>	Not available		
<b>SPAIN</b>	No evidence	Development of an early flood warning information system and mapping flood risk zones. Support for a network of ponds to store water from storms and other civil works preventing flood risks nationally, including for agriculture	
<b>SWEDEN</b>	No evidence, but an increase in flood events could occur in the climate change context		Much of the flood protection infrastructure (e.g. dykes) was constructed at beginning of 20 <sup>th</sup> century. Support for wetlands, primarily for reducing nutrient pollution, also has a flood protection value

	<b>Trends in incidence and severity of floods</b>	<b>Flood adaptation and mitigation policies in agriculture</b>	<b>Comments</b>
<b>SWITZERLAND</b>	No evidence	Investment support for conservation and maintenance of small water courses to help control floods, and compensation for farmland used for flood prevention.	
<b>TURKEY</b>	There has been an increasing trend in the frequency and intensity of flood events	Meteorological Service makes 5-7 day forecasts for agriculture to warn of possible flood events	The Turkish Emergency Flood and Earthquake Recovery Project provides a national flood forecasting and warning system
<b>UNITED KINGDOM</b>	No long term evidence of changes in flood events, but climate change projections suggest the frequency and severity of flood events could increase, while flood risks might also increase because of changes in the use of farmland, and in the management of flood defence and drainage systems	There are no specific policies that address flood risk reduction in agriculture, but agri-environmental schemes, where appropriate, can help reduce risks as a secondary objective (e.g. wetland conservation), and farmers benefit from national flood risk reduction management.	There is an increasing effort to encourage greater coordination of agricultural, environmental and flood risk management policies to better understand their impact on agricultural land use changes, management practices, and water run-off and flood risk.
<b>UNITED STATES</b>	Trend analysis shows no evidence of an increase or decrease in flood events, although increase urbanization has led to increased flood peaks downstream.	There are no direct policies that affect flood risk reduction in agriculture, but flood risk reduction is achieved as a secondary consequence of other agri-environmental programmes measures, such as wetland conservation.	Agriculture benefits from Federal and State level flood protection programmes, for example the U.S. Army Corps of Engineer's various flood protection works.

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	<b>Trends in incidence and severity of floods</b>	<b>Flood adaptation and mitigation policies in agriculture</b>	<b>Comments</b>
<b>EU</b>	In addition to addressing issues of flooding within the context of the Water Framework Directive, the EU's Floods Directive entered into force in 2007, and sets a timetable and the broad approach to flood risk management across the EU. The timetable envisages completing flood risk management plans in Member states by 2015, and agriculture is one among other sectors in the economy covered by the Plans.		

1. This table does not include payments or other policies that seek to compensate farmers for flood disaster relief.

*Source:* OECD Secretariat, 2009.

