

UK Parliamentary Inquiry into Global Food Crisis

Call for Evidence

Submission from the International Water Management Institute How to better manage water so that 9 billion people can be fed equitably, healthily, safely and sustainably by 2050

The International Water Management Institute (IWMI) is one of the 15 Centres of the Consultative Group on International Agricultural Research (CGIAR). Its Vision is “Water for a Food Secure World and its mission “To improve the management of land and water resources for food, livelihoods and the environment.” IWMI is headquartered in Colombo, Sri Lanka, and has offices in 12 locations in Asia and Africa including Vientiane (Laos), Hyderabad and New Delhi (India), Lahore (Pakistan), Tashkent (Uzbekistan), Addis Ababa (Ethiopia), Accra (Ghana) and Pretoria (S. Africa). In addition, we have a presence in Nepal, Vietnam and Syria. Our annual budget is approximately US\$24 m and this is provided by donors including the UK (DIFD also provides funds to the CGIAR Challenge Programme on Water and Food), World Bank, several European countries, the USA, Canada and Australia. We also receive funds from the Gates Foundation and the Rockefeller Foundation. Our funding is split with about 33% as core and unrestricted funds and 67% project restricted funds (tied to specific project outcomes).

Given that the enquiry is asking the question how can 9 billion people be fed equitably, healthily, safely and sustainably by 2050, we submit that this target has to be reached via planned strategic investments in research and development, innovation in farming systems and development of infrastructure (including roads and in the case of water, storage facilities ranging from small reservoirs to large dams). **IWMI advocates strongly that without sufficient water no amount of clever biotechnology and plant breeding for drought etc will allow us to grow enough food to feed 9 billion people.** The reality is that research into improving water storage, and in field water productivity has to be done in tandem with plant sciences research. Emergency food aid to countries facing drought, whilst a necessary measure, should in the longer term be replaced by increasing these

countries ability to withstand drought and climate change impacts through better water and agricultural management practices. Our submission consequently focuses on issues around water and food security.

Currently the world population is 6.7 billion and this large number is forecast to increase to about \$9 billion by 2050. Given a number of drivers and uncertainties that impinge on food production, the fact that close to 1 billion people are undernourished and the fact that we

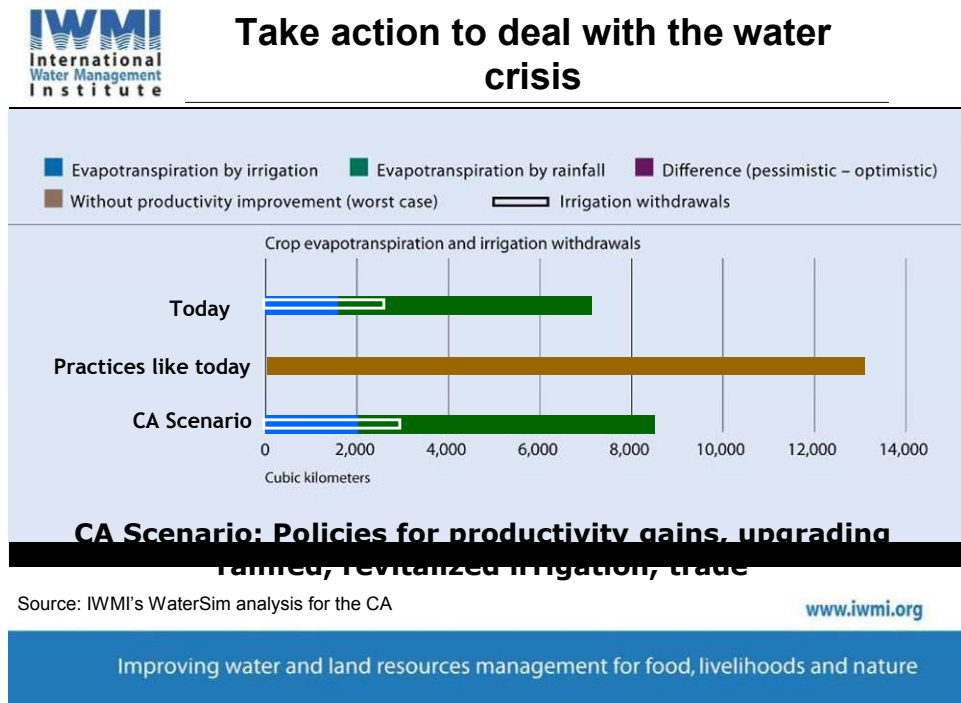


Figure 1. Water and land requirements to meet food demand in 2050 under different agricultural scenarios (from the Comprehensive Assessment, 2007)

have already come perilously close to a famine-based disaster last year, there has to be concern as to whether we can feed 9 billion people in the future.

Availability of enough fresh water for rainfed and irrigated cropping is probably going to be the single most important factor in our quest to feed so many more mouths. The IWMI led Comprehensive Assessment of Water Management in Agriculture (Comprehensive Assessment of Water in Agriculture, 2007) has already indicated that if we proceed with a “business as usual” approach, water scarcity will cause us to fail in this quest (Fig 1.). “Business as usual” means maintaining water productivity levels at their current low

rates. The Comprehensive Assessment was, however, more optimistic about the future if we can substantially lift water productivity levels via a combination of biophysical and engineering inputs and policy levers. Whilst some informed commentators indicate that we will only be able to produce enough food through expanding irrigation, the fact is that approximately 75% of production comes from rainfed areas. This is paralleled by the statistic that 80% of water evapotranspired by crops comes from rainfed farming areas and the remaining 20% from irrigation areas (Comprehensive Assessment of Water in Agriculture, 2007). However, the figures for gross value of production indicate that only 55% comes from rainfed areas indicating the importance of irrigation in terms of its higher productivity per unit area.

The availability of water and access to water will be major issues for economic development and for the livelihoods of the poor, given that they often suffer most when resources are scarce. Much of the developing world is already water scarce. Water scarcity can be described as being physical or economic in nature (Fig. 2).

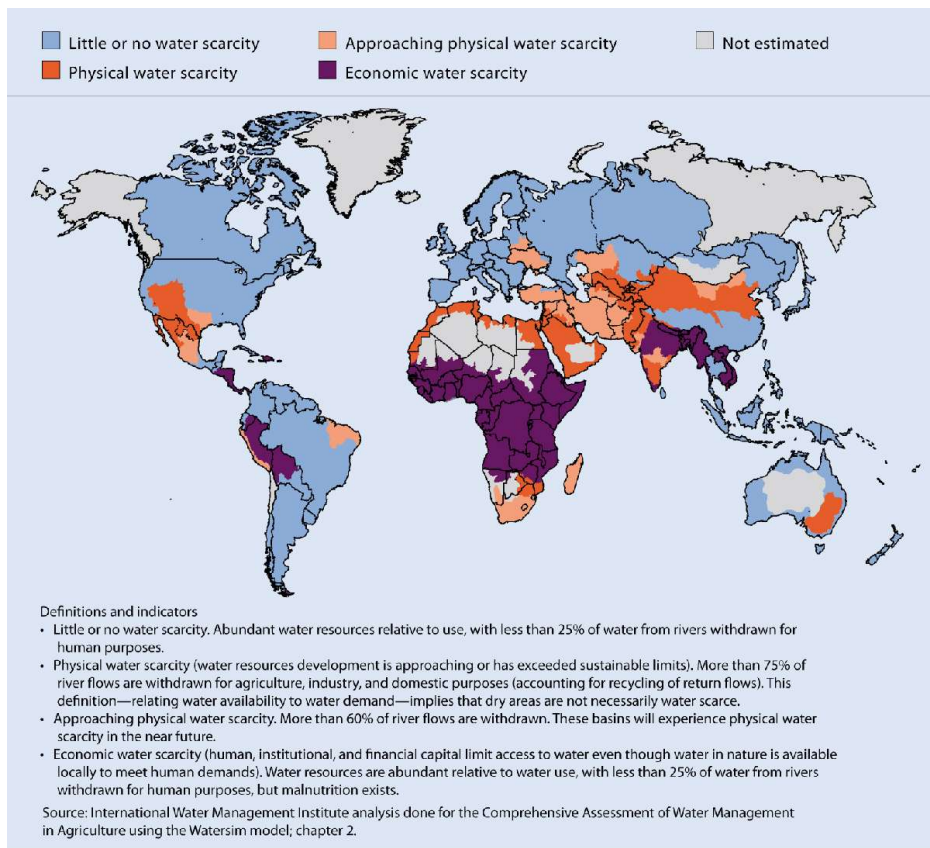


Figure 2. Global Water Scarcity in 2000.

Physical water scarcity results from the allocation of virtually all available water supplies leaving nothing for additional use or for the future, or for the environment. It has become a reality for many regions. Much of south and west Asia, China, the Middle East, northern and southern Africa, southern Australia, and south western USA are in this category. Physical water scarcity will put increasing pressure on water planners and managers to develop ways to better manage their existing water resources, to increase the productivity of water, and to develop “new” sources of water, e.g. “reuse” of wastewater. Many countries have already seen water users turn to groundwater often not cognizant of the high degree of connectivity between groundwater and surface water.

There are however, many areas in the developing world, in particular in Sub-Saharan Africa and parts of Southeast Asia, where there are still available water resources, but development and use of these resources has been constrained by lack of capital investment, or appropriate institutions to support the use of that capital. The resulting “economic” water scarcity has major ramifications for the poor and economic development in general, and its solution has the potential to bring global benefits and reduce stresses on other water scarce areas. The issue of insufficient infrastructure development also relates to limited investment in wastewater treatment facilities and the consequent widespread pollution of clean surface water bodies. Whether in areas of physical or economic water scarcity, a critical factor for the future will be the impact of climate change and ongoing and potentially increasing climatic variability on the availability and use of water resources be it for drinking water, hydropower or irrigation. The impact of climate change will vary depending on geography and scale. In some areas, total rainfall and intensity will increase causing flooding, crop damage and erosion. In other areas, total rainfall may decrease, wet seasons become shorter and variability more extreme with greater frequency of droughts. Learning how to store water better and providing supplementary irrigation to make up for erratic rainfall supplies will be the key to overcome these challenges.

DRIVERS OF WATER SCARCITY

The recent food crisis was driven by a number of factors including increasing demand due to population growth, increasing biofuels production at the expense of food crops, regional impacts of drought on agricultural water availability and changes in economic and trade policy in some countries. It resulted in a typical demand versus supply price increase, which affected the world's more much more than the middle class.

If we look into the future with respect to water availability, not only continuing population growth, but also other factors including dietary change to more water thirsty foods, urbanization, increasing biofuel development and hydropower production will all lead to further pressure on water resources and the environment.

Population growth impacts

Approximately 1.4 billion people are living in areas where water is over-appropriated and 1.1 billion of these people live in areas which are also suffering under severe water shortage. Falkenmark (2008) forecasts that by 2050, depending on the rate of fertility decline, the population in countries with chronic water shortages (above 1000 people per million cubic meters per year) will be 3 to 5.5 billion. To date, it has been the environment that has suffered as water use to availability ratios rise. Whilst many ecologists would argue that a 40% ratio is a threshold above which ecosystem health is impacted, there are a growing number of major rivers that hardly reach the sea any more leading to the concept of "closed basins." Included in this number for, example, are the Murray (Australia), Yellow (China), Krishna (India) and Colorado (USA). Population growth therefore represents the biggest single threat to water supplies and food production.

Dietary Change

On average, 1 calorie of food requires 1 litre of evapotranspired water to grow it. However, as large numbers of people in developing countries, particularly India and China, have grown more affluent, their taste in food has moved from diets dominated by grain and vegetables to consumption of more protein rich foods including dairy products and meat respectively. A diet without meat requires at least 2000 liters of water per day to produce compared with 5000 liters per day for a diet high in grain-fed beef. If we very conservatively use an average daily calorie intake of 2500, then to feed the 2050 world population of 9

billion, we will need to find an additional approximately 2,100 km³ of fresh water. This figure is undoubtedly conservative as it is based on a relatively low protein diet and minimal food wastage post farm gate.

Biofuel production

The global financial crisis has seen oil prices tumble from US\$150 per barrel to US\$37-50 over the last 6 months. Whilst this will undoubtedly have an impact on the attractiveness of ethanol production, growing fossil fuel demand over the forthcoming decades will inevitably see demand for biofuels similarly increasing. So called first generation biofuels production derived from corn, beans and sugar, create competition for not only land, but also water. If ultimately this competition takes over 10-15% of agricultural land, the impacts on food production will be very significant. However there are many uncertainties on the future impact of biofuels on food production given current rates of return, concern that their production is no more greenhouse friendly than fossil fuels and the potential advantages of new technologies that will be able to produce biofuels from crop residues and other wastes.

Urbanization, globalization and other factors

In 2008 the world saw a transition from one in which more people lived in rural environments to one with more people in the cities and towns. Whilst the turnover point has not yet been reached in the developing world, it is likely to be inevitable in due course. Bigger cities with more industry clearly already compete with agriculture for water resources and this competition will increase. Furthermore, cities generally have political power and the wealth to purchase water from other users. Currently, many agricultural developing countries and developed countries/states such as Australia and California utilize 70% or more of their total available water resources in the agricultural sector. Even if growing urban demand only requires a redistribution of 5% of this water, this will have a significant impact on agricultural production on a global basis.

Globalization will also have a range of impacts on food production. These will include demand for luxury goods such as cut flowers creating competition for land and water in regions close to international airports, product sourcing policies of supermarket chains in developing countries and the recent phenomenon of large food importing countries wanting

to buy up large tracts of land in developing countries for food production. Competition for water from the hydropower industry also means that water for agriculture is no longer available at the right place at the right time. All these kind of drivers may significantly impact food production in developing countries and have both beneficial and adverse impacts on their populations. Lastly, the negative impacts of restrictive world trade policies cannot be overlooked as a factor that may, in countries with abundant water and food production potential, limit the development of their production and marketing capabilities and thus their capacity to contribute to world food production as times get tougher.

Increasing pressure to meet the Millennium Development Goals in terms of water supply and sanitation for the poor also compete for both the water resource and scarce financial resources in the water sector.

Finally, ongoing loss of agricultural land due to urbanization and industrial development and land and water degradation often the result of population pressure will both continue to destroy or reduce the productivity of agricultural land.

Climate Change Impacts

While more detailed regional and local studies are needed to improve understanding of just how climate change will impact food production, there are some ominous signs already appearing that give major cause for concern. Firstly, rainfall and runoff records from countries with Mediterranean climates, such as southern Australia and Spain and Morocco are already indicating that declines in rainfall of up to 30% may be expected with climate change. Studies are also indicating that in some environments for each unit decline in rainfall there is up to a threefold decline in runoff. Data from Central Asia, also suggest that in the long term (30-50 years), runoff from mountain snow melt may also reduce by at least 30%. In some of the subtropics of Africa, rainy seasons are starting later, have more intense rainfall and are of shorter duration. Even in areas where rainfall is predicted to increase, increases in rainfall intensity may lead to more erosion and flooding. To what extent, such climate change and variability induced impacts on water availability may be compensated for by production being enabled in areas previously too cold for grains is uncertain, but an inescapable fact is that many of the world's poor live in the tropical and subtropical countries likely to be deleteriously impacted by climate change.

So taking the above drivers of water scarcity into consideration, **it is highly likely that as we move towards 2050, the current share of water going to agriculture and food production will decrease from approximately 70% to somewhere nearer 60%.** This makes the findings of the Comprehensive Assessment even more pertinent. In answer to how we can do business differently, the Comprehensive Assessment proposed the following policy actions for consideration by all governments:

Policy Action 1. Change the way we think about water and agriculture. Thinking differently about water is essential for achieving our triple goals of ensuring food security, reducing poverty and conserving ecosystems. Instead of a narrow focus on rivers and groundwater, view rain as the ultimate source of water that can be managed. Instead of blueprint designs, craft institutions while recognizing the politically contentious nature of the reform process. And instead of isolating agriculture as a production system, view it as an integrated multiple use system and as an agroecosystem, providing services and interacting with other ecosystems.

Policy action 2. Fight poverty by improving access to agricultural water and its use. Target livelihood gains of smallholder farmers by securing water access through water rights and investments in water storage and delivery infrastructure where needed, improving value obtained by water use through pro-poor technologies, and investing in road and markets. Multiple-use systems – operated for domestic use, crop production, aquaculture, agroforestry, and livestock – can improve water productivity and reduce poverty.

Policy action 3. Manage agriculture to enhance ecosystems services. Good agricultural practice can enhance other ecosystem services. In agroecosystems there is scope to promote services beyond the production of food, fiber, and animal protein. Agricultural production does not have to be at the expense of other services that water provides in rivers and wetlands. But because of increased water and land use, and intensification, some ecosystem change is unavoidable, and difficult choices are necessary.

Policy action 4. Increase the productivity of water. Gaining more yield and value from less water can reduce future demand for water, limiting environmental degradation and easing competition for water. A 35% increase in water productivity could reduce additional crop water consumption from 80% to 20%. More food can be produced per unit of water in all types of farming systems, with livestock systems deserving attention. But this optimism should be met with caution because in areas of high productivity only small gains are possible. Larger potential exists in getting more value per unit of water, especially through integrated systems and higher value production systems and through reductions in social environmental costs. With careful targeting, the poor can benefit from water productivity gains in crop, fishery, livestock, and mixed systems.

Policy action 5. Upgrade rainfed systems – a little water can go a long way. Rainfed agriculture is upgraded by improving soil moisture conservation and, where feasible, providing supplemental irrigation. These techniques hold underexploited potential for quickly lifting the greatest number of people out of poverty and for increasing water productivity, especially in Sub-Saharan Africa and parts of Asia. Mixed crop and livestock systems hold good potential, with the increased demand for livestock products and the scope for improving the productivity of these systems.

Policy action 6. Adapt yesterday's irrigation to tomorrow's needs. The era of rapid expansion of irrigated agriculture is over. A major new task is adapting yesterday's irrigation systems to tomorrow's needs. Modernization, a mix of technological and managerial upgrading to improve responsiveness to stakeholder needs, will enable more productive and sustainable irrigation. As part of the package irrigation needs to be better integrated with agricultural production systems to support higher value agriculture and to integrate livestock, fisheries, and forest management.

Policy action 7. Reform the reform process – targeting state institutions. Following a realistic process to suit local needs, a major policy shift is required for water management investments important to irrigated and rainfed agriculture. A wider

policy and investment arena needs to be opened by breaking down the divides between rainfed and irrigated agriculture and by better linking fishery and livestock practices to water management. Reform cannot follow a blueprint. It takes time. It is specific to the local institutional and political context. And it requires negotiation and coalition building. Civil society and the private sector are important actors. But the state is often the critical driver, though the state water institutions are often the most in need to reform.

Policy action 8. Deal with tradeoffs and make difficult choices. Because people do not adapt quickly to changing environments, bold steps are needed to engage with stakeholders. Informed multistakeholder negotiations are essential to make decisions about the use and allocation of water. Reconciling competing demands on water requires transparent sharing of information. Other users – fishers, smallholders without official title, and those dependent on ecosystem services – must develop a strong collective voice.

IWMI is concerned that **without concerted international investment in water resources development and management there will be increasing possibilities of conflict around the world.** Current potential flash points for international conflict over water resources already include the Middle East (Jordan, Syria, Israel), Central Asia (Uzbekistan, Tajikistan, Kyrgyzstan), and South Asia (Pakistan, Nepal and India). Water scarcity is already of major concern in southern India and northern China, where major droughts could lead to starvation and civil unrest if external conditions mean that there is a shortage of potential food imports. In our view, it is not a question of if, but when the next food crisis occurs and **we then expect an increasing frequency of food crises unless action is taken.**

The current level of donor funding for irrigation infrastructural development (Fig. 3) has dropped significantly over the last 20 years. However, private investment in groundwater pumping for irrigation has allowed irrigation area to increase. The major problem is however, that such private pumping is essentially anarchistic and not subject to regulation

and control. As a consequence groundwater use in much of India China and elsewhere is unsustainable. Similarly expenditure on agricultural R&D funding in general has also declined

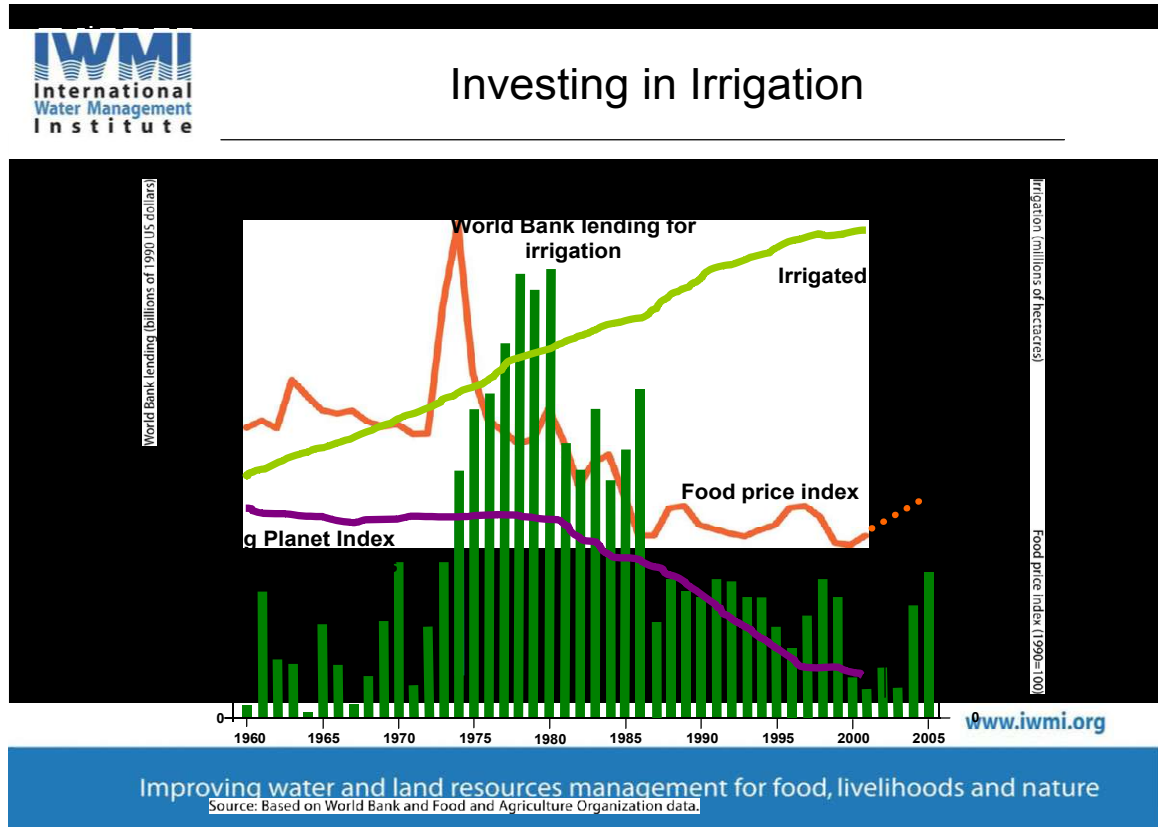


Figure 3. Irrigation investment, food prices and environmental decline.

with a concomitant decline in agricultural yield growth. Roles that the UK can take to assist in improving the situation relate to both encouraging and promoting investment in reinvigorating irrigation systems in Asia, investing in new irrigation systems in Africa, investing in looking at new ways of improving dryland agriculture via supplementary water storage and use of groundwater and promoting institutional and policy reform in water management across the board, whilst maintaining and increasing funding for the R&D required to lift water productivity in agriculture in dryland and irrigation systems.

In general, we would observe that the UK is not the force it was in academia with respect to agricultural soil science and water resources. There is a growing market for professionals trained in these areas to work on the global food challenge and consideration should be given to strengthening relevant university departments and to increasing collaboration with agencies such as the CGIAR.

Given the current drivers, water scarcity will become an increasingly significant impediment to achieving food security at local, regional and potentially global levels over the next 40 years. IWMI advocates a holistic approach to tackling this that includes across-the-board water productivity increases, policy and institutional reform and the freeing up of trade barriers that promote the flow of “virtual” water from water rich to water poor areas.

Conclusion – Recommended Actions

The following conclusions and recommendations are made based around the premise that water issues are fundamental to food security as outlined in this paper.

- Investment in water management in developing countries needs to be significantly increased to tackle the increasing number of issues arising from competition for water to ensure that global food security is not compromised.
- Investment should be targeted to assist projects and countries to take an integrated approach to water management that takes into account all the competing uses of water, social aspects and environmental impacts.
- Gender issues need to be integrated into all water and food production solutions.
- Investment in better water management practices and policy reform should be made around scientifically based solutions. Similarly all on-ground water management aid work must be based on sound scientific research.
- Investment should be targeted to assist policy makers in developing countries through the provision of improved data and information and complementary decision making systems and tools that will aid better water management strategies and practices.
- UK aid to the water sector should ideally take a collaborative and participatory approach, with DFID working hand in hand with the other development agencies, UK universities, local partners on-the-ground and scientific agricultural specialists like the CGIAR/IWMI.
- More investment is also required in research and development for water management and policy reform. However, this investment should be targeted at projects that take a holistic that integrates research with development impact via uptake strategies. The findings of the Comprehensive Assessment suggest a number of effective ways in which new research can be channeled.

References

Comprehensive Assessment of Water Management in Agriculture 2007. Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture. London: Earthscan and Colombo: International Water Management Institute.

Falkenmark, M. 2008. Peak Water – Entering an Era of Sharpening Water Shortages.
Stockholm Water Front. Dec. Issue, 10-11. Published by SIWI (www.siwi.org)