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# Mediterranean Water Resources Planning and Climate Change Adaptation

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## Summary

Over the past decade, climate change has emerged as a major global and regional development issue alongside sustainable development, environment conservation and protection. Many of the concerns overlap or converge in the water resource management field. In fact, current thinking is to view responses to climate change as an integral part of decision-making on sustainable water resources management (e.g. concerning land-water-environment interactions). Responses would also be integrated with national economic, social and regional development planning, and harmonized with other resource and environmental management activities at both policy and practical levels.

Since ratification of the UNFCC (1992), which called for all Parties to implement measures for both mitigation and adaptation to climate change, the National Communications of Annex 1 and non-Annex developing countries from the Mediterranean, as elsewhere, have largely focused on GHG emission reduction measures. The mitigation actions will be reinforced by the commitments made under the Kyoto Protocol (1995) – though Kyoto itself is yet to be ratified. However, as provided for under Article 4 of the UNFCC, attention is now shifting to adaptation. Here, most scientists now agree that climate change is inevitable and that we are probably in the early stages of more accelerated change. Thus instead of being a secondary, longer-term consideration, "planned" adaptation requires more immediate attention. This concern was reflected in the recent Ministerial Declaration from the Conference of Parties to the UNFCC (COP-8) held in New Delhi (Nov 2002).

IPCC's Third Assessment Report (2001) provides a comprehensive assessment of climate change impacts, vulnerability and adaptation using global and cross-regional scale climate models. Though the science, and thinking that it embodies is constantly evolving, it sketched out a broad framework for undertaking impact and vulnerability assessments, and identified generic adaptation measures (e.g. policy, technology and institutional responses) appropriate in different regions, situations and sectors of the economy. By analogy, the IPCC work provides directional guidance for how Mediterranean countries may proceed in this area. The UNFCCC Secretariat has also prepared generic guidelines for National Adaptation Programmes of Action (NAPAs), which the Conference of Parties to the UNFCC adopted in 2001(COP-7), though as yet only a few counties have prepared NAPAs.

In the Mediterranean, it is recognized that measures are needed both to improve the capacity to adjust to today's hydrological variability and extremes (floods and droughts) in dynamic circumstances (e.g. with current demographic, economic, land-use and regional development pressures), and to reduce the significant vulnerabilities of society, the economy and the environment to future effects. In the Mediterranean context also, adaptation means that special effort is needed to help the poorest communities or groups in the region, who typically have limited resources, less capacity to adapt, and are consequently the most vulnerable of all in society.

This paper examines some implications of climate change for water resource planning in the Mediterranean and steps to produce adaptation plans. The paper is presented in three parts:

Part 1: Climate change: influences on water resource systems and their management
Part 2: Climate sensitive water resource planning approaches and methods
Part 3: Climate adaptation in the water resources sector- toward a framework

The first part profiles the current Mediterranean water resource situation and highlights the projected first-order impacts of climate change on hydrological systems in the region, and second-order impacts on water-dependent sectors, such as irrigation and water supply. Adaptation planning is then placed in the context of overall water resource planning. Here it is simply argued that Agenda 21 (1992), and the Dublin Principles (1992), provide the wider conceptual framework for adaptation planning. Moreover, adaptation planning processes, and plans – that are necessary as discrete, separate activities initially to help focus attention and mobilize public debate and consensus on the measures - would not be seen in isolation, but rather integrated with, and inform existing water resource planning and management activities. Investing in adaptation to climate change would essentially be the same as investing in sustainable development – with high social and economic returns.

The second part of the paper looks more closely at a selection of seven water resource planning issues, tools and methodologies. It shows how these need to be systematically reviewed in light of climate change, and revised accordingly. In fact, resources managers in the Mediterranean increasingly recognize that the region's water resource systems have been largely planned, designed, and are today managed on the basis of past hydrological conditions. Because of this, the "re-tooling" of planning procedures, and the re-planning and adjustment the water resource system may become a defining feature of water resource planning in coming years. Certainly, many infrastructure components (from dams and flood control structures to urban stormwater systems) need to be adapted initially, and thereafter on a dynamic basis. Risk assessments and life-cycle analysis approaches, for example, would enable planners to better account for increased uncertainty, and cope with unforeseen issues that may arise such as critical thresholds for responses to climate change and non-linear responses in interdependent human and natural systems.

The third section of the paper considers some wider issues and steps to establish national adaptation planning processes, and those more specifically for water resources. This reflects the guidance provided by the IPCC and UNFCCC Secretariat, as well as insights from work by Mediterranean countries and European Union countries on this theme.

- ***Adaptation may require departures from conventional water resource planning practices***

Broadly, adaptation would be a continuous process, where complementary elements of an effective water resources management system would be developed and strengthened concurrently. This may involve small adjustments, evolutionary changes, or more radical reorientations in current water resource planning practices. For instance, depending on progress already made incorporating sustainable practices in planning systems, the steps might include: more clearly separating responsibilities for overall water resource planning (e.g. concerned with water availability, quality, access and allocation) from sector-specific service delivery; moving from supply to demand-oriented planning in service provision; shifting from reactive to anticipatory planning; using participatory approaches and applying the subsidiary principle (the institutional principle of the Dublin Principles) that involves taking decisions at the lowest appropriate level; and, broadly becoming more strategic, interactive, innovative and dynamic in developing solutions to water problems.

- ***Strategic Orientations: building "climate headroom" into water resource systems and their management to improve adaptation capacity***

A major strategic aim in adaptation is to increase the flexibility in the water resources system and how it is managed. Three broader strategic orientations or strategies to achieve this are: (1) reducing the risk associated with hydrological variability, and secondly to extreme events; (2)

closing the demand-supply gap in water resources; and, (3) balancing human and nature needs. The relative emphasis placed on each strategy and the interactive mix of measures (policy, institutional, non-structural and structural) for each strategy would be determined by assessing vulnerabilities in relation to current management practice and scenarios for climate change. The table below illustrates the type of measures that might be associated with each strategy.

**Strategies and Measures to Build in "climate headroom" into water resource systems and their management**

| Strategies and Strategic Orientations | Representative Responses / Measures |
|---|---|
| **Reducing the risk to hydrological variability, and secondly extreme events** | ▪ Reinforcing/introducing flood and drought preparedness programmes<br>▪ Modifying existing infrastructure and operations to cope safely and perform in more variable and extreme conditions;<br>▪ Reinforcing or introducing watershed management measures to regulate intensified runoff, erosion and sediment (more frequent storms, torrential downpours)<br>▪ Sustainable management of urban stormwater (e.g. steps to increase infiltration and increase the capacity of storm water systems) |
| **Closing the demand-supply gap in water resources** | ▪ Adjusting water allocation policies to higher value uses<br>▪ Introducing greater flexibility to allocate between competing demands and matching water quality with demand<br>▪ Balancing demand-supply for off-steam water services with:<br>- Demand side measures (end-use technologies, recycling and conservation)<br>- Supply side measures (conventional and non-conventional sources)<br>▪ Optimising existing water regulation infrastructure (operations and retrofit) to most efficient uses and ongoing changes in water allocation priorities<br>▪ Conjunctive use surface and ground water and their management |
| **Balancing human And nature needs** | ▪ Introducing policies that recognize environment needs in water allocation<br>▪ Continuous update of water quality (surface and ground water) linked to hydraulic variability (river flow conditions and current pollution levels)<br>▪ Recognizing and sustaining ecological services from rivers and wetlands (e.g. for ground water recharge and water purification)<br>▪ Adapting minimum environmental flow provisions (surface and groundwater) to the hydroperiod of wetlands |

- ***Mediterranean countries face common challenges adapting water resource systems to climate change; these are greatest where the demand-supply gap is increasing and deeper structural changes in demand will be needed***

In all Mediterranean countries there is a common need to adjust to variability and extremes and balance human and nature needs. For example, all countries need to invest in more and better hydrometric monitoring and warning systems, and link these with planning measures and operating strategies for infrastructure (e.g. updating hazard classifications and land zoning, drought indexing and operating strategies of reservoirs). There is also a common need to prepare for gradual sea level rise and the effects it will have along the 46,000 km of rapidly developing coastal zones of the Mediterranean Sea, by creating incentives or requirements to move people and structures out of vulnerable areas (e.g. defend, or phased strategic retreat, eliminating maladaptive practices)

The urgency to focus the demand-supply gap closing measures is clearly greatest in countries, or basins, where water demand now exceeds or threatens to outstrip sustainable levels of supply, and consequently supply strategies alone can no longer physically meet growing needs. This will require much greater attention to water allocation policies and related measures to increase

the flexibility of the system to physically allocate water to different uses, and much more effective use of pricing and other economic instruments for demand management and recycling of water that relieve pressure on systems, and reduce economic loss- while longer-term structural shifts in demand and use of non-conventional supply technologies are achieve. Here, supply measures are likely to be more costly than demand-side measures, even before environmental impacts (market and non-market factors) are taken into account.

However, beyond demand management, more innovative policies and philosophies toward water use would be needed for systems at their hydrological limits, such as: strategically rethinking the matching water quality to end-use demands; and the sequencing of withdrawals in the basin to optimise recycling and water quality; and managing the interaction of surface and ground water resources for optimal storage, also taking into account increased evaporative losses in hotter, dryer climates. More fundamental transformations in how water is viewed in development decisions would also be needed. For example, water supply would have to become an explicit factor in all major land use, regional development, and industrial and municipal development decisions, or provisions made for non-conventional supply to be factored into the development costs.

- ***National processes would provide directional guidance for sector-based measures***

It is now widely accepted that a national process and plan is needed to coordinate responses to climate change across sectors, and to harmonize planning in the different sub-sectors, and at different levels of water resource management. In fact, there may be a hierarchy of plans (or guidance papers, procedures, etc.) at the national, sectoral, basin and municipal or local levels that correspond to how the various responsibilities for planning and decision-making on water resource management are allocated within the country.

The UNFCCC/IPCC nevertheless stress that cost-effective strategies and measures for adaptation must be identified and implemented nationally and locally, engaging policy-makers and resource managers at all levels of government, and involving water users, the private sector, civil society and non-government organizations. This would be best achieved in overlapping "top down" and "bottom up" processes. The strategies and measures need to take into account important social and economic implications, and would be implemented on a stage-by-stage basis, in a prioritized way.

- ***While measures would be needed on a number of fronts, Low-Cost or "Least Regrets" Measures are important starting point***

Adaptation measures that would improve the performance of water resource systems in today's climate conditions, whose further delay could increase vulnerability, or lead to increased costs at a later stage, are sometimes referred to as "win-win", or "least-regret" measures. They would be effective and sensible as resource management measures and have high social and economic returns, even in the absence of significant climate change effects. These are illustrated in the table that follows. Generally, these are regarded as an important starting point.

- ***Institutional Mechanisms are In Place for Initial Stages of Adaptation Planning***

In most Mediterranean countries institutional coordination mechanisms are already in place for climate mitigation planning, and these can be used in the initial stages of adaptation planning. These include the focal points for UNFCCC or IPCC responses and Ramsar, as well as interdepartmental panels or groups, and income cases Commissions that governments have established to study and coordinate responses to these issues.

Overall, the Mediterranean climate is highly variable and all evidence is it will increase in future. The pressure on resource systems currently under stress will increase. This will leave little room to manoeuvre, such as in drought situations. The increased vulnerability to floods is a regional reality and costs of compensation and economic loss are mounting across the region.

There is a need for simultaneous, and multiple approaches to adjust to increased climate variability and extremes. The business as usual approaches will not be adequate, as the future will be unlike the past.

**Representative "Least Regret" Measures – Water Resources Sector**

| Cost Aspects | Representative Measures |
|---|---|
| Low-cost Measures | **Adapting to hydrological variability and extreme events**<br>▪ Flood zoning, land use controls discouraging development in high-risk areas;<br>▪ Optimising operation of reservoirs for flood responses in conjunction with flood warning systems;<br>▪ Introduction of climate change considerations in infrastructure design standards (safety and flexible performance) |
| | **Closing the demand-supply gap**<br>▪ Remove perverse subsidies<br>▪ Raising public awareness of water scarcity / costs of new supply<br>▪ Demand-side management measures (water-efficient devices)<br>▪ Tariff restructuring (step tariff, marginal pricing and lifeline rates for equity)<br>▪ Groundwater extraction licenses and fees |
| | **Balancing human and nature needs**<br>▪ Introducing environmental flows policies (low cost in some situations)<br>▪ Incorporating buffer zones in designated areas for wetland migration<br>▪ Improved protection and management of existing designated conservation areas |
| Moderate cost Measures to those requiring more significant up-front investment | **Adapting to hydrological variability and extreme events**<br>▪ Investment in hydrometric monitoring and early warning systems;<br>▪ Watershed management (soil stabilization and erosion control)<br>▪ Dams safety and retrofit of infrastructure for improved safety and performance under higher hydrological variability and extremes |
| | **Closing the demand-supply gap**<br>▪ Reinforcing/introducing drought preparedness programmes<br>▪ Addressing water supply leakage reduction in priority areas<br>▪ More aggressive demand management, coupled with restrictions, and incentives encourage/required structural shifts in demand |
| | **Balancing human and nature needs**<br>▪ Strengthening environmental flows policies for a range of conditions and linking to drought measures<br>▪ Operating/Retrofitting infrastructure to improve water quality<br>▪ Restoring and maintaining watersheds (e.g. vegetation) and wetlands as an integrated strategy for managing water quality and quantity. |