

Summary and Conclusions

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Introduction

There are growing concerns that global changes, including climate change, will have adverse impacts on natural and human systems. These may vary in time and space. More specifically, concerns are increasing about the likely implications of global change for poverty, economic growth, ecosystem services, livelihood opportunities, and overall human development. These impacts are expected to affect significantly the most vulnerable—women, children, the poorest, and the disadvantaged. They are also expected to affect natural systems adversely. At the same time, the water and agricultural sectors, the two main sectors responsible for food production in the MENA region, are expected to be impacted by these changes at the basin, sub-basin, national, and regional levels.

There is widespread agreement that an effective response requires revision of existing policies, laws, and strategies at national and local levels. The revision, which should be based on science, should be accomplished in an integrated and participatory fashion and should reflect the need to adapt flexibly to global change. This will ultimately require the development, strengthening, and coordination of scientific knowledge upon which policies can be based. It will also require improvements in governance systems and the creation of institutional systems that allow more transparent and participatory decision-making processes. Such processes will need to acknowledge the interests of all relevant stakeholders in order to ensure that the adaptive capacity of both social and ecological systems is improved under various change scenarios.

This chapter summarizes the main conclusions drawn from the keynote addresses, thematic presentations, and the roundtable discussions and deliberations of the 8th biennial meeting of the Rosenberg International

Forum on Water Policy held in Aqaba, Jordan, under the theme “Managing Water in the 21st Century: Challenges and Opportunities.” The main conclusions drawn under each theme are summarized below.

Managing Water under Global Change

Growing water stress coupled with the current unsustainable human practices including the overuse of natural resources, generation of contaminating substances, alteration of natural systems, and unplanned urban expansion, have resulted in serious social, economic, and environmental threats that lead to multiple global threats such as climate change. One consequence of these changes is that the possibility of predicting the future from past records is now viewed as untenable. This, in turn, undercuts the validity of business-as-usual scenarios. What is needed are effective policy reforms to attenuate or stop unsustainable patterns of human interventions that increase water stress. These trends need to be reversed, not just halted, in order to create an environment in which the rebuilding of ecological, hydrological, and social systems can occur. Moreover, the fashioning of policies to achieve such outcomes must acknowledge and rely upon underlying scientific knowledge. This will require new modes of collaboration and the strengthening of collaborative efforts between scientists and policy makers.

Reversing the situation will also require a new approach in the form of a globally negotiated and considerably strengthened urban eco-hydro-social water contract. The water-energy-food triangle and its various interrelationships should be the focus of the new contract.

There are a number of highly desirable characteristics of an effective urban contract. These include linking water security to public health protection, flood protection, environmental protection, and the creation of social amenities. The contract should also encourage and support sustainable management of limited resources and otherwise promote intergenerational equity.

Many mechanisms can be used in water-related dialogues to bring scientists, politicians, and other stakeholders together. However, such mechanisms are still characterized by conventional ways of framing and managing the problems to which they are addressed. In these instances progress is hard to achieve and, in some cases, result in a worsening of the problem. The challenge of needed reforms is to promote the emergence of

more comprehensive and integrated sets of regional frameworks, such as the European Framework Directive. Such directives should ensure that sustainable and participatory management of resources at the basin level accounts for the interests of all stakeholders, resource scarcity, and the carrying capacity of the environment at hand. It will be important to recognize that institutional fragmentation and asymmetries in governance and in economic and technical capabilities across implementing countries are serious obstacles to successes. Successful creation of adaptive frameworks will require addressing these obstacles. Failure to do so can lead to crises and conflict in water-stressed regions such as the Middle East and North Africa.

The reform of current policies and practices will be especially crucial for countries whose economies are not fully developed. Such countries must still rely on intensive use of natural resources to support economic development and contribute to food security. Many governments still lack the institutional and governmental arrangements needed to undertake the often difficult reforms required to achieve competitive advantage and promote sector survival. These sorts of reforms are also vital in promoting intergenerational equity as well as the social and environmental resilience that will be required to sustain life as the global waterscape responds to the emerging hydroclimatic realities.

Regional Planning and Management

At the water basin level, the success or value of water management strategies and regimes depends on high levels of transparency in governance, the legitimacy and effectiveness of management bodies, and information availability, scientific learning, and knowledge sharing among the various parties involved. Additionally, the level of stakeholder participation in decision making, clarity in defining roles and responsibilities, and the existence of clear conflict-resolution mechanisms are also important determinants of success. Rules and mechanisms that acknowledge uncertainty and possess the flexibility to adapt to changing circumstances are also vital determinants of successful water basin management strategies.

An important conclusion is that there is no “blue print” or “one size fits all” set of institutional arrangements that can be applied everywhere. Institutional design must be compatible with the underlying bio-geophysical

systems in which they are based. The design must also be sensitive to and reflective of the political, economic, and social contexts in which they operate. At the same time, institutional design should account for the history, culture, and sense of place that characterize the region in question. The contextual approach will almost always lead to appropriate accommodations with and adaptation to local and regional variances. This is true of institutional design as well as other factors related to management performance. It is also true that good practices and successful management models and institutional designs that exist in one basin can be customized to account for the social, economic, cultural, political, and environmental conditions that prevail in other basins. In some instances this customization can contribute to the elimination of potential conflicts that might otherwise emerge from the discourse among the concerned parties.

Institutions that facilitate basin-wide negotiations and the reaching of agreements are frequently effective in avoiding or resolving conflict and in optimizing the gains of all parties. This means that parties should enter negotiations in good faith and without unclear or hidden objectives. In addition, when negotiations take place among unequal parties sharing the same resource in a basin, the strong, hegemonic party should not dictate terms to weaker parties in order to maximize its gain or to maintain an unequal status quo. Rather, to ensure that agreements will be lasting and sustainable, the terms should address the interest of all parties in a reasonable and equitable way, and agreements should give every party the sense of ownership and respond to the aspirations of all. Failure to adopt such arrangements means that the resulting agreements, if any, will remain fragile and unlikely to achieve anticipated benefits to any of the engaged parties in the long term. On the contrary, they might even encourage more extreme and unsustainable practices than would otherwise occur.

The Fate of Agriculture under Global Change

The economies of low-income countries are still largely dependent on the economic return from agriculture. This dependency is unlikely to change over the next decade or so. Simultaneously, these economies are likely to become more vulnerable as aridity increases, precipitation declines, and temperatures rise as is expected in the MENA region. Water availability will likely be reduced significantly even while demands for water, fueled by

urban growth, intensify. Increased demand for domestic use will undoubtedly result in further reduction in the quantities of water available for agriculture. The likely outcome is that agricultural production and employment will decline and rural communities that are overwhelmingly dependent on agriculture for both livelihoods and cultural orientation will be adversely affected. The challenge for the countries in question is to redefine their existing agricultural policies and upgrade traditional practices and knowledge to improve their capacity to adapt to changing circumstances. More precisely, for agriculture to continue providing the anticipated support to national economies, to contribute to food security, and to improve farmers' livelihoods in the MENA region, various policy measures and practical actions need to be considered. Among the policy measures deserving of attention are the following.

- **Change the emphasis from land to water.** The traditional strategy of maximizing yield per unit of land may be appropriate when land is the limiting resource for agriculture. Where water is the limiting resource, strategies should focus instead on maximizing water productivity—the return from a cubic meter of water rather than a square meter of land.
- **Change current land use and cropping patterns.** These changes should be focused on growing more water-efficient crops and utilizing more water-efficient cropping systems. Many crops that are grown in water-scarce areas are, in fact, unsuited for arid conditions even while more efficient and better adapted alternatives exist. New cropping patterns should be the subject of enhanced programs of research that can delineate and characterize the comparative advantages of different agroecologies. The result should be to replace inefficient crops, reduce water demand, and increase competitiveness.
- **Change the way water is valued.** Water prices rarely reflect or even approximate the true conditions of scarcity. At the same time, such policies should accommodate the instances in which water is a common or shared resource and acknowledge matters of equity and sustainability.
- **Change trade policies.** Such policies should be designed to encourage the importation of goods that require large quantities of water for production. Trade policies should acknowledge that large amounts of virtual water can be acquired through importation. Such policies can

reduce water demand and at the same time support existing farming systems and their associated social and economic systems.

- **Design economic reforms in a way that removes subsidies.** Production should focus on crops that are relatively high in value, not on low-value crops that are economical to produce only when subsidized. Water management reforms should induce gradual changes in water use efficiency at the farm level. The water reforms must include implementation of price mechanisms to encourage great water use efficiency. These price mechanisms can be tailored through block water grants to ease the income effect on farmers while forcing them to face higher prices for incremental increases in water use. These reforms should increase the rate of economic growth and overall employment even though some studies suggest that they may not increase agricultural employment. Worse, there is a significant possibility that reforms will reduce the welfare of poor farmers and some agricultural workers even as they benefit wealthier growers with greater access to land, capital, and technology plus an enhanced capability to respond to changing market conditions. Thus, while it appears that reforms are a crucial aspect of the MENA region's ability to meet the challenges of declining water availability, such reforms will be difficult to implement because they may undermine prosperity.
- **Invest in rural communities.** Considerable investment will be needed to facilitate agricultural development and counterbalance the harsher socioeconomic effects of transition by improving other aspects of rural life. To facilitate agricultural modernization and boost rural economies, investment should focus on education, health care, finance, communications, transportation, and cultural opportunities. These investments will improve welfare, labor productivity, and the capacities of rural residents to adapt to change. Agricultural modernization, when combined with the development of complementary commerce and services, can be especially effective in improving the quality of life in rural communities.

In addition to the policy measures enumerated above, are a series of practical measures should also be helpful. The most important of these are discussed below.

- **Change attitudes towards basin-level cooperation.** Water use efficiency may be improved at the farm level but cannot be maximized

unless it is also accomplished at the basin level. This requires cooperation, especially among countries that share river basins. Water scarcity and associated problems that impact entire basins must be addressed collectively by neighbors through data exchange, transparency, and collective policies and decision-making.

- **Diversification and intensification of production systems.** Successful adaptation to climate change will require diversification of farm systems to improve ecosystem resilience, reduce risk, and simultaneously create new income opportunities. System diversification includes diversification of crop rotations. One example would be the inclusion of legume crops in cereal systems. Such practices also contribute to the maintenance of soil fertility and support the process of diversifying into higher-value crops such as dry land fruit trees, protected (greenhouse) agriculture, and the cultivation of herbal, medicinal, and aromatic plants.
- **Reduce production and energy costs.** The fundamental driver of agricultural technology adoption by farmers is to obtain an increased return on their investment either by increasing production or reducing costs. Conservation agriculture achieves both. It combines minimum soil disturbance (zero tillage), stubble retention, crop rotations, and early sowing of crops. It offers multiple benefits including savings in time, fuel, and machinery costs for land preparation; improved soil structure with better soil moisture conservation; higher potential yields and reduced soil erosion.
- **Capacity development.** In order to mount research programs to meet the challenges of increasing agricultural production in the face of intensifying aridity a cadre of well-qualified researchers will be needed. Evidence shows that the MENA countries in general are facing a “skills-gap”: an acute shortage of qualified agricultural researchers. Greater investments are needed in agricultural research, capacity development, and institutional support. Strengthening the agricultural innovation systems (research, education, and extension) will be essential. Additionally, more investment will be needed to develop a new generation of scientists and technicians who can carry these efforts into the future.
- **Strengthen the agricultural economy.** Better agronomic practices can be encouraged by creating appropriate commercial, technical, and

regulatory environments. Similarly, the agricultural innovation system can be strengthened through research, education, and extension.

- **Employ science and technology fully.** Science and technology have a significant role to play in helping to overcome the challenges faced by the MENA region. An integrated approach will be need, one that addresses the problems of enhancing agricultural productivity and managing natural resources with greater care. Thus, for example, programs of deficit irrigation and the use of saline water hold much promise. The successful development of such programs will require a strong scientific underpinning, and technological innovations as may be necessary to make such practice possible.
- **Crop improvement through conservation and the use of genetic diversity.** The MENA region contains tremendous diversity in cultivated landscapes and wild species. These provide an invaluable resource in the quest to find new methods of coping with changes in temperature, drought frequency, and new diseases and pests. The use of both conventional plant breeding and biotechnology to develop improved germplasm can significantly enhance the prospects for higher crop yields, devising production systems better adapted to climatic change, devising improved crop management systems, and developing better protocols for integrated pest management. All of these will be pivotal in ensuring food security and enhancing the resilience of agroecosystems in the face of climate change.

Bridging the Science and Policy Gap

There was general agreement among the participants that, while additional research is needed, there exists much research and background knowledge on the various dimensions of the intensifying water scarcity that are not actively utilized. Part of the explanation lies with the failure of scientists and policy makers to bridge the gap between them and facilitate the generation of effective, science-based policies. Such policies are vital for the development of water strategies and governance arrangements required to improve adaptive capacity and resilience in ecological and social systems.

This acknowledged gap between scientists and politicians at national or international levels is frequently seen as one of the major causes of the absence of widespread political support for science-based policy. Unless

scientists develop better communication tools and address politicians in understandable ways this gap will continue to widen. Scientist will continue to talk to themselves and politicians will continue to focus on the water issue from narrow political perspectives or short-term actions at the local levels that tend to guarantee reelection at the expense of broader and more far-sighted action.

The relationship between science and policy is changing. The public funding support for university-based science and government science has declined significantly. It appears that the private sector is in the process of assuming a support role. The consequences of this include:

- the private sector will acquire a disproportionately large share of influence over scientific agenda setting with less attention to questions affecting populations broadly rather than private profit-making.
- the way in which science is conducted and the likely neglect of basic science.
- the interpretation of science for public policy-making and implementation.

Given the importance of effective institutional arrangements for managing water and for bringing relevant science to bear on water problems, it makes sense for such arrangements to be regularly reviewed in an effort to minimize or eliminate fragmentation and to clarify roles, responsibilities, and lines of communication among both water and science agencies. It will also be helpful to identify instances in which collaborative machinery between institutions is absent or ineffective and make reform efforts. Effective institutional arrangements will be critical to facilitate clear communication among all of the players.

Finally, it is important that everyone connected with the management and use of water resources understand that developing and maintaining an effective national water science system is a responsibility that must be shared among all sectors. It is not the responsibility of government alone.