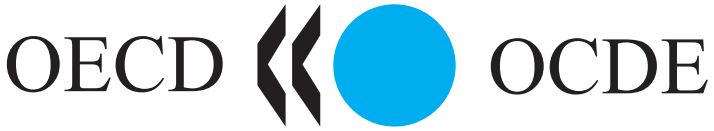
Water and Agriculture: Sustainability, Markets and Policies*

Conclusions and Recommendations



ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT

Conclusions and recommendations

CONCLUSIONS AND RECOMMENDATIONS[1]
Highlights

Agriculture's use and impact on water resources involves complex trade-offs between economic, social and environmental demands under a wide range of institutional structures. Irrigated farming accounts for a major and growing share of farm production and rural employment in some OECD countries, but overuse of often scarce water resources is an increasing concern. Agriculture is a major source of water pollution but also contributes to ecosystem services (e.g. provision of habitat for some wildlife), for certain regions within some OECD countries. Agricultural production and input subsidies, especially for water and energy, continue to misalign farmer incentives and aggravate overuse and pollution of water across most OECD countries.

The major challenge is to ensure that water resources used by agriculture are best allocated among competing demands to efficiently produce food and fibre, minimise pollution and support ecosystems, while meeting social aspirations under different property right arrangements and institutional systems and structures.

Policies and actions are beginning to shift toward more sustainable agricultural water management in OECD countries as policy makers are giving higher priority to water issues in agriculture and are using a mix of market-based, voluntary and regulatory approaches to address these issues. There is a widespread recognition of the need for greater use of market based instruments, such as better pricing structures and tradable permits, accompanied by government regulations, as well as cooperative efforts among water users. But the adoption of these measures should take into account the frequent regional imbalances of water resources within countries and the negative and positive environmental externalities arising from agriculture's use of water. A growing concern is the impact of agricultural policy on opportunities to mitigate or adapt to climate change and climate variability as they affect the water sector.

Countries are at different stages in reforming their water policies, partly reflecting the varying importance of water related issues in agriculture across OECD countries and current systems of property rights and management structures. But all countries need to reinforce the monitoring and evaluation of current water policy reform initiatives to ensure that these reforms are moving toward sustainable agricultural water management.

There are gaps in knowledge about both the science and data concerning the linkages between agriculture and water resources, which are an impediment to the flow of information to help improve policy decision making and actions at various spatial levels from the watershed, regional, national to international levels, but improving the science and collection of information is costly.

The Workshop recommended a number of issues that could be addressed by policy decision makers ranging from decision makers at the watershed through to national levels, including:

- using an appropriate mix of instruments and tools aimed at addressing agriculture resource management issues to ensure the achievement of coherent agricultural, environmental and water policy goals

1. These conclusions and recommendations have been prepared by the OECD Secretariat and do not necessarily reflect the views of the OECD Member countries and participants at the Workshop.

as well as cost effective implementation (e.g. integrated policy treatment of water and energy input use by agriculture), including coordinated policy responsibilities and structures at different levels from the watershed to national level;

- integrating and expanding current scientific research and data collection capacity to underpin improved policy making, including better water accounts;

- identifying property rights attached to water withdrawals, water discharges and ecosystem provision;

- establishing clear lines of responsibility in the institutional framework to manage water – who does what, who pays for what, who monitors and evaluates – underpinned by a long term commitment from governments to resource the necessary actions, especially with the growing concerns related to climate change and climate variability;

- strengthening water policy reforms to provide a robust regulatory framework to allow, for example, for water pricing and trading, and water service competition or benchmarking performance where competition is limited, and nutrient trading for pollution abatement; and,

- raising the capacity for stakeholders (farmers, industry and community groups) to participate in the design and delivery of policy responses for integrated water management.

1. OBJECTIVES OF THE WORKSHOP

The OECD Workshop was hosted by the Australian government and held in Adelaide, on 14-18 November, 2005, drawing together a wide range of stakeholders representing agricultural, environmental, agro-food and water industry interests from government, the private sector, International Governmental Organisations and Non-Governmental Organisations. The focus was to:

- examine the sustainability – economic, social, environmental, institutional – dimensions of agriculture's use and impact on water resources;
- review current policy and market approaches used by countries to address agricultural water issues;
- explore possible policy and market approaches to ensure further progress in agriculture's sustainable use of water resources; and
- identify issues that could be further examined by decision-makers, researchers and the OECD.

2. Background: Why are the linkages between agriculture and water important?

The major challenge for the sustainable use of water resources in agriculture is to manage community expectations to meet social and environmental aspirations, while ensuring that food and fibre is produced competitively and profitability.

Agriculture's use and impact on water resources are complex and dynamic, especially in the context of the impacts of climate change and variability on agricultural systems, and involve trade-offs between economic, social and environmental demands. While agriculture is one among many different demands for water (i.e. urban, industrial, recreational uses, and for maintaining aquatic ecosystems), for most countries it is the major user of water resources (for irrigated farming and the livestock sector), while its impact on water quality is also significant in many cases. On the other hand, improvements in water productivity by agriculture over the past 40 years have played an important role in helping to expand food production and provide employment in rural areas, while pollutant discharges from agriculture have been declining in recent years for many regions within OECD countries.

Irrigated farming accounts for a major and increasing share of agricultural production, farm exports and rural employment for some OECD countries, but overuse of water resources is an increasing concern. In addition, the growing incidence and severity of droughts linked to climate variability and climate change is placing pressure on farming and water resources. Overexploitation of water resources by agriculture, within some regions across certain OECD countries, is leading to:

- reduced environmental flows in rivers and lakes;
- natural recharge rates of aquifers being exceeded;
- increased competition for water resources between farmers and other demands for water, including the maintenance of aquatic ecosystems; and,
- higher agricultural energy intensity, as the expansion of irrigated farming usually leads to an increase in the energy requirements to support this system of farming.

Over recent years, there has been a shift by farmers and policy makers in most OECD countries from water resource exploitation to water resource and environmental management. This is associated with changing societal demands, as farmers seek to both improve their efficiency in the use of water resources and also address the growing societal interest in the conservation of aquatic ecosystems.

There is also a greater public awareness that water used by agriculture is not a "free" good for personal benefit, but one that imposes costs and generates benefits. Although water application rates per hectare irrigated have been improving in many cases, wastage and inefficiency in water use remain high, associated with poor maintenance of irrigation infrastructure and a low rate of adoption of efficient irrigation technologies, such as drip emitters. Under some farm management practices and farming systems agriculture maintains and enhances certain ecosystem services related to water, such as maintaining water meadows and facilitating groundwater recharge.

Agricultural water pollution is also a focus of attention for many OECD countries due to the:

- reduction in pollution by non-agricultural polluters which has been more rapid than for agriculture, with farming mainly responsible for nitrate and phosphorus water pollution;
- increase in point pollution from agriculture linked to the intensification of livestock farming, especially in the pig, poultry and dairy sectors;
- greater public awareness of the damage to aquatic ecosystems from certain agricultural practices;
- growing concerns related to groundwater and coastal pollution, especially from the leaching of phosphorus and pesticides; and,
- uncertainty over the extent and severity of those water pollutants derived from farming that are in general poorly monitored (e.g. pathogens, salts, heavy metals and soil sediment).

Production and input subsidies continue to misalign farmer incentives and aggravate overuse and pollution of water across many OECD countries. Market price support provides incentives to intensify agricultural production, while support for irrigation infrastructure capital (construction and depreciation costs), operation and maintenance costs (including institutional costs) together with support to lower water supply charges, discourages the more efficient use of water resources. Energy subsidies to agriculture in some countries, by lowering pumping costs, are aggravating the depletion of aquifers and increasing the energy intensity of irrigated agriculture. While agricultural support varies greatly between OECD countries and across different commodities, the provision of support for water and energy use by agriculture is common to many countries.

3. Main points from the Workshop papers and discussion

Some 50 papers were presented at the Workshop, covering the two central themes of agriculture's linkage to water quantity and water quality, over the four dimensions of sustainability – economic, social, environmental and institutional. This section provides a brief summary of the main points that emerged from the Workshop papers and discussion.

▶ Knowledge – science and data gaps

The Workshop highlighted a number of areas where gaps in knowledge of both the science and data concerning the linkages between agriculture and water resources are an impediment to the flow of information to help improve policy decision making and actions at various spatial levels from the watershed, regional, national to international levels (i.e. 'if you cannot measure it you cannot manage it'), but recognised that improving the science and collecting relevant information is costly, including:

- measuring and improving scientific understanding of the transmission and fate of farm pollutants into water bodies (rivers, lakes, aquifers, coastal waters), especially nutrients, pesticides, pathogens, salts, heavy metals and soil sediment;
- developing water accounting systems to better understand the science of water resources (e.g. stocks and flows in the system, aquifer dynamics) and practices (irrigation management and technologies) and how much water is being used, and how efficiently (in both physical and economic terms);
- understanding and measuring social capital in the context of agriculture and watershed management, so as to more clearly target social issues, institutions and main stakeholders;
- examining the merits of using the 'virtual water' concept (i.e. water required to produce a unit of crop or livestock output) as a tool to assist policy makers in helping to improve the efficiency of water use in agriculture;
- exploring the effects of climate change, variability and uncertainty on agriculture and water resources, including the institutional and policy responses, the distributional consequences, and the need to examine the linkages between one environmental area – water resources – and the consequences for other areas such as greenhouse gas emissions, energy and chemical input use; and,
- analysing the effects of existing policy distortions and policy reforms on agricultural water use and water quality, including the measurement of subsidies and prices for irrigation water.

▶ Water Management

The need for improving the management of water resources by agriculture is now widely recognised (e.g. in the Global Millennium Assessment) in view of the global pressure on water resources associated with growing populations and food and fibre demand, and in the context of increasing concerns related to climate change and climate variability.

Better management of water resources in agriculture requires identifying the reference levels that determines when farmers should pay for the pollution they generate (polluter pays principle), such as where the quality of drinking water is affected, and when society should assist farmers to enhance the provision of ecosystem services, such as the conservation of wetlands and groundwater recharge. This also involves better defining the property rights attached to water withdrawals and the rights attached to allowing discharges into water bodies from agricultural activities.

Water quantity trading has been established in some countries to increase the flexibility and efficiency in water resource management linked to agriculture, but government regulation has also helped in establishing markets for water allocation. For water pollution abatement, ***nutrient trading*** has two key advantages: as a means of providing incentives to reduce nutrient pollution; and as a way of achieving flexibility of land use in the face of regulatory restrictions. More widespread use of nutrient trading to reduce pollution abatement requires improved knowledge of mitigation strategies and best management practices, as well as government regulation to develop nutrient trading.

In some OECD countries the moves toward ***cost recovery, water pricing and water trading,*** have led to improvements in water management by farmers, through water resource saving, inducing technological innovation, shifting to higher value agricultural commodity production, and providing incentives to reduce pollution. But moving towards cost recovery for water will need to take into account the negative and positive environmental externalities arising from agriculture's use of water, and recognise that the importance of water resource issues in agriculture varies, reflecting, in particular, different ecological conditions across OECD regions and countries, from one of water abundance to one of water scarcity.

▶ Policies and Governance

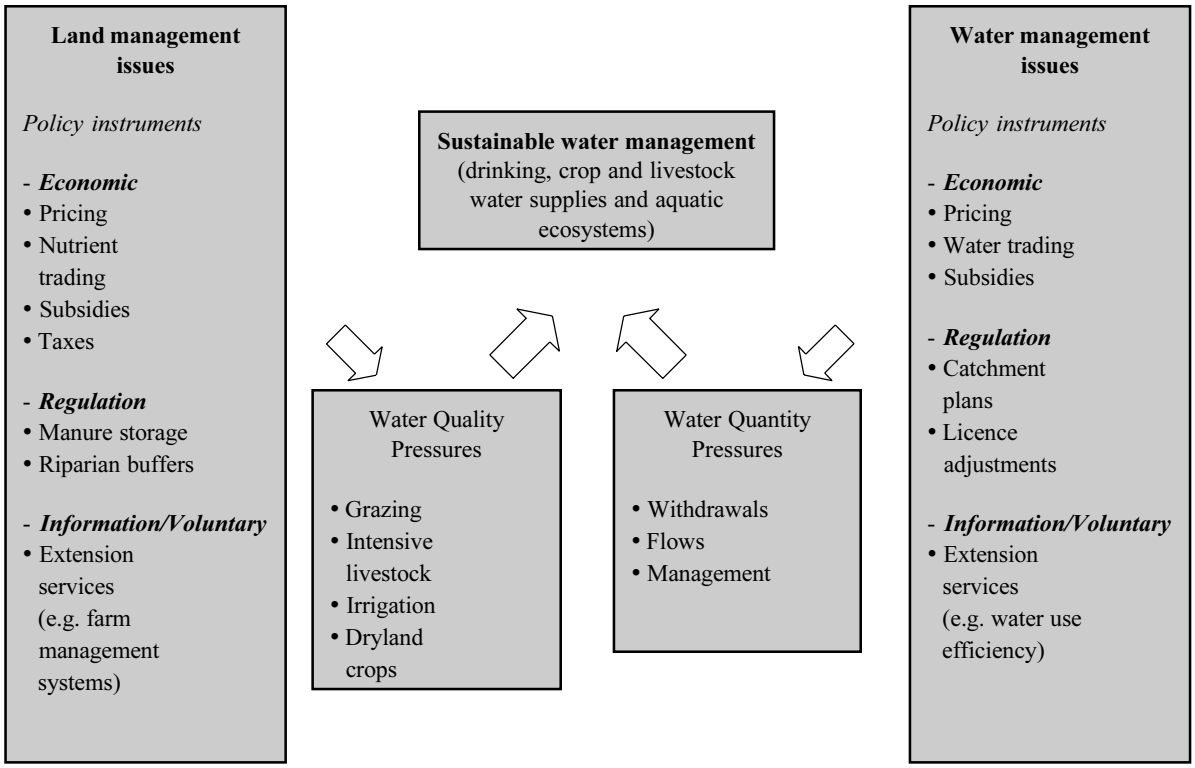
Water reform programmes are being implemented across the range of national to watershed scales in many OECD countries, while these programmes usually involve, but are not specific to, the agricultural sector. There is a growing recognition that water policies should be coherent across different scales of decision-making - from the farm through to water catchment, national and international levels, and also between the different users (e.g. urban, industry) and uses of water (e.g. aquatic ecosystems, recreational uses). The need for policy coherence is also important across agricultural, environmental and water policies, especially to avoid conflicting signals and incentives to farmers in achieving sustainable water management.

Policy responses to address water quality and quantity issues in agriculture need to be part of a policy package that encompasses a range of policy instruments, institutional reforms and broader community engagement. Water policies and institutions need to focus on the public good (e.g. maintaining aquatic ecosystems) and market failure aspects of water resources (e.g. resource depletion and pollution), by facilitating stakeholder involvement, developing information (data) and knowledge (science), and enabling public access to this information. Moreover, given the high level of vulnerability of agricultural systems and water resources to climate change and climate variability, policies will need to be increasingly responsive and flexible in adapting to these changes.

There is a diversity of approaches to water management policies across OECD countries with different emphasis on water pricing and cost recovery, property rights, quasi water markets, taxing pollutants, payments and other policy approaches to achieve water policy goals. There is also increasing emphasis being placed in many countries in establishing decision support tools and risk management strategies to improve water management by farmers. Policy focus, however, tends to be on surface water (visible) so attention to the overuse and pollution of groundwater (invisible) also needs to be strengthened.

Understanding the links between agriculture, water use and water quality can help target the appropriate policy responses (Figure 1). Pressure on water quality from agricultural activities can be caused by poor land management practices (e.g. poorly timed manure spreading, dryland salinity through tree felling, tillage practices exacerbating soil sedimentation run-off). While pressure on water resources (quantity) is largely the result of

Figure 1: **Sustainable Water Management.**



Source: OECD Secretariat adapted from Seamus Parker (see Workshop Proceedings publication).

excessive extractions, modification of flow regimes through storage, the poor management of irrigation infrastructure and inadequate uptake of efficient water application technologies by irrigators leading to water wastage and inefficiencies.

For countries where water scarcity or problems of water pollution linked to agriculture have been acute, this has prompted them to take action earlier than other countries. Some countries are building on and adapting existing institutional structures to implement water reform programmes and others, at an earlier stage with their reform programmes, are in the process of creating the required institutions.

Some countries are refining, developing and introducing market based approaches for water resource allocation and pollution, but little evaluation of their economic efficiency and environmental and social effectiveness has been undertaken. Moreover, clearer identification and enforcement of property rights is required if water markets are to be developed.

Well defined and enforceable property rights are the cornerstone of democratic and economic systems in all OECD countries, with most water rights relating to a right to use water or allow discharges into water, both of which provide the foundations of a water trading system. But limits are usually imposed on this right (e.g. drawing water or discharging waste into water bodies), and some countries are now engaged in the process of separating water entitlements from land title rights.

Developing stakeholder involvement is crucial to improve water and watershed management, but this can take time. Targeting communities, rather than individuals, seems a preferred solution to water governance issues. But transaction costs for stakeholder involvement are high, especially in the initial phase of pilot programmes, which points to the need to translate these pilots to a broader adoption or implementation at a larger scale so as to streamline the stakeholder engagement process. In this context, governments also need to monitor the equity and distributional effects of water reform policies on different stakeholders, and introduce appropriate safeguards and mechanisms to address these effects where they may be detrimental to both the farmer and wider community welfare.

4. Workshop recommendations of issues that could be addressed

The Workshop recommended a number of issues that could be addressed by OECD Member countries, researchers and the OECD Secretariat, building on the issues and responses identified at the FAO and the Government of The Netherlands, which jointly organised the International Conference on Water for Food and Ecosystems (The Hague, The Netherlands, February 2005), as well as issues identified in other recent international fora related to water (e.g. the United Nations Commission on Sustainable Development, the World Water Forum, and Sweden International Water Week). The issues outlined here are not listed in order of importance.

▶ Policy decision makers in OECD Member countries

Issues that could be addressed by policy decision makers, ranging from decision makers at the watershed through to national levels, include:

- using an appropriate mix of instruments and tools aimed at addressing agriculture resource management issues to ensure the achievement of coherent agricultural, environmental and water policy goals as well as cost effective implementation (e.g. integrated policy treatment of water and energy input use by agriculture), including coordinated policy responsibilities and structures at different levels from the watershed to national level;
- integrating and expanding current scientific research and data collection capacity to underpin improved policy making, including better water accounts;
- identifying property rights attached to water withdrawals, water discharges and ecosystem provision;
- establishing clear lines of responsibility in the institutional framework to manage water – who does what, who pays for what, who monitors and evaluates – underpinned by a long term commitment from governments to resource the necessary actions, especially with the growing concerns related to climate change and climate variability;
- strengthening water policy reforms to provide a robust regulatory framework to allow, for example, for water pricing and trading, and water service competition or benchmarking performance where competition is limited, and nutrient trading for pollution abatement; and,
- raising the capacity for stakeholders (farmers, industry and community groups) to participate in the design and delivery of policy responses for integrated water management.

▶ Researchers

Issues that could be addressed by researchers – ranging from government research institutes, the agro-food industry, environmental groups, and international governmental organisations – to help drive the research agenda toward supporting sustainable agricultural water management include:

- developing decision support tools that integrate cause-effect linkages and facilitate integrated water management at the farm and catchment levels;
- calculating the 'true' price of supplying irrigation water, taking into account the infrastructure costs as well as other costs, including the costs of planning and managing the resource, scarcity value, and the environmental and social externalities (positive and negative) associated with agricultural use of water resources, especially different irrigation systems, and the equity and distributional effects on communities in watersheds as a result of water policy reforms;
- developing technologies and farm practices that improve agricultural management of water;
- assessing and comparing property rights and institutional regimes for integrated water management;
- undertaking research to better understand the impacts of climate change on water availability for agriculture and to identify adaptation strategies and policies; and,
- developing methodologies for water information and monitoring systems to support agricultural water management.

▶ OECD Secretariat

Issues that could be explored by the OECD Secretariat include the:

- monitoring and evaluating policies and policy reforms that address water quantity and quality issues in agriculture, building on inventories of different policy approaches and data on water use, pollution and management trends (especially groundwater) across OECD countries, so as to document 'success stories' as well as the lessons learned;
- identifying ways of measuring the costs and benefits of agriculture's use and impact on water resources, taking account of the economic, environmental and social elements;
- examining the effects of different institutional arrangements on water management to develop a common set of principles to help countries improve the institutional framework for water management, with social (watershed stakeholders/community) learning and engagement a prominent theme in such analysis; and,
- analysing the impact of alternative policies and market solutions in developing agriculture's ability to mitigate and adjust to climate change and variability, taking into account differences across countries.

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