



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

*Francesco Bosello  
and Nicola  
Lamaddalena  
with contributions  
from Daniel  
Osberghaus and  
Consuelo Varela  
Ortega*



*Francesco Bosello  
is Associate  
Researcher,  
Fondazione Eni  
Enrico Mattei,  
(FEEM), Italy,  
Nicola  
Lamaddalena is  
Head of the Land  
and Water  
Department,  
Istituto  
Agronomico  
Mediterraneo  
Bari (IAMB)*

## Perspectives in Resource Management and Climate Change Adaptation in the Southern and Eastern Mediterranean

No. 4 April 2013

### 1. Introduction

The Mediterranean region is one of the world's climate change hotspots and is at the heart of drastic socio-economic and human transformation. Recent research shows that temperature increases will be higher than the global average, precipitation is projected to decline and the probability of extreme drought will increase (IPCC, 2007). Final vulnerability, however, also depends on sensitivity and adaptive capacity, which are highly country-specific and differentiated, particularly between the northern and the southern shores of the Mediterranean. In contrast to the rather low vulnerability of EU-Mediterranean countries, with losses ranging from -0.25% to -1.4% of GDP for temperature increases above 4°C (Ciscar et al., 2011; Aaheim et al., 2010) is the much greater vulnerability of south-eastern Mediterranean countries (SEMCS). The area will experience particularly adverse impacts on crop production driven by increasing water scarcity, which exacerbates existing desertification and water overuse, pollution and salination in a context of increasing demand (IPCC, 2007; FAO, 2011). Another less obvious but relevant channel of potential negative economic impact in SEMCS is the climate-induced loss of biodiversity. As well as threatening ecosystem life-support services it can impact negatively on tourism attractiveness. This policy paper focuses specifically on these aspects and discusses possible policies to alleviate or reverse negative consequences.



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

## 2. Water resources and agriculture

Social and political developments and future climate trends, if not properly addressed, may have dramatic implications for the agricultural and water sectors of the SEMCs. They will endanger economic development, lead to natural resources degradation and social instability. This is stressed in a first study, by Varela et al. (2013), covering all SEMCs under all MEDPRO scenarios, which proposes an econometric analysis for the SEM region as a whole and a detailed integrated assessment, modelling exercises that focus on Syria, Jordan and Morocco and addressing the complex interaction of the human and water systems. Water resources will be increasingly under stress, albeit with country variability; water withdrawals in SEMCs are projected to increase and water availability to decline. Up to 2030, withdrawals will remain below the total natural renewable water resources in most of the countries analysed, but they could reach the limit in irrigation-dependent agricultural economies, such as Egypt. Because the agricultural sector is the largest water consumer in the region, irrigation expansion will prove to be a limiting factor on the increase of water consumption for alternative uses in future years. In addition, some countries (such as Syria, Algeria and Turkey) could reach their irrigation surface potential in the coming years. On the one hand this would imply that water consumption patterns in agriculture in these countries will be rather stable by the end of 2030, but on the other hand economic development and social stability will require less-water-consuming and technically efficient irrigated agriculture and, in turn, the implementation of water-saving policies and improved water governance.

These findings are reinforced by Lamaddalena et al. (2013) studying crop water requirements, net irrigation requirements and relative crop yields under various conditions in the SEMCs' environment to mimic potential future climate conditions. As shown in Table 1, potential yield losses dominate in the region and are particularly relevant in Morocco, Tunisia and Turkey, albeit in a highly differentiated fashion.

Both studies, however, also show that a sustainable development path is possible in which water withdrawals can decrease (about one-quarter of their reference levels in 2004), preserving renewable water resources, reversing the negative effects on crops, compatible with GDP, population and trade expansion. This, however, requires an extended implementation across

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

SEMCs of a combination of technical, managerial, economic, social, institutional and even behavioural changes that foster a substantive 'structural change'.

Along these lines: water investment, ranging from 'hard' irrigation infrastructure development such as dams, reservoirs and canals to diffusion of non-conventional water sources (e.g. desalinated water) could complement less costly 'soft' demand-side water saving practices, such as increasing technical efficiency through modern irrigation and improving water management through appropriate governance structures and the use of efficient economic instruments, such as appropriate water pricing (quotas and tariffs). The application of these demand-side, less costly measures is key to a sustainable future in which economic growth, population increase and trade expansion is compatible with the conservation of water resources.

**Table 1. Changes (%) in potential crop yields under changing climatic conditions in the SEMCs region**

Future/ Current	WHEAT	CEREALS	FIBRE	FRUIT& OIL		SUGAR	TOTAL	%
				VEG	SEEDS			
Algeria and Libya	(0.4)	(1.2)	0.0	(0.7)	0.0	-	<b>(2.3)</b>	
Tunisia	(5.8)	(2.5)	(0.0)	(11.8)	(0.0)	(0.0)	<b>(20.1)</b>	
Morocco	(7.3)	(3.6)	0.0	(0.8)	(0.0)	(0.0)	<b>(11.8)</b>	
Egypt	2.3	(1.1)	(0.1)	0.7	0.0	0.0	<b>1.8</b>	
Middle East	(2.5)	(0.8)	(0.0)	(2.4)	(1.1)	(0.0)	<b>(6.9)</b>	
Turkey	(8.7)	(4.9)	(1.2)	(3.6)	(1.0)	(0.6)	<b>(20.0)</b>	

Note: Losses in brackets.

Source: IAMB elaboration.

Technical and agronomic drivers will not be sufficient on their own, however. Institutions need to be adapted; governance improved and common practices changed. More specifically: institutional reforms should be implemented to promote water users' associations and participatory irrigation management approaches; land tenure arrangements need to be revised with specific attention to well- defined property rights; new lifestyles geared towards water saving have to be promoted. All these measures need to be framed within a systemic perspective integrating the national, the river basin and the site scale as well



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

as multiple institutions and public and private actors. In particular, private initiative and autonomous adaptation need to be appropriately supported with capacity building and awareness-raising campaigns.

The optimal combination of all these ingredients will then depend upon country and scenario specificity.

Traditional water planning in the region is still a long way from adopting this integrated approach where technological, economic, social, institutional and environmental aspects are fully incorporated. However, some changes are becoming apparent in the dynamics of water planning, whereby more emphasis is given to: i) demand management rather than sole reliance on finding new sources of supply; ii) a growing awareness of the importance of preventing and mitigating various types of water conflicts; iii) more emphasis on incorporating ecological values into water policy; iv) re-emphasis on meeting basic human needs for water services; v) the importance of stakeholder participation; and vi) a conscious breaking of the ties between economic growth and water use.

Cooperation between the EU and SEMCs could be crucial to promote and enhance these outcomes. It could work on different levels: direct financial and technical support could be provided by the EU when resources in SEMCs are lacking. This direct intervention would be particularly appropriate to foster irrigation modernisation and sustain the huge investment needed.

A wider EU-SEMCs cooperation launching an ambitious programme for water efficiency could be developed within the framework of the European Neighbourhood Programme for Agriculture and Rural Development. It could apply in the context of bilateral action plans to facilitate institutional reforms; the revision of land tenure arrangements; the development of economic tools for adaptation, such as water tariffs; the improvement of water allocation efficiency and the adoption of water demand management.

The EU could also take on the role of coordinating these different bilateral actions and, at the same time, support SEMCs to establish a structured programme focused on the communication and dissemination of emerging best practices.



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

### 3. Ecosystem protection and tourism

Another area where appropriate resource management and preservation can offer not only environmental benefits, which are often difficult to quantify, but also direct and tangible economic development opportunities is that of biodiversity/ecosystem protection.

Collecting precise quantitative evidence on SEMCs' expenditure devoted to this activity is particularly difficult because information is often scattered and sparse. Nonetheless, it could be estimated that the region as a whole is devoting roughly 0.013% of its GDP to the preservation-management of biodiversity. It is worth highlighting the huge differentiation at country level, however. Indeed, expenditure ranges from 0.06% of GDP in Algeria to the 0.001% of Syria and Lebanon. Foreign support to domestic biodiversity protection efforts, which in the region tends to constitute a relevant share of the total, also varies. It ranges from almost '0' in Syria to 80% and 70% in Morocco and Egypt respectively (Onofri et al., 2013).

These current expenditure levels appear largely insufficient to a proper management of existing biodiversity/ecosystem resources (Lopez et al. 2006). A scenario fulfilling minimal sustainability requirements would imply that at least the existing resources under some form of legal protection are properly managed and preserved. In turn, this would require the SEMCs' budget devoted to protected area conservation/management to rise to 0.1%; 0.3% of GDP, therefore, depending on the country – a ten-to-thirty fold increase compared to the present.

The benefits of pursuing this sustainability path are very difficult to quantify. Biodiversity and ecosystems provide a set of services like the stability of the food chain; the resilience of agricultural production to adverse shocks; the possibility to develop new treatments for diseases (bio-prospecting) and recreational and amenity attractiveness, which can be captured only indirectly by market transactions and prices.

Onofri et al. (2013) focus on the special case of tourism in SEMCs' coastal areas. Applying econometric techniques they find that biodiversity richness is an important attractor, especially for international tourists. In a context of policy inaction against pressures stemming from a changing climate and other



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

anthropogenic drivers, this can translate into an average decline of arrivals in coastal areas of 10%, with a negative impact on total tourism demand higher than the 2% in the majority of SEMCs by the middle of the century. Tunisia is particularly exposed, where tourism demand could decrease by 4.5%.

For the SEMC region as a whole, the direct economic costs can be quantified as a GDP loss of 0.2% in a business-as-usual scenario, if resources currently devoted to preservation are kept constant in the future. Losses could be higher in alternative scenarios assuming a decreased interest in resource availability for ecosystem protection. This is what happens in the “EU-Mediterranean area under threat” scenario (Ayadi & Sessa, 2011), where all losses roughly double. A particular vulnerability is highlighted for Morocco and Tunisia, where losses are 0.37% - 0.6% and 0.42% - 0.65% of GDP depending on the scenario (Bosello & Eboli, 2013).

These insights offer important policy implications. Note first that the quantified losses refer just to one limited segment of tourism activity: international arrivals in coastal areas, and to just one very specific biodiversity/ecosystem service; that of the attractiveness of biodiversity richness.

Similarly, the benefits (or avoided costs) of protection seem to outweigh its cost in Tunisia, Syria, Jordan, Lebanon and Israel. The benefits and costs balance out in Morocco and Turkey, essentially. This constitutes a strong argument for preservation, and an interesting result, also for the tourism industry. It might signify that tourism policy could focus on the preservation of environmental and cultural quality of the destination rather than on price control. At the same time, many SEMCs appear to be particularly dependent on international support for ecosystem protection and a long way from its sustainable management. The EU could thus directly sustain SEMCs’ protection efforts in a first phase through bilateral agreements, but also taking the opportunity offered by the climate change adaptation financing established in Copenhagen and iterated at the Doha Conferences of Parties on international climate change agreements. In a wider perspective, it can assist SEMCs in the development of a sustainable tourism industry, promoting national and local initiatives in this direction.



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

#### **4. Keys to successful adaptation strategies in the SEMC region**

To conclude, some last general policy recommendations are proposed, based on an in-depth study of theoretical aspects of climate adaptation and a series of three country case studies: Turkey, Egypt and Tunisia (Osberghaus & Baccianti, 2013). This concluding section shows that many successful instances, along the lines so far highlighted, already exist in SEMCs. Accordingly, these best practices of resource management and/or climate change adaptation just need to be strengthened and expanded, or in a word 'mainstreamed' into national policies. This will drive development to the region, but will also benefit the EU itself, through more regional stability and intensified exchanges.

First, the role of government is essential for the achievement of a sustainable adaptation future. In SEMCs, climate change is expected to cause severe alteration of environmental conditions over time and constant monitoring is recommended. Problems like coastal erosion, floods and water scarcity need prevention so adaptation measures should be implemented in advance to minimise expected costs. This basic step has been only partially implemented in the countries covered by our case studies. Turkey developed the Turkish National Sea Level Observation System to measure the sea level along Turkish coasts and the Authority for the Protection of Special Areas to keep watch on the most vulnerable areas. In Tunisia the Coastal Protection and Planning Agency (APAL) has been active since 1995 and deals with coastal supervision. Drought monitoring is active in Turkey, Tunisia and Egypt but there are no other types of monitoring system operating in the region. For instance, Medany et al. (2009) note the importance of developing an early warning system for the increasing occurrence of diseases and pests in agriculture, and Iglesias et al. (2006) recommends monitoring water quality and scarcity. Improved data exchange may also be necessary, as the UNFCCC Report (2010) and Agrawala et al. (2005) suggest for the River Nile: there should be better information-sharing between Nile Basin countries and enhanced precipitation monitoring networks in upstream countries of the Nile Basin.

National planning has the positive effect of showing commitment and signalling to the population the primary importance of adaptation measures. Public awareness should not be taken for



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

granted. In a survey of Tunisian wheat farmers, Abou-Hadid (2006) showed that many individuals were not aware of the importance of farming techniques in adapting to climate change.

In order to unleash the full potential of private investment, any possible barrier to private adaptation (in terms of incentives, legislation, knowledge gaps, or customs) has to be removed. For instance, since 2003 Tunisia has implemented measures to sustain private adaptation. The plan for water management included restructuring farmers' bank debt, importing and subsidising drilling products and carrying out a public awareness campaign. Financial support is particularly important in countries where a large share of the agriculture sector consists of family-owned farms in poor condition with very limited financial and human capital.

Given the potential conflicts and synergies of adaptation with mitigation, the regulation of externalities of adaptation measures, including CO<sub>2</sub> emissions, should be adopted (e.g. taxes, financial subsidies, legislation and advocacy). As an example of small investment, in the tourist sector building insulation should be subsidised against the installation of air-conditioning. For large investments, the example of water desalination plants is striking. Public authorities should favour alternative options due to the energy-voracity of this type of water harvesting technology.

International coordination is important for countries sharing river water sources or sea coasts. Since 1999, the Nile riparian states developed the Nile Basin Initiative, permitting the collective management of Nile issues. Even if conflicts may occur, the diplomatic approach is necessary for efficient international resource management. Furthermore, a comprehensive and legally binding agreement on how to handle Mediterranean adaptation issues may be agreed upon and ratified by states on both shores of the Mediterranean. This would include, for example, migration issues and the coordinated regulation of CO<sub>2</sub> emissions (as externalities of some adaptation options).

Given the fact that climate change impacts are similar on both shores of the Mediterranean, there should be efforts to reach coordinated and common adaptation policies. This could materialise in common research projects, regular cooperation meetings at a high political level, joint information campaigns, meetings of researchers, practitioners and policy-makers in the



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

climate impact community and adaptation case studies on both shores of the Mediterranean. In this way, decision-makers could learn from other experiences and base their decisions on a better knowledge base. An example is the cooperation between the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Tunisian Ministry for Agriculture and Water Resources (MARH) in developing the National Adaptation Strategy for Tunisia.

Policy development should also involve stakeholders within the country. The involvement of civil society and local communities in the development of adaptation policies not only ensures fairness in decision-making but also provides information input that would make the resulting plan more complementary with private adaptation. The principle of stakeholder participation is already part of some national plans (i.e. the National Water Resource Plan, Egypt).

Besides economic efficiency, adaptation policies have to consider further aspects like equity and security of supply. Equity issues may require several levels of intervention: in the international framework, the support of developed countries to developing countries is important to ensure the implementation of effective adaptation policies, providing financial, technological and political assistance (as mentioned earlier for the German GIZ and Tunisia and as already initiated by the UNFCCC Adaptation Fund). At the national level, each country should adopt specific policies to economically support the most vulnerable individuals. All adaptation policies should be implemented in such a way as to avoid burden on future generations. Moreover, each country needs a deliberate strategy on how to approach the problem of horizontal equity – rules and regulations that determine which groups will be protected by public adaptation and which will not. This would have to include a priori devised compensation payments. The example of water pricing shows the conflict that may arise between resource management and equity concerns. The most effective way to incentivise conservation is to set high water prices. However, this solution hurts low-income individuals and farmers. Alternative measures could include consumption-differentiated tariffs or water permits freely allocated to farmers in need.



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

To avoid inaction by private investors, a sound institutional setting is needed. A clear assignment of responsibilities in the domain of adaptation measures – whether they are to be met by the government, private households, or by private firms should be provided. Otherwise, waiting for the action of the respective counterpart may cause delays. Moreover, ensuring political stability, combined with an enduring trust in property rights on the part of the private economy, which can be realised only through their clear, legally binding definition, is crucial. Failure to do so engenders mistrust among individuals about the possibility to benefit from investment in the future. Aggregate private underinvestment would be the expected result.

## References

Aaheim, A., T. Dokken, S. Hochrainer, A. Hof, E. Jochem, R. Mechler and D.P. van Vuuren (2010), "National responsibilities for adaptation strategies: Lessons from four modelling frameworks", in M. Hulme and H. Neufeld (eds), *Making Climate Change Work for Us: European Perspectives on Adaptation and Mitigation Strategies*, Cambridge: Cambridge University Press.

Ayadi, R. and C. Sessa (2011), "What scenarios for the EU-Mediterranean in 2030 in the wake of the post-Arab spring", MEDPRO Policy Paper No. 2, CEPS, Brussels, October.

Abou-Hadid, A.F. (2006), "Assessment of Impacts, Adaptation, Vulnerability to Climate Change in North Africa: Food Production and Water Resources", final report submitted to Assessments of Impacts and Adaptations to Climate Change, Project No. AF 90.

Agrawala, S. (2005), "Bridge Over Troubled Waters: Linking Climate Change and Development", in D. Cyranoski, *Climate Change: The long-range forecast*, Nature 438, pp. 275-276.

Bosello, F. and F. Eboli (2013), "Economic Impacts of Climate Change in the Southern Mediterranean", MEDPRO Technical Report No. 25, CEPS, Brussels, February.

Ciscar, J.-C., A. Iglesias, L. Feyen, L. Szabó, D. Van Regemorter, B. Amelung, R. Nicholls, P. Watkiss, O.B. Christensen, R. Dankers, L. Garrote, C.M. Goodess, A. Hunt, A. Moreno, J. Richards and A. Soria, (2011), "Physical and economic consequences of climate change in Europe", proceedings of the National Academy of Sciences of the United States of America, 108(7), pp. 2678-2683.



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

Food and Agriculture Organization of the UN (FAO) (2011), "Climate change, water and food security", FAO Water Report No. 36.

Iglesias, A., L. Garrote, F. Flores and M. Moneo (2006), "Challenges to Manage the Risk of Water Scarcity and Climate Change in the Mediterranean", Water Resources Management, Vol. 21, pp. 775-788.

IPCC, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007), M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds), Cambridge: Cambridge University Press, UK and New York, US.

Onofri, L., P.A.L.D. Nunes and F. Bosello (2013), "Economic and climate change pressures on biodiversity in southern Mediterranean coastal areas", MEDPRO Technical Report No. 24, CEPS, Brussels, February.

Osberghaus, D. and C. Baccianti (2013), "Adaptation to Climate Change in the Southern Mediterranean A Theoretical Framework, a Foresight Analysis and Three Case Studies", MEDPRO Technical Report No. 26, CEPS, Brussels, February.

Lamaddalena, N., R. Khadra and A. Scardigno (2013), "Assessing the relation between water scarcity and agriculture in the MED 11 regions and adaptation", MEDPRO D4a2.

Lopez, A.O and S. Jimenez-Caballero (2006), "Sustainable financing resources for protected areas in the Mediterranean", IUCN, Gland, Switzerland and Cambridge, United Kingdom, Fundación Biodiversidad, Madrid, Spain and Agencia Española de Cooperación Internacional of Ministerio de Asuntos Exteriores y de Cooperación, Madrid, Spain.

Medany, M., S. Attaher and A.F. Abou-Hadid (2009), "Adaptation of agriculture sector in the Nile Delta at Farm Level", part of the FP6 project Adaptation of agriculture in European regions at environmental risk under climate change (ADAGIO).

Plan Bleu (2012), "Water and climate change: which adaptation strategy for the Mediterranean", UNEP, MAP, Blue Plan Notes No. 23, September.

Report on the Euro-Mediterranean Conference on Research and Innovation, Barcelona, 2-3 April 2012, consolidated report.



# Policy Paper

Thinking together for the future of the Mediterranean

*EMEA Policy Papers present concise, policy-oriented analyses of topical issues in Euro-Mediterranean economic affairs, with the aim of interjecting the views of EMEA experts into the policy-making process in a timely fashion.*

UNFCCC (2010), "Egypt National Environmental, Economic and Development Study (NEEDS) for Climate Change", under the United Nations Framework Convention on Climate Change, Cairo.

Varela-Ortega, C., P. Esteve, I. Blanco, G. Carmona, J. Ruiz and T. Rabah (2013), "Assessment of the impacts of socio-economic and climate changes on agriculture and water resources in the southern Mediterranean", MEDPRO Technical Report No. 27, CEPS, Brussels, February.

## Disclaimer

**This paper was first produced in the context of the MEDPRO (Mediterranean Prospects) initiative, a three-year project funded under the Socio-economic Sciences & Humanities Programme of DG Research of the European Commission's Seventh Framework Research Programme.**

**Unless otherwise indicated, the views expressed are attributable only to the authors in a personal capacity and not to any institution with which they are associated.**