Mainstreaming Climate Change Adaptation

In National Policies, Strategies and Action Plans

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Mainstreaming Climate Change Adaptation in National Water Policies, Strategies and Action Plans in the MENA Region
Based on examples from ACCWaM’s three pilot countries

- Findings for Jordan -

Draft summary of a study report by Holger Hoff prepared for ACCWaM – Adaptation to Climate Change in the Water Sector in the MENA Region

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1. Background

The GIZ Regional Programme: “Adaptation to climate change in the water sector in the MENA region” focusses on capacity development at all relevant levels (regional water policy, national water sectors, implementation of measures at local level) with the objective to foster capacity to adapt to climate change in the water sector in the MENA region.

One of the main objectives of ACCWaM is to contribute to a better adaptation of National strategies, plans and projects in the water sector to regional climate change scenario. Therefore the programme aims at an improvement of the capacities of regional and national water sector institutions to develop and implement strategies for adaptation to climate change.

To approach this objective ACCWaM has contracted Holger Hoff, senior researcher at the Stockholm Environment Institute in Sweden, as a consultant to critically review existing national water policies, strategies and action plans in ACCWaM’s three pilot countries Lebanon, Jordan and Egypt and to recommend steps and actions on how to mainstream climate change adaptation into policies and water master planning in these countries.

Holger Hoff was assigned with the tasks to

- **Participate** in and contributed to ACCWaM’s program planning workshop scheduled for 5-7 May 2012 Sunday and Monday)
- **critically review** water master planning, water strategies, action plan etc. in light of the need for mainstreaming climate change adaptation
- **conduct** visits to the water institutions and/or ministries in ACCWaM’s three pilot countries
  - Egypt: MWRI (Ministries of Water Resources and Irrigation)
  - Jordan: MWI (Ministry of Water and Irrigation)
  - Lebanon: MEW (Ministry of Energy and Water)
- **discuss** with the aforementioned water policy maker and relevant water officials ways and options for mainstreaming climate change adaptation (e.g. perhaps as appendices or updates), also with regard to building capacity in water ministries e.g. training
- **propose** a general framework and specific action in close consultation and cooperation with relevant ministries and in line with the Regional Strategy for Water Security
- **agree** with ministries on how to proceed, roles and responsibilities, timeframe, focal points for mainstreaming, training needs, support etc.
- **prepare** guidelines including on mainstreaming adaptation to CC into national development policy

The field work and interviews were conducted in June/July 2012 followed by a further assessment of the policy documents. The final report is to be completed soon. The following text has been prepared by ACCWaM and is based on the draft version of Holger Hoff’s report.
2. Report Summary

a. Adaptation in the regional context

The consulted stakeholders in the three pilot countries generally agreed, that the region’s water systems are subject to various interacting pressures in addition to climate change, in particular rapid population growth, urbanization, and economic development (resulting also in greenhouse gas emissions growing faster than global average) and environmental degradation. The resulting increased demand in particular for irrigation and municipal use exerts additional pressures on water resources. Consequently water demands have outstripped supply and almost all MENA countries have become too water scarce to produce all required food locally and hence are vulnerable to price shocks on world markets. The Nile and Jordan are international rivers which illustrate this by having become “closed basins”, with no remaining unallocated water. Hence adaptation to climate change, which is projected to become a major additional pressure in the MENA region, needs to be embedded in the context of adaptation to other pressures which are generally considered to be more important in the short to medium term (e.g. Farajalla et al 2011). Additionally, many of the MENA countries may share borders or resources with non-Arabic countries, or countries in the midst of conflict. This adds an additional challenge in terms of adaptation and managing shared water resources in a contentious environment.

Additional climate change pressures (real or perceived) can serve as an opportunity to promote much needed technological, socio-economic and institutional innovation and adaptation in the water sector. The attention to climate change can raise awareness for measures, reforms and behavioural changes that have long been overdue and that are win-win options for countries, with or without climate change. National climate adaptation strategies, for example, can promote horizontal and vertical integration - across disciplines, sectors, ministries and hierarchical levels and scales, which are urgently required in the water and other sectors (OECD 2011).

However, climate change is perceived by many stakeholders in the MENA region as a distant threat, and currently much less important than other pressures. It is worthwhile to point out that several water-related decisions made today have a lifetime that reaches well into the second half of this century (e.g. dams, transfers, urban and spatial planning, or new energy systems). At the same time, there is plenty of evidence to suggest that climate variability is going to pose growing threats to water systems in the MENA region in the near term, suggesting more intense, longer and more frequent droughts and increasing uncertainty in rainfall and water availability. In fact, various stakeholders expressed their personal impression that they have already been faced with increasing variability for some time. Current responses to climate and other pressures and acute crises (e.g. droughts) are often limited to emergency and coping measures that are only short-term and reactive. These responses may in fact compromise future opportunities for adaptation, leading to what is commonly referred to as maladaptation. Mainstreaming climate change however is about pro-active, longer term and integrated planning and – if necessary - transformative development that address root causes of vulnerability, and strengthens human security and sustainability. Rural poor communities, unskilled labor, as well as internally displaced people, are generally most exposed and most vulnerable to climate risks, e.g. due to their dependence on natural resources and lack of resources to respond to change (World Bank 2011). These vulnerabilities are aggravated in most MENA countries by low investments in social safety nets and limited public services such as water supply. Hence adaptation needs to be mainstreamed in conjunction with poverty alleviation, development and environmental planning efforts.

Awareness rising about climate change and its impacts and about win-win opportunities through technical, economic and institutional adaptation, many of which are at the same time IWRM objectives, is important.
b. Findings and suggestions

The consultation with stakeholders and the review of documents has led to the following suggestions.

Mainstreaming climate adaptation in strategies and plans

It has been realized that current strategies and plans are seriously deficient with regard to climate change adaptation. The experience in the three countries has shown that climate change and adaptation currently plays a minor or no role in water sector planning, strategies and action plans. Even in cases where climate change is explicitly mentioned, action is largely lacking. This situation reflects a general underestimation of climate change impacts on water availability, demand and management (relative to other pressures) and over-emphasis on remaining uncertainties in climate scenarios, which delays action and shifts costs to future generations. Neglecting climate change will likely lead to ‘lock-in’ situations and path dependencies (e.g. when investments in long-term water infrastructure are not climate-proof), increasing vulnerability (so called ‘mal-adaptation’) and re-active emergency type responses to crises rather than pro-active adaptation.

Accordingly there is significant potential – and need – to mainstream climate change adaptation into existing strategies and plans. Any opportunity to do so should be taken advantage of, e.g. when these documents are updated or revised. Given the nature of climate change with long-term and lasting effects, pro-active approaches are required at all levels, local, national and regional. Waiting for the full effects of climate change to manifests themselves before taking action will come at high cost.

Efforts to mainstream climate adaptation into water planning can build on lessons learned from the efforts of other MENA (and non-MENA) countries that already have experience with adaptation processes. Individual MENA countries have initiated climate adaptation activities that should be synthesized and experience shared within the region. Also the widespread use of decision support systems such as WEAP (Water Evaluation and Planning System) for water and climate adaptation planning in various MENA countries\(^1\) provides a solid base for a regional adaptation initiative.

Technical adaptation measures

A wide range of technical adaptation measures, as developed under IWRM, are available and have been successfully tested and implemented in different MENA countries. Knowledge platforms such as weADAPT\(^2\) can be used to share and disseminate adaptation technologies, knowledge and experience across the MENA region.

Demand management

As discussed for the pilot countries, demand management has the largest potential for adapting to climate change and water scarcity. First priority must be reductions in agricultural water demands through technological, economic and institutional measures, given that agriculture is still the largest water user in the MENA region. But also municipal demand saving has huge potential, in terms of loss reduction but also lowering of household demands through water smart appliances and behavior.

Supply management

On the supply side, the largest adaptation potentials for bridging the water gap and reducing uncertainty (depending on specific context) are with i) wastewater and grey water reuse, ii) water quality protection, iii) water harvesting and storage, and iv) possibly also desalination, if that can be powered by renewable energy. Given its still higher costs than most other supply and demand

\(^1\) www.weap21.org
\(^2\) weadapt.org
management measures it would require support, e.g. by the Gulf countries, to further develop the technology, bring costs down and deal with environmental externalities. This could be an opportunity for implementing the goal of the Arab Water Strategy (LAS 2012) to reduce inequity among Arab countries.

**Decentralization vs. centralization**

There is no clear answer whether centralized or decentralized smaller distributed solutions are more appropriate for addressing climate risks, adaptation and improving efficiencies. Instead the respective benefits depend on the national and local context.

However, the general principle that diversification increases resilience applies also in the MENA region. Also local participation is generally facilitated by smaller scale distributed solutions (while private sector involvement seems to focus on larger solutions). Reducing local vulnerability requires participatory processes for identifying appropriate adaptation measures which contextualize, complement, and implement national and top-down policies, strategies and plans. Across the MENA region, water user associations are foreseen to provide this local perspective, but are generally not operational yet. However decentralized individual solutions – which may not have been planned but are simply an outcome of weak regulation and management - are not sustainable per se. For example about 20% of the total electricity generation in Lebanon is from small private back-up generators – a response to unreliable central supply – which is the most expensive form of power generation economically and in terms of air pollution and noise (Farajalla et al 2011).

**Integrated approaches**

Synergies from integrated approaches, e.g. across water and land management, between water and energy management, and between adaptation and mitigation need to be explored jointly with local partners. Depending on climate and agro-ecological conditions, improved land management can unlock the potential of large amounts of green water and increase overall water productivity drastically. In particular spatial and urban planning is still completely disconnected from water management, a fact that will further aggravate climate driven water problems. The high import bill for energy (Lebanon and Jordan each import more than 95 % of their primary energy needs) in combination with significant potential for energy savings in the water sector in the MENA region (Saudi Arabia, alone uses about 1.5 million barrels of oil per day for desalination according to World Bank 2011) – the enormous water demands in some parts of the water sector call for better coordination of these sectors and between adaptation and mitigation. Without water smart energy supply and energy smart water supply, demands in Southern and Eastern Mediterranean countries are projected to grow rapidly, from 150 km$^3$ water per year in 2005 to 200 km$^3$ in 2025, and from 20 TWh of electricity per year in 2005 to 200 TWh in 2025 (Plan Bleu). Successful experiences should be shared across sectors, e.g. energy contracting (sharing revenues from energy saving with the contractor) might also work for “water contracting”. In any case, more realistic water pricing will play an important role in demand management.

**Economic incentives**

Economic incentives and market mechanism that reflect the true value of water and costs for water provisioning, are key for demand management, reduction of wastage and improvements in resource productivity, and hence are an important pre-requisite for adapting to growing climate and other pressures. However in particular in agriculture, the biggest water user in the region, perverse subsidies for water and energy (e.g. electricity for water pumping) persist in many MENA countries, largely due to vested interests in water policy making.
Net import of virtual water on which the MENA region has increasingly become dependent (Allan 2001, Wingqvist et al 2010), arguably is the most important adaptation measure and contribution to food security in the MENA region. Hence it needs to be fully integrated with water management, and its costs and benefits (including exposure to world commodity market volatilities and associated vulnerability of importing countries) need to be transparently compared with those of other water supply and demand management measures.

**Water Governance**

While technological innovation, and economic incentives can help to mitigate current water scarcity and delay the crossing of critical water scarcity thresholds, discussions with stakeholders identified as most important the need for improved water governance, in particular the enforcement of existing laws and regulations.

According to Rogers et al (2003) the following are key elements of improved governance:

- inclusiveness
- accountability
- participation
- transparency
- predictability
- responsiveness

Unfortunately, the full implementation of these principles and hence of genuine water reforms that would also better prepare for future climate conditions are still pending. As stated by Al Jayyousi (2012), water sector reforms would also need to address the closely interlinked issues of water, food and energy security – e.g. through national coordination mechanism, inter-ministerial committees, institutional capacity building and extension services, as well as regional communities of practice or learning alliances.

Currently integrated approaches are primarily addressed by the respective Ministries of Environment and/or environmental authorities, rather than more powerful and influential water and agricultural ministries (see also Zeitoun et al 2012). Hence, collaboration of these separate sectors and ministries is essential for effective adaptation.

Integrated and participatory approaches further require closer links between governmental and non-governmental (and private) sectors, with NGOs now beginning to form regional alliances such as the Arab Climate Alliance (ACA 2012). Hence development cooperation should direct its efforts on climate mainstreaming also to local, national and regional NGOs.

**Synergies through cross-sectoral measures**

While the focus of this report is on the water sector, measures in other sectors also impact or are impacted by water resources management, e.g. agriculture, forestry, land use, grazing-, rangeland- and environmental management, and energy. If management and governance are coordinated between sectors e.g. through multi-functional systems (such as conservation agriculture, aqua-cultures, water and energy co-generation etc.), synergies can be developed and overall resource productivity – and eventually resilience - are likely to be higher than under strictly sectoral management (Hoff 2011). Similarly, coordinated climate adaptation and mitigation activities can result in co-benefits, higher water and energy productivity and eventually lower costs. Accordingly, policies, strategies and action plans in other water-related sectors should be carefully screened for opportunities to mainstream climate change adaptation into water management (Bazilian et al 2011, UNEP 2011).
While the National Communications to the UNFCCC of the three pilot countries are generally cross-cutting - across disciplines and sectors – they are rather general and unspecific when it comes to concrete measures and target groups. The National Water Plans in contrast are more specific about required measures and actors, but they lack the coordination with other sectors. So the two separate types of planning processes and documents need to be better linked for successful mainstreaming of climate change adaptation into water management. In each of the three pilot countries there are excellent opportunities for doing so, through ongoing or upcoming revisions of key water and climate planning documents.

**Context-specific adaptation**

Lastly, this initial study for the three pilot countries Lebanon, Jordan and Egypt needs to be continued through iterative assessments of local challenges, for developing context-specific adaptation strategies and actions jointly with local partners. Upcoming events such as the Arab Water Week\(^3\) or the Abu Dhabi Sustainability Week\(^4\) as well as initiatives such as DesertTec\(^5\) provide opportunities for integrating this pilot study with larger climate adaptation and mitigation activities in the MENA region.

### 3. Jordan

**Summary**

Jordan is one of the most water scarce countries, so that only a small fraction of its food requirements can be met from local production. Given its very high population growth rate and the impacts of climate change, enormous additional pressures on Jordan’s water system are projected. While Jordan is exploiting any possible water supply and demand side measures, there is a bias towards large scale, centralized and energy-intensive supply-side solutions (and similarly water-intensive solutions in the energy sector), such as long distance transfer of fossil groundwater and a planned conduit from the Red to the Dead Sea. Small scale, decentralized and demand side measures, including decentralized wastewater treatment, loss reduction, rainwater harvesting, aquifer storage and the use of renewable energy in water supply receive relatively less attention. Virtual water imports will have to be integral part of any future climate adaptation and water strategy. Turning Jordan’s predicament into an advantage, the country could become a role model in climate adaptation, not only in terms of its advanced technologies, but also its adaptation planning (through country-wide standardized WEAP planning), the development of an integrated water and climate database and the integration of climate issues in the national water strategy.

**a. Jordan - Background**

Jordan’s population growth rate (2.4% according to World Bank 2011) is one of the highest in the region and in fact in the world, which translate into a doubling of population in about 30 years.

Jordan is at the extreme end of water scarcity (when expressed as water availability per capita or demand vs. supply), even within the MENA region – see comparison in figure 12 below with Egypt and Lebanon. The perception of most stakeholders in our discussion was that other pressures have been increasing scarcity much more rapidly than climate change, and that Jordan is already employing about every possible water management measure, so that there is little room/need for additional climate change adaptation measures in the foreseeable future – when considering a medium-term planning horizon until say 2020 or 2030. Stakeholders consulted consider changes in water availability in that

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\(^3\) [www.arabwaterweek.org](http://www.arabwaterweek.org)

\(^4\) [www.abudhabisustainabilityweek.com](http://www.abudhabisustainabilityweek.com)

\(^5\) [www.desertec.org](http://www.desertec.org)
time frame to remain within the current variability ("we have been adapting to climate variability for the past 1000 years").

![Graphs showing demand-supply relations for current and future situation in Jordan, Lebanon, and Egypt.](image)

Figure 1 demand-supply relations for current and future situation in Jordan, Lebanon and Egypt, World Bank 2011

Fortunately, most current water management options also prepare for further reduced water availability under climate change. An example for projected decrease in water availability is provided by Menzel et al (2007), who calculated in the context of the GLOWA Jordan River project a 25% reduction of annual water availability for a medium change climate scenario which assumes lower increase in greenhouse gas emissions than currently observed.

### b. Technical options for climate adaptation in Jordan

**Demand management** remains the most important adaptation option to climate change. In agriculture, the largest water user in Jordan, water productivity can still be improved, e.g. through more drip irrigation, despite the leading role that Jordan already has in advanced drip irrigation in the MENA region. Note that there are potential conflicts between drip irrigation and wastewater reuse, e.g. clogging of dripping holes in pipes. The difficulty in reducing illegal abstractions in cities as well as in agriculture points at difficulties in enforcing existing regulations. That is particularly critical for overexploitation of groundwater in the highlands, which would require control over the small number of large – often absentee - farmers with high water use. Participatory activities towards reducing groundwater overexploitation by the Highland Water Forum demonstrate the need to differentiate between the different types of users, e.g. small vs. large water users and local vs. absentee farmers.

Despite Jordan’s extreme water scarcity, per capita urban water use is still higher than in some European cities. Also unaccounted for water is still very high in the cities – up to 50% in Amman. Stakeholders consider technical loss reduction to be easier to achieve than the reduction of illegal use.
The recent private sector engagement in urban water supply bears the risk of diluting the important water saving message by implying that privatization will guarantee unlimited access to water.

Given that Jordan’s food supply relies to about 75% on imported virtual water, these imports with agricultural commodities will remain the most important demand management measure in quantitative terms (see also virtual water imports in figure 17). Consequently, Jordan’s water strategy requests that “Jordan must remove tariffs on imported crops”\(^6\). It is not clear however, in which way virtual water imports affect the overall vulnerability of Jordan’s water and food security. While a geographically more distributed resource base in principle reduces drought risks, imports expose Jordan at the same time to the world market price fluctuations and the possibility of major exporters to reduce or stop exporting in case of drought, scarcity or other shock.

There are limited opportunities for supply side management in Jordan, given the full exploitation / overexploitation of available surface and groundwater resources. The main supply side options currently implemented and projected for future national water management, are the transfers of i) fossil groundwater from the Disi Aquifer (under construction) and ii) of desalinated seawater from the Red Sea (planned) to Amman and beyond. As a general rule, building a country’s water system on a variety of different (and distributed) solutions is likely to be a more resilient adaptation option to future disturbances or shocks, compared to a single centralized large-scale solution. Also pumping of water across such large distances and elevation gradients – as from near the Dead Sea (below sea level) to Amman (up to 1000 m above sea level) for municipal demands requires large amounts of energy (comparable to desalinating the same amount of water).

Wastewater reuse provides a growing contribution to Jordan’s water supply – higher than in most other countries of the MENA region. It not only recycles water but also nutrients, which otherwise would have to be provided with additional inputs of energy-intensive fertilizer. Currently the central As Samra treatment plant for the Amman area is upgraded, and additional wastewater treatment and reuse capacity is being developed for the Zarqa basin and Jordan Valley (eventually expanding wastewater reuse to the northern Jordan Valley), freeing up freshwater for municipal and other higher value uses. Early treatment of industrial and other wastewater before it mixes with other water has been recognized as a priority measure to avoid pollution-related losses in usable water. Decentralized wastewater treatment in rural and semi-urban settings has been identified as an important addition to the existing central treatment plants, for its flexibility and specific treatment of different wastewaters, and eventually also for more resilient climate change adaptation, e.g. by the SMART project\(^6\).

Additional brackish water can be (and in the Jordan Valley is already) used in bio-saline agriculture if salt resistant crops are selected – see also proposed adaptation project in Jordan Valley in section 2.2.7. Crop choice and crop breeding – also for drought resistance - are important adaptation options in the agricultural sector.

While water storage in principle is an important adaptation option to increasing climate variability, there is very limited potential in Jordan for additional storage. In some cases existing storage volume cannot be filled with the (shrinking) available water resources – as for example in the Yarmuk basin, where the Al-Wehda / Unity Dam doesn’t fill up. Here as well as in the Jordan river basin, upstream riparians have already diminished flows much more than climate change ever could.

In this situation, artificial groundwater recharge is the only under-utilized storage option. It avoids evaporative losses and hence becomes even more important under higher temperatures. Artificial storage is currently planned for pilot projects in the highlands.

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Small-scale rainwater harvesting and storage structures are mandatory, as part of Jordan’s building code, but the existing legislation is not sufficiently enforced.

c. Economic options / enabling conditions for climate adaptation in Jordan

Economic water productivity can be increased if water is reallocated (possibly also through water markets) to higher value uses, such as tourism (example Dead Sea) and other services sectors that are not very water intensive. This diversification and reduced economic dependence on water resources is not only a strategy for climate change adaptation, but also for diversification and resilience building— if embedded in a consistent land use, food security, and development strategy. The establishment of water markets as a tool for allocating water to highest economic productivity is insufficiently established, lacking a sound legal framework. Consequently, some farmers simply sell water for a much higher price than the very low price for which they received the water.

d. Governance options / institutional reform and awareness raising for climate change adaptation in Jordan

Jordan has initiated a process of institutional reform in the water sector, e.g. decentralization, establishment of water user associations and ongoing restructuring within the Ministry of Water and Irrigation (MWI) in the context of the Institutional Support and Strategy Program (ISSP) for the water sector. These initiatives provide a window of opportunity for more integrated (e.g. water-energy and water-land) approaches and for mainstreaming climate change adaptation into water planning (coordinated in the MWI by the Department for Management of Water Resources).

Cross-cutting programs may help to achieve the required integration across sectors, such as the program on water quality, health protection, and food security, which is to enhance Jordan’s capacity to adapt to climate change, and which is supported by UNDP, WHO, FAO, UNESCO, and the national ministries of water and irrigation, environment, health, agriculture, and education. The experience with a new cross-cutting ministry for mega-projects however was less encouraging, it was dissolved again.

The integrated water data and information system for consistent and continuous data, which is currently developed at MWI is an excellent response to the information needs of improved water management under climate change. It includes climate, hydrological surface water, groundwater water, and water quality data, and integrates monitoring, telemetry and central data management in the ministry. For climate change adaptation it will be important to analyze time series for climate change signals and continuously integrate any new information from science for adaptive management (including e.g. the new regional ensemble climate scenarios from the UN ESCWA / SMHI initiative).

Use WEAP opportunity, which is not only a participatory planning tool, but at the same time consistently integrates relevant data and time-series.

Jordan’s water- and climate-related data are currently consolidated and analysed for water planning in WEAP. WEAP models have been developed over the past years (with the help of GIZ/BGR, SEI and the GLOWA Jordan River project) for all major river basins of Jordan, in order to test various climate scenarios and climate adaptation measures for their system-wide effects. These models are now merged into one national WEAP model. WEAP has also been used in Jordan’s National Communications (in line with UNFCCC guidelines). The Jordanian water data and information system and national WEAP model could become a blueprint for other MENA countries as an integrated climate change adaptation framework. Coupling to other applications such as ModFlow (groundwater), Mabia (irrigation), and
MYWAS (cost-benefit analysis) in Jordan and various other MENA countries has already made WEAP a de-facto standard planning tool for the region.

Most recently the WEAP water planning tool has also been coupled to LEAP\(^7\), an energy planning tool, so the two can now be used for integrated water-energy planning, e.g. identifying and quantifying negative externalities from mono-sectoral planning and potential synergies from integrated approaches.

Climate change is receiving considerable attention in Jordan and hence provides an opportunity to initiate or accelerate much needed further technological improvements, demand management and institutional reform. Going beyond these typical IWRM measures, additional climate risks and resulting vulnerabilities need to be communicated to policy and decision makers, such as those associated with droughts and other extremes. These extremes may materialize much faster than projected changes in average water availability and are likely to overtax existing coping mechanisms. Careful assessments need to determine the limits of adaptation by means of conventional measures, and possibly required further reaching transformative changes, in response to mounting climate pressures.

Jordan in many respects is a pioneer in the region, simply because of its already pressing water scarcity. So solutions from Jordan will be of interest for the other countries, when these follow the same development path in terms of urgency and responses to water stress.

### e. Integration of water and other sectors for climate adaptation and mitigation in Jordan

Integration of water and energy (climate adaptation and mitigation) holds significant potential in Jordan for increasing overall resource productivity and averting or delaying crises. While water is projected to be the most impacted sector from climate change, at the same time, 15% of Jordan’s energy demands – and related greenhouse gas emissions – are from the water sector (desalination would increase that further). Moreover some of the proposed future energy pathways (e.g. nuclear or mining of oil schists) would be very water intensive. Accordingly, any reductions in wastage and improvement in water productivity also provide co-benefits in the energy sector – and vice versa. Integrated water and energy assessments will have to include future climate change effects and mitigation goals (e.g. through renewable energy).

Given the good progress Jordan is making with addressing the water - energy nexus (in particular energy-smart water pumping and energy recovery from wastewater treatment plants – the As Samra plant is almost energy self-sufficient) it could become a role model for the MENA region for integrated climate and water management solutions. In Jordan, the emphasis on renewable energy seems to be increasing, also relative to the ambitions for centralized nuclear power production – which could significantly increase vulnerability of Jordan’s water and energy systems (see also Kiswany 2012). Continuity and long-term planning are essential for climate adaptation (and mitigation), but these are currently subject to frequent changes of ministers and other high level officials and associated priorities.

**Integration of water and land management**, holds significant potential also for addressing additional climate pressures, e.g. in terms of water-smart spatial and urban planning and land use zoning, improved soil management for green water storage etc. Reducing land degradation / desertification and rehabilitating land holds co-benefits in terms of soil water storage (important for bridging dry spells) and also for C-storage (integration of adaptation and mitigation).

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\(^7\) [www.sei-international.org/mediamanager/documents/Publications/Climate/leap.pdf](http://www.sei-international.org/mediamanager/documents/Publications/Climate/leap.pdf)
Figure 2: rapid growth of Amman over the past century – mostly at the cost of good agricultural (even rainfed) land, which has drastically reduced the productivity of associated green water, which is lost for biomass production.

f. Current water and climate plans and strategies in Jordan

The central document in water planning is Jordan’s Water Strategy 2008-2022 – Water for Life. After many years of gradually introducing stricter water laws, e.g. prohibiting further exploitation of depleted groundwater basins, monitoring of groundwater use, or introducing block tariffs on water use, Jordan’s Water Strategy has recently been updated. When comparing the new 2012 version with that from 2008, climate change is now receiving much stronger attention. “The nation has to be prepared for additional water stress caused by climate change” is listed as a core principle of the strategy, and adaptation to climatic change is listed as a “specific targeted objective”. However proposed top-down measures at national level do not automatically reduce vulnerability to climate change in the respective local context.

The strategy contains a long wish-list of measures, only a few of which have been implemented so far. The strategy has a strong emphasis on demand management, which is key for adaptation to climate change and increasing water scarcity, given the full (and over-) exploitation of all available water resources in Jordan, requesting e.g.:

- “irrigated agriculture in the highlands will need to be capped”
- “encourage farmers to use modern and efficient irrigation techniques”
- “reduce evaporative losses through closed pipes”
- “transferrable water rights”
- “optimizing water allocations as per the National Water Master Plan”, which can help to improve economic water productivity.

But the strategy also prioritizes the few remaining supply side measures, e.g.
• “use of grey water”
• “use of rainwater harvesting is encouraged”

The strategy points out, how water should be linked to other sectors, in particular agriculture and land management, primarily for improving water quality:

• “land use licensing ...in order to minimize negative impacts on groundwater and surface water”
• “coherent and inter-sector spatial planning, including urban and peri-urban development need to be applied”

Beyond land use and spatial planning, water quality aspects also need to be recognized as important measures to enhance or at least maintain water availability (differentiated quality requirements for different uses) and improve water productivity.

Also links between water and energy (and food) are addressed in the National Water Strategy:

• “water, a scarce resource...needs to be...linked to other crucial resources such as energy”
• “increase energy efficiency of the water supply and distribution systems and harness alternative energy sources to provide 20% of the power required to pump water”
• “wastewater treatment technologies with due consideration...in energy consumption”
• “encourage power generation from sludge”

The strategy further addresses the need to improve and better manage water-related data and information (a pre-requisite for planned adaptation), suggesting to:

• “establish a water research unit within the ministry” and a
• “water information system at the ministry of water and irrigation” as well as to
• “set up a national water training center”

It proposes an “institutional reform in Jordan’s water strategy” for example pointing out the “need to collaborate among all concerned ministries”. It hints at the need for institutional adaptation by pointing out that “there exists an overlap of responsibilities with other ministries” and the need to “clarify the responsibilities of the different ministries involved in the water sector”.

It provides an entry point for mainstreaming climate change adaptation into overall development planning: “The NWMP should link between water sector planning and national development planning”

The investment or action plan for implementing the strategy (MWI 2012) doesn’t include any specific climate change adaptation measures (mentioned once in the document). However this plan is currently updated, in line with the Institutional Support and Strengthening Program (ISSP) for the water sector. This program is expected to lead to a restructuring of the Ministry of Water and Irrigation and as with any new structure, there is a window of opportunity to introduce new concepts and innovations for mainstreaming climate change adaptation.

The National Water Master Plan which was developed with GTZ support, published in 2004 is currently being revised and streamlined, with WEAP as a central planning tool. Existing WEAP models which have been developed for individual basins in Jordan are currently integrated in one national WEAP system.

The 1st National Communications to the UNFCCC were published in 1997, the 2nd National Communications in 2009. They mainly contain a description of the knowledge (and limitations) along the well-known chain from global to regional climate models, and further to impact models, vulnerability and adaptation assessments for the water sector (also using WEAP), the agricultural sector and other sectors. So they list some of the important water management measures, but without identifying
innovative and integrated measures. With the 3rd communications now under preparation, there is an opportunity to fill that gap. In particular it will be important to also develop an adaptation action plan.

The Ministry of Environment also coordinates the development of a climate change policy, which is integrating perspectives from a wide range of other ministries and stakeholders. This effort is being led by the national climate change committee. Again, there is scope for closer integration with water planning.

g. Institutions consulted in Jordan
- Ministry of Water and Irrigation
- GIZ
- BGR
- Ministry of Environment
- UN Joint Program (Adaptation to Climate Change to Sustain Jordan MDG Achievements)
- French Embassy in Jordan
- Friends of the Earth Middle East (FoEME)

h. ACCWaM Pilot project in Jordan
The proposed pilot project will focus on sustaining groundwater resources in the Azraq basin, which are projected to diminish under climate change through a combination of improved recharge and reduced abstraction. This is to be achieved by: i) artificial recharge using dams for capturing and infiltrating excess water from flash floods, and ii) providing farmers with less water-intensive income alternative, i.e. energy farming. Given that groundwater is the main (and critically overexploited) irrigation water source in much of Jordan, and the successful participatory approach through the Highland Water Forum, this pilot project can demonstrate the feasibility of improved groundwater management and knowledge and capacity building for later outscaling and upscaling to other aquifers. Additionally assessments will be required for future groundwater recharge under climate change – e.g. based on new UN-ESCWA / SMHI regional ensemble climate scenarios.

Additional suggestions by Jordanian stakeholders for climate change adaptation projects were:
- water harvesting and storage in the Badia region, to tap some of those 90% of precipitation that become green water which Jordan’s national water plan considers not to be available for water supply. This could build on the model of the GIZ pilot project, including aquifer storage
- desalination of brackish water or use of brackish water for bio-saline agriculture in the Jordan Valley

i. Recommendations for Jordan
Even more so than in Lebanon, supply side options are largely exhausted and accordingly demand management must have highest priority in climate change adaptation in the water sector, through increased water productivity and reduction of technical losses and of illegal abstractions. Water markets as tools for increasing water productivity are not yet fully established.

Very few opportunities remain on the supply side, such as grey water reuse, rainwater harvesting and aquifer storage. Water quality management remains essential to avoid further reductions in water availability. Virtual water imports as the main adaptation option to increasing water scarcity has to be fully integrated with water and land planning.
Despite further advanced water strategies and plans, also in terms of climate adaptation, compared to other MENA countries, there is still a significant implementation deficit, e.g. when it comes to reducing illegal abstractions.

Jordan can turn its disadvantage of being most pressed in terms of water scarcity into an advantage, if it becomes a role model in the MENA region in adaptation, providing alternative and integrated water and energy opportunities, which are much more cost effective than those development pathways that the Gulf countries are now proposing. Jordan’s advanced position in adapting to water scarcity is illustrated e.g. by

- its high level of wastewater reuse,
- energy efficiency improvements in water pumping
- energy recovery in wastewater treatment (“triple win”)
- water data integration and integrated scenario planning (using WEAP) in the MWI

Windows of opportunity for mainstreaming climate change adaptation exist, e.g. through institutional reforms ongoing in the water sector and upcoming revisions of the:

i) investment or action plan for implementing the national water strategy,
ii) National Water Master Plan,
iii) 3rd National Communications to the UNFCCC
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