

## Competition or Cooperation? A New Era for Agricultural Water Management

Reliable supplies of water for agriculture have helped meet rapidly rising demand for food in developing countries, making farms more profitable, reducing poverty, and helping vast regions of the world develop more dynamic and diversified economies. Can these successes be sustained with demand for food rising and water resources waning? That is the challenge now facing policy makers, planners, and practitioners in agricultural water management (AWM), as well as their allies in the World Bank and other development organizations.

### Achievements and Challenges

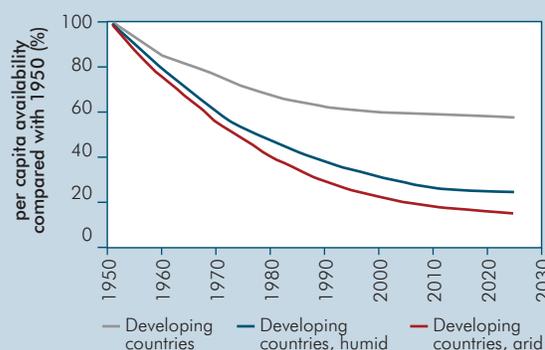
AWM is part of a *process of resource management* that provides a key input to agricultural production and farm incomes. With strong links to other sectors and to the broader economy, AWM encompasses irrigation and drainage, rainfed agriculture, reuse of recycled water, water and land conservation, and watershed management. It is also closely related to broader aspects of macroeconomic growth policy.

During the past four decades, irrigated agriculture has been the key to improving nutrition in the developing world. Demand for food tripled over the period, rising much faster than populations. Food production in the developing world almost kept pace with demand, with production up two and a half times during this period (the gap has been filled with imports).

But the spread of irrigation is slowing. The pace of expansion dropped from around 2 percent a year in the 1960s and 1970s to less than 1 percent a year in the 1990s. Many countries now face serious constraints to further expansion, often because of social and environmental concerns or because less water is available for irrigation.

With the rapid development of irrigated agriculture over the last four decades, water withdrawals for irrigation more than doubled. At the same time, demand for other uses increased even faster, as populations, urbanization, and industrialization grew. The result of these converging demands has been a steady decline in per capita water availability in developing countries (Figure 1). In many basins, groundwater is now being mined at unsustainable rates.

**Figure 1. Declining water availability in the developing world**



This note summarizes key messages from *Reengaging in Agricultural Water Management: Challenges and Options* by Christopher Ward, Salah Darghouth, Gayane Minasyan, and Gretel Gambarelli (Washington, DC: World Bank, 2006). Readers may download the complete paper from [www.worldbank.org/water](http://www.worldbank.org/water).

The increase in water productivity from 1961 to 2003 was spectacular, as large-scale irrigation schemes led by governments brought rapid increases in food production. But the institutions erected to manage those schemes have since proven inefficient and unresponsive, lacking incentives to improve management or to respond to farmers' changing needs. In many basins, water productivity remains low and take-up of modern technology is slow.

In general, the Green Revolution and public investment in enhanced water management did not specifically target the poor. AWM has helped reduce poverty in irrigated agriculture, but the improvements have largely bypassed farmers in rainfed areas, where poverty rates have stagnated.

The environmental and social impacts of irrigation have been mixed, but stresses are growing. Farmers face increasing difficulty in fulfilling their role as trustees of land and water, as many countries approach the limits of water and land resources. The environmental costs and risks of irrigated agriculture have grown steadily in the face of shrinking water flows, overexploitation of groundwater, pollution, waterborne diseases, and destruction of natural habitats and livelihoods (following the draining of wetlands, for example).

Overall, worldwide advances in AWM have been significant, providing clear evidence of the potential for advancement through concerted action—but the remaining challenges are great, especially in Sub-Saharan Africa.

## The Changing Global and National Contexts

A global debate over water resources management and food security is sharpening the agenda for AWM. International research now reflects the growing importance accorded to water productivity, with major recent publications on the water-for-food challenge from the International Food Policy Research Institute (IFPRI), the International Water Management Institute (IWMI), and the United Nations Food and Agriculture Organization (FAO).

The global trade environment and national marketing strategies will be critical determinants of the action agenda that emerges from that debate.

The efficiency of irrigation depends on incentives provided by markets. Some nations have begun to move wholesale toward market-driven policies for AWM that focus on productivity and incomes; however, trade barriers, domestic restrictions on market development, infrastructure constraints, and poorly organized supply chains (particularly for smallholders) dampen the power of market incentives.

At the same time, the environmental and social aspects of AWM no longer lurk at the fringes of stakeholders' thought and action—they are now fully in the mainstream. The practices of water resources management must change to reflect our broadened understanding of how human activity, water resources, and ecosystems interact. Mirroring the new consciousness are integrated and basin management approaches and campaigns to manage demand.

The roles of various stakeholders are changing as well. There are tentative moves toward a greater role for water users, as a movement that emphasizes participatory irrigation management (accompanied by some decentralization) has caught on in more than 50 countries. Few public irrigation schemes have ever become financially self-sustaining, but recently private investments in smaller schemes, often by farmers, have been substantial. Public-private partnerships for large-scale irrigation have showed promise in a few cases, but the future of the PPP model in irrigation is not yet clear.

## Future Stresses and Risks

The population of the developing world is projected to increase by half over the period 1999–2030. The generic trend toward urbanization, too, is expected to continue. At the same time, self-sufficiency in food production is expected to decline, resulting in a growing imbalance in food trade. Nations with fast-growing economies will import a growing share of their food, increasing the importance of international trade terms and trends—and of macroeconomic stability at the national level. Poorer nations that are less able to pay for imports will need to develop irrigated agriculture and improve crop production.

The FAO estimates that to meet projected demand crop production in developing countries will have to increase at about 1.6 percent per year

over the next three decades. Irrigated areas will have to provide more than half of the increment through improvements in water productivity—which will require major programs of modernization of large-scale irrigation, improved productivity in the use of groundwater, and diversified production of higher-valued irrigated crops.

But most of the rest of the additional food that will be needed by 2025 will have to come from intensified rainfed farming, according to estimates by IFPRI/IWMI. That means that farmers will have to do a better job of managing water. The productivity challenge in rainfed farming is to introduce accessible technical solutions without increasing risks.

In irrigated and rainfed areas alike, growing water scarcity will have to be managed. In most parts of the world, the water available to irrigation is likely to be further constrained, and irrigation consumption will grow much more slowly than consumption for municipal and industrial uses. Water stress will create a strong push to improve water productivity and to strengthen the use of demand management. With modernization and greater efficiency, some potential exists for expansion of irrigated area, especially in Sub-Saharan Africa and Latin America. The FAO estimates that the irrigated area in developing countries could increase by almost 20 percent (40 million hectares) between 1997 and 2030.

But greater water scarcity means greater risks for the environment and for society. It will be essential to manage increased environmental risks from additional irrigation and from draw-downs of groundwater. The keys to successful risk management are the technical, managerial and economic instruments that have been developed progressively in recent years.

## Better Policies, Institutions, and Investments

To improve AWM, it will be necessary to consider options and trade-offs at multiple levels—the farm, the region, the sector, the nation, and the globe. For the farmer, access to assured water supplies is an essential prerequisite for stimulating saving and investment, for increasing income and assets sustainably, and for reducing vulnerability. Farmers' interests in AWM reform include irrigation

modernization, user participation, water rights, and demand-driven investment. Priorities for agricultural policies that promote profitable farming include market development (through better cooperatives, supply chains, and infrastructure), research, and technology transfer.

At the regional level there are several ways to improve AWM. These include modernizing large-scale irrigation, ensuring efficient least-cost water service delivery to meet farmers' needs, changing institutions to create a demand-responsive system of water service, involving water user associations and federations in modernization, improving the profitability of small- and medium-scale irrigation schemes through community-driven approaches, accelerating the development of sustainable groundwater irrigation schemes, and enhancing water productivity in rainfed agriculture through market-driven approaches that involve community participation.

At the sectoral level, policies for water resources management, agriculture, rural development, and the environment need to mesh to support sustainable, market-driven growth in rural incomes.

Nationally, the integration of policies into a broader framework of macroeconomic policy for growth is the key to productivity and profitability. Governments should be responsible for core public sector tasks related to AWM—among them integrated water resources management, environmental protection, research and technology transfer; and rural infrastructure. Governments should correct market failures through interventions in poverty reduction, water pricing, and the development of product and financial markets. Governments should also seek broader engagement of other stakeholders in decentralization and inclusion.

At the global level, AWM will be affected by trade reform, climate change, and international research. Trade reform policies will strongly influence water productivity and profitability in agriculture by opening up external markets. But impacts can be negative as well as positive, so vigilance is warranted.

## Toward an AWM Action Plan

AWM lies at the crossroads of four areas of public policy for sustainable growth: water resource man-

agement, agriculture, rural development, and the environment. The World Bank’s corporate strategies in these areas all call for a reengagement in AWM. According to those strategies, most growth should come from improvements in the *productivity* of agricultural water. Institutional improvements are needed to increase the efficiency of resource use, and water for agriculture has to be used sustainably within an integrated framework. Sustainable increases in farmers’ incomes are essential, as well, with a focus on the poor

As the AWM components of the corporate strategies are implemented, the World Bank must keep at least two objectives in view. First, it must identify options for reform of policy, institutions, and incentives that will accelerate productivity improvements and pro-poor growth; and, second, it must articulate priorities for investment in AWM (Table 1). Achieving those objectives will require consensus on the role of the public sector and other stakeholders—to be reached through a vigorous program of global discussions.

**Table 1. Investment in AWM—today and tomorrow**

	Present	Expected future investment emphasis	Accompanying measures needed
Large-scale irrigation	Large public command areas producing low-value staple crops using surface irrigation	Modernization, conjunctive use, market development	Large-scale irrigation governance changes (more decentralization, financial autonomy, user participation)
Small-scale irrigation	Farmer-financed schemes, based on run-of-the-river, small dams, and so on	Water productivity investments	Demand management measures; technology transfer and cost sharing arrangements for on-farm investment
Groundwater	Irrigation from tube wells, privately financed	Drip, fertigation, protected agriculture, market garden crops	Correct incentive structure; develop groundwater governance systems for sustainability
Rainfed improvements	Low-yield farming, vulnerable to risk	Water harvesting, supplementary irrigation, no-till agriculture	Major research and technology transfer agenda; incentive structure adjustments; targeted cost-sharing programs

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