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Water and Climate Change in the MENA-Region

Adaptation, Mitigation, and Best Practices

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Introduction

Owing to the rising levels of greenhouse gases, the present global average increase in temperature stands at 0.8 °C, and for Europe even at 1 °C, since the beginning of the 20th century. This is having a concrete impact on global water resources. By 2080, 20 % of the population will be living in highly flood-prone areas. The proportion of the population suffering from water scarcity due to declining annual rainfall will rise from 1.6 billion (1995) to 5 billion in 2050. The MENA-Region, southern Africa, large parts of Asia, Australia, New Zealand and some countries in Latin America will be affected most severely by water scarcity. In Syria, for instance, the renewable water resources are expected to be halved by 2025. For the MENA-Region, the IPCC forecasts a temperature rise that will be higher than the global average temperature rise of 6.4 °C in 2100. The Arab Water Council (AW C) is assuming a drop in rainfall of up to 25 % by 2060. Soil moisture will decrease by approx. 10 % due to severe evaporation. Agricultural productivity will fall correspondingly, and the food security of the population in the region will be at risk.

The different implications that climate change has for water management can be summarised as follows:

- dwindling of the flows into the river systems due to the long-term melting of the mountain glaciers,
- more frequent flood disasters,
- declining rainfall,
- lower regeneration of groundwater,
- surge of national and regional conflicts over the use of shared water resources,
- higher costs for the provision of water,
- increase in water-related diseases due to the deterioration of water quality.

Strategies for climate change adaptation regarding water management in partner countries should include the following approaches:

- application of the Integrated Water Resources Management (IWRM) approach,
- boost of resource efficiency,
- taking account of climatic risks when planning water management projects,
- creation of incentives and political guidelines for boosting efficiency,
- application of measures in agricultural irrigation, such as wastewater reuse, rainwater storage basins, reduction of losses, sustainable wastewater management, etc.,
- protection of the eco systems,
- measures for energy use/generation such as local hydropower plants, local wastewater purification with processes that are close to nature and have lower energy needs, grey water recycling, waste heat utilization from wastewater,
- strengthening of regional and cross-border cooperation,
- capacity building measures.

German Development Cooperation prescribes that all programs and projects within the framework of development cooperation are to be examined and evaluated in terms of their implications for the climate and their need for adaptation in the future.

The scheduled conference water and climate change in the MENA-Region is going to focus on these issues, for that, international experts from the region are going to attend and share their experience.

Main objectives of the conference will be:

- To discuss with international experts the impact of climate change on water resources in the Arab region.
- To elaborate adaptation and mitigation strategies on local and regional levels.
- To analyse the role of IWRM in the climate change aspects.
- To assist the needs for capacity building activities to deal with the situation.
- To discuss the possibilities of technologies and research application in the region.
- To discuss the contribution and role of the civil society and the private sector.

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Opening Ceremony

During the opening ceremony, representatives of three main development partners in the field of water resource management explained their approaches and requirements for co-operation and talked about challenges.

Adolf Kloke-Lesch

Member of the Management Board,
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany

Adolf Kloke-Lesch welcomed the guests and key note speakers and addressed special thanks to the Arab Countries Water Utilities Association (ACWUA) and also to the German Federal Ministry for Economic Cooperation and Development, BMZ.

He underlined that access to water and sanitation is a human right of every citizen and at the same time a demanding responsibility of the national governments and their leadership.

He characterized the recent development in the MENA-Region as an ongoing process which will lead to significant changes. Good governance, transparency, social accountability, citizen feedback, open information, good corporate governance, and the effective use of competitive markets are fundamental for stability and sustainable development in the region. So he highlighted three essential issues for the tasks ahead: qualified human resources, well governed institutions and cooperation with the civil society.

Kloke-Lesch emphasized the intention of GIZ to support regional cooperation and dialogue processes to ensure stability and economic growth as well as political reforms concerning all countries in the MENA-Region. Further he mentioned the institutional change: the BMZ has started to bring together the three German organizations of technical cooperation, the DED, GTZ and InWEnt are



merged to GIZ. “The accumulative synergies of this merger will strengthen our cooperation in a spirit of partnership with the countries of the MENA-Region”, he pointed out.

GIZ as one of the two main implementing organizations for German Development Cooperation, on behalf of the BMZ, is engaged in the water and environment sector in the MENA-Countries for more than 20 years.

Further he addressed the conference aims and said: “We all share a commitment to establish an important forum to initiate innovative ideas in the region and to create the space to develop visions for an integrated water policy in the region under the condition of a changing climate”.

Khaldon Khashman

Secretary General, Arab Countries Water Utilities Association (ACWUA), Amman, Jordan

Khaldon Khashman, who spoke for ACWUA, the Association of Arab water suppliers, gave an introduction to the challenges the region faces due to climate change. The Arab Countries Water Utilities Association, with its 90 public and private utilities in 16 countries, made climate change one of its important topics.

It is expected that the MENA-Region will see a two-degree increase in temperature during the next two decades and a four-degree increase by the end of the century. Khashman pointed out that two degrees meant a lot in an already high temperature region. The rise in sea level water of 0.5 meters would affect 43 port cities with two million people being displaced.

Climate change also affects the timing of the rainy seasons. As a result, floods and droughts are increasing. Agriculture, employment, urban development, tourism and cultural assets will be affected.

Water resource management needs to take these changes into account. The quantity of water will decrease. Droughts are occurring ten times more often than in the beginning of the 20th century. Evaporation is increasing which affects surface and ground water. Runoff is decreasing by 20 to 30 percent. At the same time, the quality of water is at risk. A rise in water temperature can result in water



pollution. The increase in intense rainfall may result in the flooding of dams and saline intrusion into the groundwater.

Khashman pointed to the gap of knowledge in the Arab Region concerning climate change and stressed the need to improve understanding.

ACWUA is contributing to this improvement. The association already organizes working groups, which help collect data and disseminate best practices. The role of ACWUA is "understanding regional climate change impacts, and identifying effective mitigation and adaptation measures."

"At last, I hope the political change in the region will bring more opportunities," Khashman said.

Reza Ardakanian

Director, UN-Water Decade Program, United Nations University, Germany



Reza Ardakanian, the director of the UN-Water decade program and a former vice minister in Iran under started his lecture on "Capacity Development for the Transition from Integrated Water Management to Adaptive Water Management" with a rhetorical question: "What is UN-Water?"

"UN-Water is not a new agency but an interagency mechanism, an umbrella for organizations," he explained. It strengthens coordination between UN-entities and non-UN partners on all issues related to fresh water and sanitation.

Its main mission is capacity development in the area of Adaptive Water Management (AWM). AWM poses a new challenge. Integrated water management, which still needs to be applied by many actors, is no longer sufficient. Many actors in IWM lack the skills, knowledge and flexibility to react to increasing risks and uncertainties. Adaptive Water Management uses the lessons learnt in implemented water management and develops pro-actively improved management policies and practices.

Ardakanian stressed the need for public awareness and commitment, within the political system as well. Capacity building of UN-Water therefore targets four groups: the public sector, politicians, decision makers and individuals.

UN-Water trained educators in India in 2008. It also organizes workshops on higher education.

Politicians are targeted through "the important and efficient channel: the media," Ardakanian explained. "Well-trained journalists have some impact on politicians through their publications, but also indirectly when they face them in an interview, and force to them be prepared."

There have been workshops for journalists on "Climate change and adaptation in the area of water supply and water resources management" in Teheran, Cairo and Montevideo.



Key note speeches

Odeh Al Jayyousi

Regional Director, IUCN West Asia/Middle East, Amman, Jordan

The main message of Odeh Al Jayyousi's keynote speech was that the existing approaches and the way of thinking needed to be challenged. "What constitutes a good life?" he asked.

Describing the MENA-Region he started off by categorizing three different ways of thinking:

The fatalist school of thought says: "The world will end, so why bother."

The sceptical school of thought says: "We have enough oil, so why bother."

The third category, according to Jayyousi, was rational discourse, the idea that science should inform policy. "I am here to talk to the third kind of people," he said, but also stressed that we shouldn't generalize. "We are talking about a heterogeneous entity, gulf region, poor countries are very different."

Yet, the "way we think" also constituted a major challenge for him on the global level. "The challenge we have is that the market economy does not include ecology, even though climate change is actually a market failure."

Speaking for the International Union for Conservation of Nature, he emphasized the interlinking of different sectors: "We need water for food, for energy, for ecosystems. There should be a dialogue between these sectors."

Ralf Otterpohl

Director of Institute of Wastewater Management and Water Protection, Hamburg University of Technology (TUHH), Hamburg, Germany

Keynote speaker Ralf Otterpohl made a point that he would not so much speak about water, but about soil. According to him the severe water stress in the MENA-Region was due to bad soil management. He stressed that rich soil makes water.



The message of climate change, of the need to change our ways of life would be difficult to get across. "We don't have a simple message to the media and to the people, because the statistics are not linear." The monetary value to be applied to ecosystems should be calculated. "e.g. 100 billion per year for medicine," Jayyousi suggested. "The BIP does not give us the total economical truth."

Further, Jayyousi asked: "What do we mean by economic growth? We need to define how we can have prosperity with limited growth."

He had good news. Showing a world map in which large parts of the Sahel region were coloured green, he explained that these areas in Africa were getting greener due to rainwater harvesting and soil

improvement. The planting of trees would provide shade in which vegetables could grow better.

"This could be a solution for MENA as well," he asserted asking: "Why is this not headline news? Why does nobody know about this?" He explained that local water renewal can be improved if the humus content in soil is improved. A new approach is to compost bio-waste and excreta with charcoal.

Globally, the loss of soil fertility is dramatic. Prices for industrial fertilizer are going up. Thus, farmers can only survive if they use organic fertilizer. This is where charcoal comes in. "In the Amazon region, it has been discovered that ancient civilizations created rich soil through organic waste management, also including charcoal, the Terra Preta" Otterpohl recounted. The charcoal can be produced by energy production by gasification of woody waste for electricity generation or household cookers.

(Recent studies about the use of charcoal in fertilizer showed that the yield could be raised by 30%.)

Another solution would be rain water harvesting. "Little check dams or many simple swales can change the whole region," he said. Also wastewater was a reliable source, which could be used in cost efficient

Stefan Uhlenbrook

Director Academic Affairs, UNESCO-IHE, Institute for Water Education, Delft, The Netherlands

Stefan Uhlenbrook stressed the need for capacity development in his keynote speech. When travelling to Africa he had observed: "They always tell me: Oh it's the temperature increase. Awareness there is very high," he assessed.



ways. Another point he made concerned water consumption in Europe. "We have to look at the real water demand," he said. "We are proud in Germany to have a relatively low water consumption, but in fact we use much more importing shoes, clothing, food from abroad." He strongly recommended (water efficient) the few hygienically safe shower heads which use 6 liter per minute instead of 18 and thereby could save 200 Euro per person and year on the energy and water bill.

In the MENA-Region, the problems were evident: the population growth is high, available water resources are low. The decline in water availability is especially felt in the Arab region. In the year 2030, the whole region will suffer from severe water scarcity.

Yet, he said that there was a funny pattern in the projections for the next 50 years in the MENA-Region. Only some countries strongly improved their adaptation measures. "These are areas that hardly have any runoff at all."

As an example of the need for capacity building and knowledge exchange, he mentioned the UNESCO Institute for Water Education's work in the Nile basin. As Uhlenbrook said, the rise in storage in the

Mekong basin had been predicted. "How does that look like in the Nile basin?" he asked, "What would that mean for the MENA-Region?"

Panel discussion

Replying to a remark by Odeh Al Jayyousi about the media, chair Alex Kirby, who worked for the BBC for twenty years, elaborated on the journalistic point of view: "The challenge with climate change is that it happens over a long period. You can't write about it again and again. The other problem is that it is difficult to get this thing in 600 words."

The Jordanian professor for water engineering Ziad Al-Ghazawi disagreed: "I think climate change is not a slow process. Last winter, when temperatures dropped journalists were making jokes, but I believe media people know quite well that climate change is not just about temperature rise." He saw the problem more with politicians than with journalists. "Coming from the MENA-Region we have listened to the same kind of excellent presentations for years. If nothing changes, we as scientists have to take the extra step and talk politics," he said. In his opinion, now was a good time to start because of the revolutions. He stressed: "We reached zero, not because of a lack of science, but because of corruption."

An employee of the German Ministry for Economic Cooperation and Development recounted his experiences when travelling to the region: "I always asked if I could also talk to the Minister for Agriculture. This was considered absurd, because he was not concerned with water." He was wondering if it could be possible in the future to have one person in the cabinet responsible for agriculture and water.

Ralf Klingbeil from ESCWA in Beirut agreed. "If 70% of water goes to agriculture, we have to address the topic in a very different way," he said, recalling the German experience: "When the Ministry of Agriculture is only responsible for farmers, they are just a lobby group. Now (in Germany) we have a Ministry for Consumer Safety."

Ralf Otterpohl wanted to correct this statement, because he believed that the Ministries of Agriculture were not representing farmers but agro-business. "Farmers are going into bankruptcy."

"We need to adapt knowledge and make it work locally," he said, concluding that capacity building and development was always a no-regret-strategy.

Uhlenbrook reported from the Netherlands that the number of ministries there had been reduced to 11; water was under the umbrella of the Ministry for Environment. "In developing countries I am often astonished by the large number of ministries. It doesn't make things more efficient," he said.

Another participant was also quite pessimistic about government practices: "There are a lot of projects going on in the MENA-Region. But after four to six years the documents are forgotten in some ministry."



Jayyousi had a more optimistic approach: "We talk about the American dream, the European dream. We never talk about the MENA dream, what we want to be in 20 years. With the revolution we need to create our own dream." The regimes collapsed in his view because there was no justice and no ecological awareness.

The discussion shifted towards technological issues when Otterpohl mentioned Desertec suggesting that the region could be a great producer of renewable energy. "I am amazed by the opportunities in the MENA-Region. In our region it's so hard to get energy. MENA could be so prosperous and this could be achieved with political changes," he stressed. A participant from Tunisia objected that technology from the north costs a lot.

First Joint Session and Discussion: Water Resources and Climate Change

Basem Shomar

Institute of Earth Science, University of Heidelberg, Germany

In his lecture on "Important Aspects of Climate Change and Implications on Environment and Water", Basem Shomar talked about the complexity of climate change.

Climate change affects fresh and ground water, land use, forestry and biodiversity. It means changing the hydrological cycle. Although there will be more evaporation, the risk of flooding and storms also increases. All these sectors are interrelated. "Affecting one component of the hydrological cycle will affect others," the environmental chemist who originates from Palestine said.

Shomar gave a telling example while recounting the consequences of melting snow. "The function of snow equals those of dams," he said. "We build dams to control water levels in order to reduce the risk of flooding. If the snow melts it is as if a dam is destroyed."

Further on he explained that if snow melted earlier water would be made available to plants earlier in the year affecting the whole life cycle. Plants would be most affected, because they are more vulnerable to stress, disease and fire. As a result birds, fish, etc. would also be affected. "If you change snow regulated



systems to rain dominated systems the whole ecological system will change."

All this affects human health. Manmade consequences such as conflicts over water can be added. Thus, Shomar made human health the focus point of his discussion of climate change.

He concluded that climate change means that it would be hard to predict water availability. "Climate change makes all needs to be less workable. It makes all the existing problems worse."

Ralf Klingbeil

Regional Advisor Environment and Water, UN ESCWA, Beirut, Lebanon

As an introduction to his lecture on "Water, Scarcity, Climate Change in the Middle East – Challenges to Water Management" Ralf Klingbeil had a theory: "The current uprisings in the Middle East also take place because of the scarcity of natural resources." Water was what he had in mind. He said that one of the important reasons behind most of the population displacement in Iraq was unmet water needs. He referred to maps of Iraq showing in dark red regions

with significant people displaced due to droughts and dark blue showing areas in need of water.

"The actual renewable fresh water resources in the MENA-Region are the lowest in the world," said the regional advisor to ESCWA – the Economic and Social Commission to Western Asia with 12 members in Asian Arab countries plus Egypt and Sudan. At the same time, the percentage of withdrawn renewable



water resources in the MENA-Region is the highest globally.

Pointing out that "climate change is an additional challenge to water management in the region,"

Mohamad Kayyal

Damascus University, Damascus, Syria

Talking about the challenges of decision-making in Syria, Mohamad Kayyal gave a practical example to Basem Shomar's earlier lecture. Syria is one of those countries which will see the change from a snow regulated to a rain dominated ecosystem. "In Damascus city, we depend on melting snow from the Lebanese mountains," Kayyal explained in his lecture "Evaluation of the Monitoring and Decision Making Systems for Climate Change in Syria".

"Right now it is spring, the melting snow will provide water for over four months," said the engineer, philosopher and adviser to the president of Damascus University. Yet, if the snow melts earlier or comes down as rain "we will get more water in a shorter period."

The impacts will be multi-sector such as: destruction of ecological habitats, reduction in biodiversity, loss of wetlands, land degradation, coastal erosion and a decline in water resources.

Therefore, creating a strategy will be very complicated. Kayyal said that the response of the Syrian government to the challenge of climate change was

Klingbeil stressed the other factors contributing to more and more countries moving towards water scarcity. One of these factors constitutes the high rate of population growth in the region. "Soon, more people will be living in MENA-Region than in Europe, but with a GDP of less than Spain and Italy," said the trained hydrogeologist who originates from Germany.

But irrigated agriculture also adds to the problem, Klingbeil said, his diagrams showing the stark rise of irrigated agriculture in the Middle East. Klingbeil raised the question: "Is it worth spending all this money on agricultural production in an arid country?" Although more land is being used for irrigated agriculture, the contribution of agriculture to the GDP is declining.

He concluded: "We need to assess what is really needed."

similar to that of other countries in the region. Syria participates in talks and has signed several documents such as the Kyoto protocol. The social devel-



opment plan for the years 2011–2015 includes a special sector on climate change.

However, Kayyal was skeptical as to whether this would lead to effective measures. The starting point was, in his opinion, the factual data which could be given to decision makers. Data was so far collected by the Ministry of Agriculture and Agrarian Reform, the Ministry of Irrigation and the General Metrological Department. The Ministry of Agriculture's interest in this data is limited because it is not concerned with water. Yet, Kayyal stressed that a more important problem was the limited cooperation, answering his own question: "How do these institutions deal with each other?" with "They don't at all."

Janek Hermann-Friede

Water Integrity Network (WIN), Berlin, Germany

Janek Hermann-Friede explained in his presentation "Water, Corruption and Climate Change" why development cooperation targeting climate change was vulnerable to corruption.

Corruption in the water sector was a reality said the representative of the non-governmental organization "Water Integrity Network" which fights corruption in the water sector. Hermann-Friede said that according to estimates 20–40% of water sector finances are being lost due to dishonest and corrupt practices. The World Development Report 2010 estimated costs for developing countries to adapt to climate change between US\$ 30 to US\$ 100 billion in new and additional finance each year until 2050.

The special vulnerability of the water sector to corruption is due to time pressure to implement adaptation measures, the complexity of information and lack of transparency. "Climate change will lead to large amounts of money flowing into the water sector," Hermann-Friede explained. "Time pressure may lead to fewer accountability measures." He saw the fact that decision makers had not come up with any clear criteria on adaptation measures up to now as especially alarming.

But not only is there a lack of data Syrian decision-makers could rely on, there is also a lack of knowledge concerning climate change in general. "What do local communities know about climate change? What do farmers know?" Kayyal asked, answering: "Actually, not a lot," and pointing to the fact, that there was no proper protocol in the Ministry to deal with this.

However, at the time being one proposal for creating a "Coordinating Unit for Climate Change" which could be part of the Ministry of Environment is being looked at.

Kayyal concluded with a metaphor for decision making related to climate change: "It's like an orchestra which needs a maestro."



Underlining this he recalled: "Although climate change contributes to increased water stress, scarcity is largely due to weak governance and the absence of regulatory frameworks and law enforcement."

He said that very complex knowledge was necessary to design a water management strategy. Thus, it would be very difficult for the public to detect where corruption might occur. "The complexity makes it hard for civil society to fulfil its role," Hermann-Friede said.

"People need to know what the corruption is to take effective anti-corruption measures." Hermann-Friede

ended on a hopeful note: "With the new developments in the MENA-Region we have a lot of focus

on corruption. This can create momentum to increase integrity in the water sector."

Panel Discussion

Most statements and questions during the panel discussion concerned corruption, but also decision making in general. A participant from Yemen believed the losses due to corruption were much higher than 20 % and called for a scenario on how to deal with corrupt countries. He also expressed his surprise that the Ministry of Agriculture and the Ministry of Environment in Syria should work together on climate change. "I believe neither is interested," he said. Another participant pointed to the fact that counter corruption laws were in existence, but "we don't know how to implement these laws."

In response, Hermann-Friede clarified that 20 % was a global figure, not referring to MENA only. He also stressed his point that more hard facts were needed. "Facts need to be collected and need to be verified to be politically useable. So politicians don't just say: This is something you made up. Then it needs to be seen what can be done against corruption."

A participant from Morocco addressed policy and politics. "In our region, farmers and industry are

very strong in preserving their interests," he said mentioning the national strategy of agriculture, the green strategy, which was in part contradicting the national strategy of water.

Basem Shomar added to the discussion on data that most expertise was not from local organizations but international. "In Jordan and Palestine, we have the World Bank." He raised the question of how cooperation could be enhanced from an international point of view.

Ralf Klingbeil stressed that his lecture gave an overview about different factors impacting the water resources and its management, among others the intensive agricultural use of water for irrigation. "Also in Arab countries many people depend on agriculture for their livelihood." Yet, large scale agribusiness developments have in the past used huge sums of money which might have been better invested in a more long-term sustainable way for the benefits of the people.



Session IIa: Water Resources and Climate Change in Mashrek Countries

Thomas Ammerl

CLIMB-Project Consortium, Bavarian Research Alliance GmbH (BayFOR), Munich, Germany

The title of Thomas Ammerl's lecture "CLIMB – Climate Induced Changes on the Hydrology of Mediterranean Basins – Reducing Uncertainty and Quantifying Risks" already clarified what the acronym CLIMB stands for. The project's goal is to analyze ongoing and future climate induced changes in hydrological budgets and extremes, Ammerl explained. These changes could then be linked to associated risks thus quantifying uncertainties in climate change impact.

The project's scientific approach is to integrate advanced geophysical field monitoring techniques, remote sensing analyses and retrievals, climate model auditing and downscaling, integrated hydrologic modeling and socioeconomic factor assessment.

CLIMB with Ralf Ludwig from the LMU in Munich as the scientific co-ordinator was funded under EU's FP7 Environment Theme during a period of 48 months (01/2010 – 12/2013) with an EC contribution of 3.15 million Euros (www.climb-fp7.eu). There are 19 beneficiaries from 9 countries: Austria, France, Germany, Italy, Egypt, Palestinian territories, Tunisia, Turkey and Canada. CLIMB is also joining the research cluster CLIWASEC (Climate induced changes on water and security in southern Europe and neighbouring regions) together with the FP7-

Hülya Boyacıoğlu

Department of Environmental Engineering, Dokuz Eylül University, Izmir, Turkey

Hülya Boyacıoğlu presented a study comparing European countries in her lecture on "Regional Differentiation of Climate Change, Impact on Water – Resources in Europe: Environmetric Approach".

"How are fresh water sources changing due to climate change in Europe?" she asked. The study found that dryer winters in southern Europe and



more extreme floods and droughts throughout the year were changing the water availability in Europe. The investigation compiled a trend of climate parameters in four categories of European countries: Class I: Northern countries
Class II: France, Germany, Central Europe

Class III: Southern Europe

Class IV: Cyprus

The distribution throughout Europe is obviously not the same. Rainfall differs from 500–500,000 m³/day. While Estonia has the highest water abstraction, neighbouring Latvia has the lowest. Only in Turkey is water abstraction increasing. In eight countries – mostly Eastern European or Scandinavian – abstraction is decreasing. Yet, for most countries no data is available.

The water abstraction rate for private use is high when water is free, like in Ireland. In most of the European countries, annual rates of freshwater abstraction change between 50 m³ and 100 m³ per capita. While Bulgaria has extraordinary high losses in its water network, Germany has the lowest losses.

Agriculture is the major water user in Europe – just as in most places in the world. Approximately 55 % flows to this sector. Spain and Greece use ten times



more water in this sector than countries in Central Europe. Although, countries like Belgium, Poland and Norway show an increasing trend. On the other hand, Romania's and Sweden's abstraction for agricultural use is decreasing.

Holger Hoff

Senior Scientist, Stockholm Environment Institute, Stockholm, Sweden

In his lecture "Water and Climate Change – A Scenario Planning Tool for the Jordan River Basin", Holger Hoff first outlined the situation in the Jordan River basin. Blue water resources (river flow and groundwater) have been overly allocated. This situation is aggravated by climate change, land degradation and the rapidly growing water demand. Palestine, Jordan and Israel are already heavily dependent on importing foreign water (virtual water). Due to climate change, the southeastern part of the Mediterranean area will have a strong reduction in rainfall. Adding to this pressure, is that the affected states are limiting themselves mainly to the management of blue water (river flow and groundwater) missing opportunities in improving green (soil) water use. Hoff asserted that a planning tool permitting public authorities to take an integrated approach in a sustainable way would therefore be necessary. The WEAP (Water Evaluation Planning) tool he presented is based on a new transboundary consensus database and participatory scenario development. This fully completed model for the region integrates climate change and socio-economic



scenarios. Some of the implemented adaptation options in WEAP are: groundwater development, water transfers, desalination, wastewater plants, water harvesting and demand management. In conclusion, Hoff appealed to everybody: "We wish to apply this tool; we invite regional collaboration on using this tool."

Ziad Abu-Hamattah

Faculty of Engineering Technology, Al-Balqa Applied University, Al-Balqa, Jordan

According to Ziad Abu-Hamattah, agriculture will remain the most important water user (85 %) in the region, followed by industry and the tourism sector (10–15 %). Yet, demand may rise, he warned in his lecture on "Water Resources and Environmental Management in Jordan and the Middle East."

The domestic water requirements will increase with population growth. Industrial and tourism water requirements may be multiplied by a factor equal to 2 or 3.

"The situation is a nightmare," Abu-Hamattah stated. "In an area of about 15.5 million km² and a total population of already 385 million inhabitants, about 5 % of the world population is left with only 1 % of the world's renewable water resources."

Mitigation measures could be the treatment of wastewater, groundwater abstraction control, groundwater artificial recharge, new techniques for water resource studies (protection, exploitation and management), the protection of groundwater resources from pollution and improved legislation.



He stressed that major water policy reforms were needed. His suggestions were adopting an integrated approach to water resource management in service delivery or raising water tariffs, adopting a sustainable groundwater use strategy, decentralizing water management responsibility or promoting cooperation for sustainable management of transboundary water resources.

Session IIa: Water Resources and Climate Change in Mashrek Countries

The afternoon session started off with an explanation. Chair Alex Kirby announced that Jamal al-Dadah would not be able to attend the conference and speak because Israel did not allow him to leave the Gaza Strip.

Magdi Abdelhamid

Botany Department, National Research Centre, Cairo, Egypt

"Most of Egypt is desert. Considering this and the amount of people living there we have a problem." Magdi Abdelhamid summed up the challenge his country is facing. He started his lecture "Coping with Water Scarcity for Food in Egypt" by defining water scarcity.

Water is defined as scarce when the availability in a country or region is below 1000 m³/person/year. Severe scarcity would be if people have less than 500 m³/person/year. Egypt had a share of water per capita of 860 m³/year in 2003. This is expected to decrease to 582 m³/year by the year 2025. Egypt depends completely on its annual share of Nile water, e.g. with Sudan.

Water scarcity in Egypt means that food security is at risk. The import of basic goods like wheat, maize and farva beans is proportionally high even though the farming of these goods has increased to 210%. "Crop yields in Egypt are among the highest in the world," Abdelhamid stressed. The amount of crops



being exported is actually rising. At the same time, due to population growth, more and more fertile land is being used for housing. The population is predicted to grow up to 150 million in 2050 and then to 190 million by 2100.

Mahmoud Shatat

Coastal Municipalities Water Utility (CMWU), Gaza, Palestinian Territories

The Gaza-Strip is in dire need of wastewater treatment. That was the essence of Mahmoud Shatat's lecture on "The Impact of Climate Change on Wastewater Treatment in the Gaza-Strip".

"In the Gaza-Strip, water availability depends completely on ground water," he explained. More than 1.6 million people live in the Gaza Strip, a very small region measuring 378 km². While the north sees

450 mm of rainfall annually, the south only gets 200 mm.

Water stress occurs here constantly. There is a lack of water even after wastewater treatment. "More than 90% of groundwater is contaminated either by chlorides or nitrates. We need to utilize every drop in Gaza," Shatat stressed. Treated wastewater means a sustainable resource for the Gaza-Strip.

Yet, only four wastewater treatment plants exist with a combined amount of 99,000 m³/day. Another three are planned with an estimated capacity of about 180,000 m³/day.

Wastewater treatment in the Gaza Strip is a natural type where microbes are the key player. Trickling filter processes are the most sensitive to temperature change. Thus, climate change could affect treatment plants.

However, the model results Shatat presented showed proper efficiency at high temperature. The efficiency even increased with a rise in temperature in both aerated lagoon and the trickling filter. However, the increase in temperature will effect the level of dissolved oxygen. Shatat said that an increase in the level of aeration was therefore required.

The main concern of wastewater treatment is the potential reuse for the irrigation of citrus orchards.



The growth rate of citrus will increase leading to higher water consumption and evapotranspiration which will increase the salinity of irrigated areas.

Round table discussion

"Nightmare was a good expression for showing the urgency that lies within the problem," was chair Alex Kirby's opening statement for the round table discussion.

After summing up the lectures' conclusions, Bassim Abbassi from the Jordanian Department of Water Resources asked Hülya Boyacioglu how climate change affects statistics? She said it was difficult to assess because water use also depended very much on lifestyle. As an example, washing machines use only 10% compared to 10 years ago.

The scenario-planning-tool got some laudation from the audience. Holger Hoff from the Stockholm Environment Institute elaborated that WEAP was a very simple tool with no maintenance necessary. The Palestinian Authority had started using it and GIZ implemented it, too.

One critical participant recounted that climate has been changing since the earth has had an atmosphere. "10 – 30,000 years back, climate change happened," he said, asking: "Are any of your models looking at those scenarios dealing with that?" Yet, according to Hoff, the speed of climate change seems to be unprecedented. More than 20 climate models

on the MENA-Region agree on what is going to happen. Yet, he asserted that climate change was only one concern among many others.

Someone asked Mahmoud Shatat about the oxygen concentration in treated wastewater: "Evaporation would increase with higher temperature ... What about that?"

Shatat answered that European standards were being used. "Evaporation is a problem, and causes salinity, but it is being considered."

Magdi Abdelhamid elaborated on the situation in Egypt after being asked about planning cycles in agriculture. "Wheat earns you less money than strawberries. So farmer grow strawberries, although wheat is needed," he explained. "The growing system used to be controlled, now everyone is free to plant whatever may lead to more profit." In addition, farmers don't even get the import price when selling wheat.

One question concerned the possibilities of desalination systems in Gaza. Indeed, plants had been planned with an amount of 54 m³/a, Shatat answered. But American funds had been suspended.

"It's all politics. For the Palestinian Authority depends on foreign funds." Another participant asked who would be allowed to use the water in Gaza from desalination plants. Shatat said that the Palestinian Authority would establish a monitoring system. Someone commented that brackish water was cheaper than desalination. Shatat argued that brackish water would be more saline than seawater after time. He affirmed that "seawater desalination is semi-sustainable, but the huge technical development will make it sustainable, especially when you connect it to renewable energy."

Basem Shomar stressed that desalination was a good way to keep the groundwater stable for coming

generations. "Let's deal with politics, because this is what it is about in Gaza," he urged, and was seconded by another participant who recalled that water and politics were closely related in many places, also in Jordan and the Nile basin.

One participant asked who was going to be responsible for water issues in Egypt after the revolution. It was answered that different state actors were competing, but now a new company was responsible for water and wastewater meeting international standards.



Session IIb: Water Resources and Climate Change in Maghreb Countries

Maria Snoussi

Department of Earth Science, University Mohamed V-Agdal, Rabat Morocco

Maria Snoussi outlined the impacts of climate change on Morocco and social and political challenges in her lecture on "Vulnerability to Climate Change and Adaptive Capacity of Water Resources in Coastal Plains of Morocco".

In Morocco, the temperature has already increased by 0.6–1.2 degrees. Rainfall decreases annually by 4%, while spring rainfall has declined by 40% since the 1960s. It is projected that droughts will increase and intensify in the south and the east of the country, winter rains will be concentrated during a shorter period of time and the period of snow cover will shorten. Yet, the professor also stressed that "in the MENA-Region we talk all the time about droughts, but there are also floods, which are exacerbating the sediments of the reservoirs."

The ongoing development of the coastal region is a political and social challenge. "The coastal plains are the most valuable land, yet they also host most population and most industry," Snoussi said. Climate change will lead to further degradation. At the same time, population growth in the coastal area is increasing the risks posed by sea level rise for the people.

Mokhtar Jaait

International Institute for Water and Sanitation (IEAP-ONEP), Rabat, Morocco

The Moroccan water utility ONEP provides the country with more than 80% of its water. The Head of its R&D department, Mokhtar Jaait, clarified the specific situation in Morocco: "The main characteristic of water availability in Morocco is scarcity but also variability in space and time. More than 80% contains only 7% of water."

Morocco suffered from both droughts and floods which have both lead to the displacement of people.



Snoussi asked: "How can we link the coast and the uplands?" She proposed a Highland – Lowland Partnership and an Integrated Coastal Zone Management.

Another problem she raised was the many dams in Morocco. "There is a problem with downstream watershed, but also water obstruction by dams," she said.

Mokhtar pointed out: "Who consumes more suffers more."

Therefore, one of ONEP's most effective policies for coping with climate change was demand management. Water consumption needs to be reduced. Yet Mokhtar said that this couldn't easily be done through pricing. Water is very cheap, but needs to stay so for social reasons.



Thus, ONEP has been quite successfully working at raising public awareness. "We tell people through public media don't consume a lot of water." This has led to water consumption being reduced from 130 litres per day and capita in 1990s to 70 litre today. In comparison: Cairo's consumption is steady at 400 litres per day and person.

ONEP also started desalination in the south and will extend it to the north. Mokhtar pointed to the fact that so far only 12% of wastewater had been treated. Some studies for the tourism area Marchika will be conducted in this field.

Vera Tekken

Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany

Further exemplified by Vera Tekken was the situation at Morocco's coast. The geographer at the Potsdam institute for Climate Impact Research was part of the project "ACCMA – Adaptation to Climate Change in Morocco", which studied the role of climate change for regional water availability and its impacts for regional economic development. It focused on the Moulouya River Basin, which was the most important water resource in the region.

The team started from the perception that the people in this region had hundreds of years of experience with droughts and floods and, therefore, a lot of knowledge about adaptation. While the team did find a slight increase in temperature and a slight

decrease in precipitation, they assessed that the economy had a huge impact on water scarcity.

In the coastal region, the government was encouraging tourism, and especially luxury tourism, meaning golf courses. This entailed people migrating to the coastal zones. Climate Change is not the main trigger for regional vulnerability, the ACCMA project found.

Alarming was the fact that water scarcity was neither considered in the plan for agricultural development – le plan Maroc Vert – nor in the plan for tourism development – le Plan Azur. Tekken pointed out though that the issue was just as neglected in Spain when planning tourist areas.

Christian Dede

Integrated Water Resource Management Program, GIZ, Algier, Algeria

In his lecture on "Algeria's Water resources", Christian Dede concentrated on the Northern part of Algeria, pointing out that the South was entirely dependent on fossil ground water. Because of the concentration of agriculture and population, the North was consuming 90% of the water. Most consumption resulted from irrigated agriculture, followed by drinking water, while industry played only a minor role.

Since 1965, the rainfall in the North has decreased by 10–35%. Half of the available water is groundwater, 50% is renewable surface water, a small but rising amount comes from desalination. Due to rising demand and decreasing rainfall, groundwater tables are falling. If no measures are taken, irrigation demand will increase due to climate change. At the same time, drinking water consumption will increase

due to population growth. This would mean that the demand would rise from 7 km³ today to 9 km³ in 2030, while the offer would decrease from 7 km³ to 4.5 km³.

One option for more sustainable resource management would be wastewater reuse. Dede assessed that about 600 million cubic metres per year could be used. Network losses could be reduced to 150 million cubic metres. Algeria already uses its gas resources making desalination comparably cheap. However, this would mean greater emissions. Furthermore, referring to government plannings, 30 new dams are to be built. The German development agency GIZ, which Dede represents, is sceptical about the feasibility of this plan.

Dede was emphasized the rise in demand due to the policy of the Ministry of Agriculture. Production has strongly increased in the last decade. Irrigated surfaces have almost tripled. The high water consumption of farmers is also due to the low efficiency of the predominant traditional irrigation techniques.

Dede stressed that if irrigation water demand hadn't risen, the situation would still be sustainable. He fears that the government will maintain this devel-



opment or, even worse, aim towards self-sufficiency in food production. "This would be completely irresponsible," he said.

Dede proposed a number of possible measures which he would like to present for the following round-table-discussion: irrigation efficiency, the change of crops, food imports, water pricing, the reduction of waste and losses in the drinking water networks, desalination, groundwater recharge, the reduction of reservoir silting and the enhancement of waste water use.



Session IIb: Water Resources and Climate Change in Maghreb Countries

Moulay Driss El Hasnaoui

Water Secretariat of the Ministry of Energy, Water and Environment, Rabat, Morocco

In his lecture "Climate change, impact and adaptation in Morocco, water resources management for attenuation and perspectives of development", Moulay Driss El Hasnaoui outlined the policy of the Moroccan government.

Speaking for the Ministry of Environment, he pointed out that the potential of surface water in Morocco was the highest in the Maghreb. Water resources ranged from 5 billion cubic metres in dry years to 50 billion in rainy years.

Yet, demand was rising. The area created for irrigation had increased continuously during the last decades. This was due to the implementation of agricultural policies aimed at achieving food security, explained the state secretary. Yet, rainfall agriculture still constituted 83% of production. In domestic water use, Morocco was well behind Algeria, while Libya used the most per capita.

Climate Change has led to severe droughts resulting in empty dams, sedimentation and erosions in

dams in the last couple of years. But there has also been frequent flooding.

The impact was severe on agriculture – a sector that creates 40% of employment opportunities.

Besides the already mentioned risks of climate change like floods, frost, excessive temperature, storms, degraded forest, forest fires, reduction of wetlands, loss of biodiversity, Hasnaoui also pointed to the increase of diseases like Malaria.

The Moroccan government will continue its program of dams, work towards water saving techniques such as drip irrigation and raise awareness in the population, he said. Agricultural production will be secured to save jobs in rural areas.

Hasnaoui concluded that investment was needed, but also ethics and better coordination.

Annabelle Houdret

adelphi, Berlin, Germany

In her presentation "Water, Climate Change and Crisis: Identifying, Risks and Opportunities for action" Annabelle Houdret presented a new tool for assessing conflict risks and cooperation opportunities around water.

Assuming that climate change increases competition over natural resources, adelphi has developed WACCAF – Water, Crisis and Climate Change Assessment Framework. This can analyze complex problem structures. "Different sorts of water conflicts are embedded in different political and social

relations. We don't very often look at cooperation opportunities even though on the ground people are cooperating," Houdret explained.

The tool follows six steps:

Step 1: Defining the scope and region of the analysis

Step 2: Identifying user groups

Step 3: Analysis of water availability to understand why different user groups have unequal access to water or unequal availability of water

Step 4: Analyses of the political and social context and the international dimension

Step 5: Identification of cooperation, conflict resolution, and prevention potential

Step 6: Connecting the dots

Houdret announced that a publication on this approach would come out this summer.

Lebdi Fethi

Ministère de l'Agriculture et de l'Environnement, Tunis, Tunisia



Speaking for the Ministry of Agriculture he outlined the measures taken: "Water saving was the first program. We went to drip and sprinkle irrigation."

Floods are managed through dams. One solution for droughts is a transfer network for water. "Interconnection of watersheds" is the keyword.

Artificial recharge of water tables is another solution. Yet, Fethi said that one cubic metre could cost 2 Euro in Tunisia. The problem of financing also arises with desalination. Unlike other countries in the region, Tunisia does not have cheap energy available. Thus, Fethi said that the technology of desalination was not really an option yet. Although unconventional energy, like solar energy, was ready but only in small quantities.

Additionally, the government is encouraging water harvesting, which means a return to traditional, small scale infrastructures and robust water and soil conservation systems especially in the south.

For the future, the Ministry is aiming at reducing losses. Fethi said that wastewater treatment should be obligatory for industry and tourism, not for irrigation. Advanced technology was the key for him: "Why not an International Agency dedicated to this very important worldwide common challenge."

Outlining the water situation in Tunisia, Lebdi Fethi mentioned the great pressure on fossil ground water and the importance of agriculture. The economy relies on the agricultural sector. Fethi, during his lecture on "Climate Change: Good practices in Tunisia", said that, 93% of agricultural land was fortunately not irrigated.

Many studies have been conducted on the effects of climate change. "The only thing we know for sure is that we have drought events," Fethi said and stressed the need for inter-annual water management.

Djamel Latrech

Observatoire du Sahara et du Sahel (SASS), Tunis, Tunisia

In his opinion, the problem was not so much one of water but also of availability of soil. Yet, water scarcity is also looming. There is overexploitation of basin, fossil exploitation, salted water, excessive pumping height and depletion. So far the SASS is still working on its common database, which was set

up by the respective ministries in the three countries. Annual meetings take place on the ministerial level. A superficial study has also been conducted. These first steps constituted hard work. As Latrech explained, there was much suspicion which hampered the exchange of information. "Once the info

system is implemented it will facilitate other aspects," he said.

The SASS has now started a more in depth socio-economic study with a survey of 3000 farmers. The main objective is twofold:

- to understand the real behavior of water users, mainly the irrigators, to face the challenge of water degradation induced by the overexploitation of non renewable water
- to improve the water valorization.

Latrech stressed that a participatory approach would be needed for this purpose.



Round Table discussion

The aim of the round table discussion was to assess the potential of several adaptation approaches in each of the Maghreb countries and to analyze the differences of potential between countries. To this end, the discussion facilitator Christian Dede asked the participants from the different countries to position – on a pin board – a set of adaptation approaches into a two dimension diagram. The x axis of this diagram represented the feasibility of the approach and the y axis its efficiency and/or effectiveness. A set of ten classical adaptation approaches was asked to be assessed by each country, namely desalinization, water pricing, rainfall harvesting, modification of crop and cattle systems, groundwater recharge, reduction of losses in irrigation networks, improvement of irrigation efficiency, virtual water, non conventional water use, reduction of dam silting.

Three diagrams were filled, representing the potential of these approaches in Algeria, in Morocco and in Tunisia. Comparison of the diagrams points out interesting differences, some of which are highlighted below:

- It was noticed that the potential of the dam silting reduction measure is assessed equally by the three countries which reflects similar situation of the dams across these countries.
- Concerning wastewater reuse, the three countries have the same assessment of the moderate efficiency of this approach but whereas Tunisia

considers it as weakly feasible, Morocco and Algeria consider its feasibility higher. This difference might come from the fact that Morocco and Algeria mainly take into account technical considerations (treatment capacity and number of treatment plants in Morocco, distance between production and utilization zones in Algeria) whereas Tunisia – which benefits from a longer experience in this field – integrates in its feasibility assessment social considerations that the country already faces like acceptance of this resource by the farmers. It was summarized that concerning waste water reuse the priority in Morocco is to enhance the national treatment capacities whereas in Tunisia the priority is to enhance the awareness of farmers through e.g. quality control (but no doubt Morocco will soon face the challenges that Tunisia is facing today).

- Desalinization is considered like highly feasible in Algeria but not in Morocco and Tunisia which is due to the fact that energy is cheap in Algeria whereas it is very costly for Tunisia and Morocco.
- As for water pricing it is assessed differently by the three countries and the reasons identified were the following: in Algeria farmers irrigate from individual wells and water pricing is thus considered as not feasible although efficient. In Morocco it is considered to have a significant potential. In Tunisia it is already implemented but the challenge lies

in the acceptance by the farmers. It was concluded that a strong awareness among farmers is necessary in all countries as well as a participatory management in order to define a locally adapted water pricing instead of implementing the same policy at the national scale.

- Reducing agricultural production (as the main water consuming economic activity) was not evaluated to be feasible in each of the three countries, as agriculture plays a crucial role both in the labor market and as resource to generate export.

Visualizing the different situations allowed for each country to investigate the reasons for these differences. This is an interesting exercise to provide some key themes on which a country might need to 'work' for a specific measure to become more successful.



Session IIIa: Water and Waste Water Management and Climate Change Adaptation

Nadir Al-Ansari

Department of Civil Mining and Environmental Engineering, Luleå University of Technology, Luleå, Sweden



In his lecture on "Possibilities of Restoring the Iraqi Marshes known as the Garden of Eden", Nadir Al-Ansari first gave an overview of the area and its importance.

The Iraqi Marshes, measuring 15,000–20,000 m², are the largest wetlands in the region. They play an important role for migrating birds. 60% of the fish eaten in Iraq comes from the marshes. The temperature differences are extreme at 50 degrees in summer and 0 degrees in winter. The rainy season lasts

40–60 days per year, evaporation is high with 50% in summer, but a low 6% in winter.

The Sumerians had already used the marshlands for agriculture irrigating with canals. In fact, the first laws regulating water resource management originated during this time.

The problems with the marshes started in the early 1980s during the Iran-Iraq war when Iraqi troops prevented the flow of water from the Tigris into the marshes so they could hide in them and attack from there. In the 1980s, it was a restricted area. After the Kuwait war in 1990, the government dried the marshes because they were the homeland of the Shia which had been encouraged by the US to rebel against Saddam Hussein.

In 2000, only 10% of the area was left untouched when huge oil fields were found in the marsh area. After the fall of the regime, people destroyed the hydraulic structure allowing water to flow although slowly. Al-Ansari finished on a hopeful note: "We believe we can re-establish 75% of the area." 100% could not be recovered because the inhabitants would want to keep their agriculture and the oil fields could not be flooded.

Mohamed Elshemy

Water Engineering Department Tanta University, Tanta, Egypt

In his lecture "Climate Change Impacts on the Water Quality Characteristics of the Southern Part of Aswan High Dam Reservoir, Lake Nubia", Mohamed Elshemy presented a case study on future temperature and inflow effects on the lake's chemistry. Scientists were under the assumption that,

according to the ICCP Report 2007, lakes and rivers have been warming affecting thermal structure and lake chemistry.

They measured eight water quality characteristics at 17 stations in Lake Nubia, the Sudanese part of the

lake formed by the High Aswan Dam in Upper Egypt. Three future scenarios for the years 2010–2099 were used. For the years 2010–2039 scenario, an increase by about 34.7% of the inflow in 2006 from the river Nile will reach lake Nubia according to the most positive scenario. Thus, the authors found that climate change will have a significant impact on the hydrodynamic and water quality characteristics (7.4% for water temperature, -3.9% for DO, and 72.4% for ammonium).



Hussain Al-Towaie

University of Aden, Aden Yemen

"Do we really need desalination?" Hussain Al-Towaie asked in the beginning of his lecture on "Necessity and Impacts of Water Desalination in the MENA-Region." For the MENA-Region, he might have answered this positively, even though he had many reservations about the method as it is practiced today.

A few countries in the region have more than 1000 m³ renewable water per inhabitant per year. These are Iraq, Iran, Syria and Lebanon. The rest suffer from water scarcity. "We have enough saline water," Al-Towaie said. However, the technology used to extract it right now poses two problems:

energy and brine. At the moment, oil is the source of energy. The waste is thrown into the sea. Not only are the temperature and salt-content high, but it also includes chemicals like chlorine and antifoaming additives and possibly copper if copper-nickel alloys are used for heat. "So I say it is not sustainable," concluded Al-Towaie.

He recounted that 45% of worldwide desalination took place in the gulf countries. They increased their desalination capacities by 30% in the last three years. Still 90% of the plants relied on high energy MSF-technology. Only in the last couple of years did they start building plants with more energy efficient MED-technology, which now constituted 10% of the facilities.

Al-Towaie mentioned three different options for energy: 1. oil or gas, 2. nuclear, 3. renewable. Opting for renewable, he elaborated on its potential:

- 1 km² used for solar panels is enough to desalinate 165,000 m³ per day.
- 50 km x 50 km are needed to avoid the MENA water deficit in 2050.
- Every 10 km² in MENA yields the equivalent of 15 million barrels of fuel oil per year in the form of solar energy.



Bassim Abbassi

Department of Water Resources and Environmental Management,
Al-Balqa Applied University, Al-Balqa, Jordan

Bassim Abbassi presented a comparative study on different wastewater treatment plants in his lecture on "Decentralized Wastewater Treatment in Jordan: using Low Cost Eco-Technology".

With 145 m³ per capita per year, Jordan takes 4th place among countries with water scarcity across the globe. The government were aware of the limited water resources from early on. Already in 1970, the first wastewater treatment plant was built. Today, Jordan has 24 treatment plants for six million inhabitants. 60–65 % of the population is connected to wastewater treatment. The remaining 35 % mostly lives in rural areas where connection is difficult for financial reasons.

Wastewater treatment needed to be decentralized to reach these 35 %, Abbassi said, asserting that luckily the decision makers were aware of the problem. The solution lay in constructed wetlands (CWs) because they are cost efficient and effective.

CWs contain gravel, or soil, drainage material, water plants and microorganisms.



The team surrounding Abbassi identified five suitable wetland plants and compared them in an evapotranspiration study. The five were: *Phragmites australis*, *Typha domingensis*, *Juncus acutus*, *Cyperus involucreatus*, *Cyperus laevigatus*

Most efficient and compatible with Jordanian standards were: *Cyperus laevigatus* and *Typha domingensis*.

Ziad Al-Ghazawi

Jordan University of Science and Technology, Irbid, Jordan



Professor Ziad Al-Ghazawi reported on the success of his team after four years of experimenting with riverbank filtration. Al-Ghazawi explained that riverbank filtration was a very efficient and low-cost method of pre-treatment for irrigation water in Zarqa river in his lecture on "River Bank Filtration for Wastewater Reuse in Irrigation."

The ancient Iraqis and Egyptians used riverbank filtration. In Europe and the USA, the technology is widely used as a pre-treatment method for water supply.

Even though Jordan was innovative in water reuse long before the first reports on climate change were

written, it is still in dire need of more innovative approaches. Only 10 % of cultivable land is cultivated because of a lack of water resources. 1/3 of agriculture is irrigated, 2/3 is rain fed. Agriculture is an insubstantial contributor to the GDP.

Riverbank filtration is very efficient in removing viruses, bacteria and parasites, which are the main concerns regarding water reused for irrigation. As Al-Ghazawi explained, farmers had planted tomatoes, peppers and lettuce, which are eaten raw, and irrigated them with polluted water. "The government used to tell them not to pump from the river because poorly treated wastewater goes there. But these regulations were not enforceable in reality

since the existing agricultural activities have been the source for subsistence for the River communities. So, we were concerned with human health when we started this Project in 2005 long before the new treatment plant at Al-Samra was commissioned in 2008 and expected to improve the water quality in the River," Al-Ghazawi said. Al-Ghazawi made a strong point for his low-cost technology when addressing Hussain Al-Towaie: "The technology costs for desalination connected to renewable energy are still too expensive. American companies are selling this technology. Oil-rich MENA-Countries are able to pay." In the end, he stressed the importance of creating their own technology in the region.



Session IIIa: Water and Waste Water Management and Climate Change Adaptation

Feras Matar

Manager, Engicon, Jordan

Speaking for the Amman-based consulting engineering firm Engicon, Feras Matar presented "Standard Operations and Maintenance Procedures in the Spectrum of Capacity Building" – short SOMP – for the water sector.

This company was developed jointly with other two German companies namely GFA and DWA in cooperation with the GIZ 22 SOMP for the water sector in Jordan because "the water sector in Jordan was suffered from the absence of operation and maintenance standards," Matar stated.

He said that SOMP were reliable, effective and efficient for the reparation of water systems, but unfortunately not effectively applied. They were approved by the SOMP steering committee and the Minister of Water and Irrigation as standards while the Jordanian Institute for Standards and Metrology (JISM) approved them as guidelines.

Also, based on these SOMP, training curricula were developed targeting mainly engineers, operators and technicians that work the water utilities in the Arab region. The result was better performance and the retaining of staff.



The Manager of Training programs of Engicon recommended that other water providers should also use these curricula.

Also, he stated that better management, operation and maintenance of the the water utilities using SOMP will strongly support the utilities for better management of the available water resources and reducing the wasted water.

Fayez Abu-Hilou

Project Management Unit, Palestinian Water Authority, Al-Bireh, Palestinian Territories

Fayez Abu-Hilou presented a case study on the use of prepaid water meters in his lecture "Prepaid Water Meter a Matter of Debate".

Prepaid water meters (PWM) would, in his opinion, create awareness for water use, defeat the unwillingness to pay, improve the cash flow and save consumers time and money. PWM were used in Brazil, Egypt, Uganda, Nigeria, Tanzania, Sudan etc.

Awareness for responsible water use was necessary in the Palestinian Territories because water was scarce and political reasons made it impossible to share water equally with the Israel.

In June 2010, the council of ministers accepted the use of PWM. However, according to existing laws its use was not legal; as article No. 3 states: "Everybody has a right to use water in good quality." It is

thus prohibited to cut services for people who can't afford to pay.

The reservations against the use of PWM are multiple: Many believe that it puts profit above the needs of the people. They fear that PWM will be a problem in the case of emergencies, for example when Israel closes checkpoints, and people therefore can't buy water.

There are also negative effects expected on social and environmental conditions: "Neighbours in Palestine share water. They might stop, which could endanger community life," Abu-Hilou explained.

Another fear is that poor families will be forced to decrease their consumption, using less water for hygiene. The use of untreated water might lead to an outbreak of diseases. In the United Kingdom, PWM were declared to represent a threat to public health in the 1998 Water Act. In South Africa, PWM were declared illegal in Orange County.

Nevertheless, the Palestinian Water Authority wanted to get reliable data and thus did a case study in the north. There, 80% of households are only connected to water networks during the summer. In the winter, when they have water in their harvesting systems, they don't use the network.

In the case study, the people had no prior information and could not contribute. At the end of the trial period, 28% of the users showed a high accept-



ance of the PWM. However, this was mostly because with the PWM their connection to the network had been improved. 51% of participants in the study were in opposition to the PWM, 47% criticized the operational process. Yet, one positive result is that people do not complain about water shortage as they did before.

As a conclusion to the study, Abu-Hilou recommended a free minimum lifeline which would satisfy the basic requirements of health, hygiene and culture to protect the interests of the poor.

He said that further studies would be needed since consumer opposition was not clear because of the previous water supply conditions.

Mervat El-Hoz

Faculty of Engineering, University of Balamand, Lebanon



Mervat El-Hoz was not concerned with quantity but with quality of water. Lebanon had huge amounts of water, she asserted in her lecture "Performance Evaluation of the University of Balamand Advanced Wastewater Treatment Plant". "Syria, Israel, Jordan live off water coming from Lebanon," she said. "Unfortunately this water is polluted."

According to studies on climate change, Lebanon had a temperature increase and a precipitation decline. Sea level rise and increase of extreme weather events would affect the country strongly.

Lebanon has had a wastewater treatment plan since 1982. However, until today, the country has only had four treatment plants, two of which are working.

On the other hand, there are 13 outfalls of untreated water into the sea which discharge 200,000 m³ per day. Only 2% of wastewater is reused in Lebanon. In Jordan, it is 80%, in the Emirates, 100%.

The wastewater treatment pilot plant of the University of Balamand is the first of its kind in Lebanon. It is based on extended aeration with a capacity of 100 m³ per day.

The monitoring program of the pilot plant was carried out through weekly tests conducted on influent and effluent streams collected from the treatment plant. 20 parameters were tested. Everything worked well until spring 2009, with exception of high concentrates of nitrate and phosphor. As El-Hoz elaborated: "We stopped watering the playground of the university because the grass was growing too fast." They managed to reduce the phosphor with aluminum solution.

After spring 2009 and during the last period of the study, a decrease in effluent quality, especially the BOD5 and COD, was observed. Operational problems were the reason:

Panel discussion

Chair Alex Kirby opened the panel discussion with a question: "Are prepaid water meters better for cutting water demand than postpaid meters? If I pay afterwards I see my consumption, with the prepaid I just go and pay again."

In Palestine it was different, Abu-Hilou explained. "They were not paying their bills. With the PWM they are aware that they need to pay for the service."

Concerning the riverbank filtration one participant asked if the sediments didn't become saturated with chemicals. He was also wondering if farmers would have to pay for water after it had gone through filtration.

According to Al Ghazawi, the riverbank filtration project was still at the beginning stages. "At this stage we are writing manuals for the farmers so they

1. Three out of 4 working air blowers were non-operational.
2. Some of the air diffuser tubes of the aeration tank were clogged.
3. One of the two chlorine dosing pumps went out of service leading to an insufficient amount of chlorine added during the disinfection process.
4. The flow splitter wasn't distributing the flow equally, so one of the modules had a higher flow than the other.
5. The multimedia sand filter was not working well due to problems with the backwashing pump.

These could be repaired. Yet, El-Hoz pointed to a structural problem: "The person in charge has no technical training. The operator of the plant should have a thorough knowledge. This is what we lack. We should have educated people to monitor the water quality."

She ended her lecture with an urgent appeal: "Wastewater treatment can be for reuse but it also protects the environment. Phosphor and nitrate go into the valley and later into the Mediterranean Sea. What we throw away is going directly into the ground water, flowing into the rivers of Syria, Turkey and Israel."

know were to go and tap the water. Some farmers have tribal rights to the water. The only problem is salt, not chemicals. Clogging is a problem." He believed though that these problems would be solved as most German cities on the Rhine used riverbank filtration.

Many participants addressed the topic of desalination. "How do you view the options for desalination for a city of one million like Sana?" one asked. Another affirmed that he was not as optimistic about desalination.

According to Al-Towaie something new must be invented, because of the high quantity of waste. There should also be studies conducted on the quality of desalinated water because it is being sold as bottled drinking water.

Al Hoz was asked why the effluents in the Balamand treatment plant were more polluted than the influents. She suggested power cuts and the fact that the water from the septic tanks came from farmers as reasons.

In a last round, Ziad Ghazawi again stressed the need for local technology: "Wastewater systems can be built from concrete which is available in our region. But 90% of plants are imported from the UK or the US. Most of our wastewater systems in Jordan are okay We only need to enhance the capabilities of the operators."

Fayez Abu-Hilou further elaborated on the special stresses in the Palestinian Territories: "Israelis consume four times more than Palestinians. We

buy the water from Israel which means we buy our water – our groundwater. We are only allowed to buy the amount which was agreed on in Oslo accords."

Nadir Al-Ansari explained that Iraq has only had a Ministry of Environment since 2003. "Marshes are now a big issue," he said. Yet, there were problems with neighboring countries, such as Turkey taking out too much water from the Tigris. "Turkey is taking advantage of the weak government in Iraq," he believed. The Tigris water is needed to restore the marshlands. But some water for the marshes could be won by water harvesting and wastewater treatment.



Session IIIb: Water and Waste Water Management and Climate Change Adaptation

Klaus Röttcher

Faculty of Civil and Environmental Engineering, Ostfalia University of Applied Sciences, Campus Suderburg, Suderburg, Germany

"What is traditional water management?" Klaus Röttcher asked in the beginning of his lecture on "Tradition and Modernity, New Ways for an Efficient Water Management." He answered: "Usually it is antiquated, not efficient or uncomfortable."

However, he added that in combination with modernity it could be more sustainable, better adaptable to the local situation, an additional option, especially for rural areas, helpful for public awareness and participation and a local alternative to large central networks.

Röttcher presented an example of a bridge built in Isfahan, Iran. This bridge was conceptualized to allow for traffic on two levels, one for people and one for animals and cargo. In addition, it was capable of generating waterpower, had a storage function and groundwater infiltration and distributed water for irrigation. All in one.

The precondition for such a structure is the fundamental understanding of how the traditional



methods worked, not only technically but also in their social context. In order for it to work, it is necessary to have the proper network and the possibility for developing solutions together with users and to identify problems early on. Röttcher concluded that this could only happen with broad political support and a real water price.

Mohamed Ghazy

Institute of Sanitary and Environmental Engineering, Technical University Braunschweig, Braunschweig, Germany

"Naturally dewatered sludge is not adequate for either Egyptian, nor European standard," Mohamed Ghazy explained in his lecture on "Sewage Sludge Management in the MENA-Region: Perspectives towards Climate Change Mitigation." Yet, he suggested that using anaerobic digestion or sludge storage lagoons could lead to improvement.

With a growing population, about 57% living in rural areas and about 43% in urban areas, wastewater is increasing rapidly.

Currently, there are different sludge treatment options available in Egypt: sludge storage lagoons, natural dewatering, mechanical dewatering etc so

different scenarios were constructed. The scenarios presented were designed with the protection of the environment in mind and a focus on their global warming potential. But the aim was also to spend only minimal funds.

As a general conclusion, the application of anaerobic digestion processes with energy recovery as well as composting processes in sewage sludge treatment in the MENA-Region countries are shown to be promising options for sewage sludge stabilization. They are available at a low economic cost and could lead to significant climate change mitigation.



Andrea Dührkoop

Institute of Agricultural Engineering in the Tropics and Subtropics, University Kassel, Kassel, Germany

Andrea Dührkoop presents a research project dealing with an innovative approach to water-saving irrigation, based on porous irrigation pipes as an upgrade of both subsurface and pot irrigation.

In a BMBF (Federal Ministry of Education and Research) funded joint research project of the support program "Partnerships for Sustainable Solutions" (coordinated by the International Bureau, partners include the Kassel university, German companies and universities in Kenya and Algeria) an innovative irrigation pipe following the pot-irrigation principle

will be developed. Due to their specific material properties, the irrigation pipes are auto regulative, i. e. they release water depending on the plants' water demand. Compared with existing irrigation methods, the system owns a high saving potential in terms of water consumption and operating costs. The method offers an easy-to-use low-tech system.

Numerical modeling and laboratory experiments show encouraging results. Now the BMBF project offers the possibility to test the irrigation pipe in field trials in the partner countries Algeria and Kenya.

Wasim Ali

SMART Research Project, Hydrogeology Institute, Karlsruhe Institute of Technology, Karlsruhe, Germany

Wasim Ali presented the SMART project in his lecture "SMART project Role by Capacity Development in the Region of the Jordan Valley". The objectives of the project are the development and management of water and related resources in order to maximize economic and social welfare, the protection and sustainability of ecosystems, the development of concepts for an improved integrated water resource management, multilateral and interdisciplinary cooperation and the testing and transfer of adapted technologies.



The project contains different work packages. The main focus is on work package 9, scenario definition. It shall improve the availability of information and foster communication between partners, stakeholders and end users. Its aim is also to support and facilitate the implementation of the IWRM-tools (Integrated Water Resources Management) and technologies which were developed in SMART I and SMART II. Finally, it shall improve human resources, at both the academic and school levels.

Capacity development is targeting schools, university students and scientists. The water fun

Jennifer Möller-Gulland

Ecologic Institute, Berlin, Germany



Jennifer Möller-Gulland presented innovative methodologies to assess quantitative and monetary benefits of improved water resource use and its adaptation to climate change. These methodologies are part of an ongoing EUROPEAID project, which assesses the potential qualitative, quantitative and monetary benefits of enhanced environmental protection as a result of the convergence of European Neighborhood Policy countries' environmental

program for schools will be established in 50 villages in Jordan and 50 villages in Palestine.

It shall raise the understanding of the importance of wastewater. A PhD program will have 15–20 new PhD and MSc-students. In the Scientific Advanced Training (SAT-Program), scientists have the chance to intensify their research during research stays in Germany or in the SMART region. The aim of this program is to strengthen relations between colleagues from several countries participating in this program.

policies and legislation with those of the EU (<http://ecologic.eu/3651>).

Quantitative benefits of improved water resource use are assessed by means of an in-depth assessment of water footprints in the agricultural sector, including production and trade patterns. The analysis illustrated that Israel could decrease current agricultural water demand by around 50%, which equals 96% of potable water used annually in agriculture, by adjusting production and trade patterns based on water footprints. The monetary benefits of improved water resource use can be assessed by the application of the rationales of "costs of water supply uncertainty" in agriculture and of "costs avoided" from water produced by desalination. The resultant benefits to farmers due to decreased water supply uncertainty, by e.g. increased wastewater reuse, are estimated at EUR 136 million (NIS 712 million) annually. Improved water resource use may lead to a reduced demand of desalinated water, which can be monetized at 0.36 EUR/m³.

Session IIIb: Water and Waste Water Management and Climate Change Adaptation

Jobst Maßmann

Federal Institute for Geosciences and Natural Resources (BGR), Hannover, Germany



In his lecture on the "Investigation of Climate Change Scenarios using the WEAP-Modflow Decision Support System", Jobst Maßmann first explained the meaning of WEAP-Modflow. The

Decision Support System (DSS) for the Integrated Water Resources Management (IWRM) using WEAP (Water Evaluation & Planning System) includes a Modflow-Linkage. The WEAP-Modflow DSS supports local water institutions in determining the water balance with regards to constraints as well as water management scenarios.

The pilot study in the Zabadani Basin in Syria showed that climate predictions are highly uncertain, but scenario analysis can help to assess the expected range. Since groundwater is the main resource in the Arab region, a linked approach is essential. The WEAP-Modflow DSS is a powerful tool for investigating water and climate relevant problems in the framework of IWRM. It is cost-free for developing countries and has successfully been applied in many areas in the Arab region.

Annika Kramer

adelphi, Berlin, Germany

In her lecture "Twin2Go – Best Practices and Policy Lessons on Adaptive Water Governance", Annika Kramer first explained that Twin2Go is the short version of "coordinating twinning partnerships towards more adaptive governance in river basins." The aim is to consolidate insights gained during projects with regard to adaptive water governance and in the context of climate change. Also, Twin2Go formulates best practices and tools for implementation and disseminates the results to policy makers and practitioners.

"So, the main question is: What factors increase the adaptive capacity of water resource management?" Kramer asked. To fulfil the conditions for adaptive water governance regimes, one needs so called poly-centric regimes, which means decentralized multi-

level structures with higher performance and the capacity to adapt water management. Further, sound



legal frameworks are necessary. Last but not least, there is a need for implementation capacity (know-

ledge, resources), effective institutions, mechanisms for motivation and enforcement.

Rodrigo Vidaurre

Ecologic Institute, Berlin, Germany



Rodrigo Vidaurre presented work performed in the context of the CLICO project (Climate Change, Hydro Conflicts and Human Security), which commenced in January 2010, in his lecture on "Political Efforts to Address the Interface between Climate Change, Water Conflicts and Human Security in

the MENA-Region". Whereas Climate Change is often related to increased conflict and issues such as migration, there is little to no empirical research that addresses this link. The CLICO project analyses in a variety of approaches both historical and current data to ascertain the nature of this relationship. Fourteen research teams collaborate on the project, coming from the EU, Israel, Palestine, Egypt and Ethiopia; the project performs case studies in ten of those countries.

Vidaurre presented two examples of policies, analysed as part of CLICO, that address this link between Climate Change and human security. One of them comes from Turkey, where the introduction of an agricultural insurance pool in 2005 helped improve the farmers' situation by distributing the risks associated with crop failure due to climatic hazards. This will help farmers sustain their livelihoods, in this way reducing the driver for internal migration and thus having positive effects on human security.

Thomas Ammerl

Bavarian Research Alliance GmbH (BayFOR), Munich, Germany

In his lecture on "European Research Funding for MENA-Countries", Thomas Ammerl gave an overview of what kind of actual European funding for research & development (R&D) exists by explaining also the political background ((European Research Area, EU-Africa-strategy) and different future-related concepts (Europe 2020 strategy, Innovation union). He also focused on international R&D-programs (NATO, ISDR, World Bank) and how to get it. The Seventh Framework Program of the European Commission (FP7) offers also great possibilities for the integration of MENA partners, e.g. in the Environment Theme by addressing five major key challenges: Coping with climate change;



Sustainable use and management of land and seas; Improving resource efficiency; Protecting citizens from environmental hazards; Mobilizing environmental knowledge for policy, industry and society. Ammerl's advice was: "The first barrier to be addressed is finding the right partners to gain funds. Don't only view it from a national perspective, you

have to demonstrate also the European added value when you are integrating international MENA-partners. BayFOR (www.bayfor.org) as a non-profit company is providing you the necessary support in the proposal development if at least one Bavarian institution is part of the research consortium."

Panel Discussion

Starting with a summary of the presentations, Ralf Klingbeil expressed his pleasure that WEAP has developed from a surface water system decision making tool to a decision-making tool that also addresses the groundwater system.

One participant was concerned about insurance policies in the case of houses being swept away by floods caused by climate change. Another partici-

panel urged that politicians needed to be engaged in scientific discussions because the facts were well known but not put into practice. Yet another participant reminded everyone one of the unreliability of data, saying there could be a problem physically measuring groundwater abstraction.



Session IV: The Role of German Development Cooperation

Qasem Abu-Haija, Royal Department for Environment, Protection and Rangers

Harald Kirsch, GIZ, Amman, Jordan



Qasem Abu-Haija and Harald Kirsch presented the lecture on "Rangers in Jordan – General Tasks and Mission and Specific Roles in Water Resource Protection" together.

Abu-Haija first gave a background on their common work. The Royal Department for Environment, Protection and Rangers was established in 2006. It is the executive arm of the Ministry of Environment, but belongs administratively to the police department. Since 2009, the GIZ has been advising rangers, who enforce environmental laws and take actions against violators. The rangers also cooperate with civil society, remove environmental hazards, cooperate with relevant authorities and increase national support by raising awareness. The violations had increased from 7781 in 2007 to 49000 in 2010. However, this was partly due to the police now taking environmental violation as serious as other violations.

Harald Kirsch from the GIZ stated that he had been working with the rangers in Amman since 2009. He elaborated on the issue of raising awareness, which especially targeted school children and students. The

rangers take environmental short stories to schools when they hold lectures.

His second topic was the water protection zones which had been established in Jordan according to the 2006 guidelines with the support of the BGR.

Zones 1 and 2 are clearly marked at the entrance. Protection zone 1 is fenced and extends a minimum of 50 m upstream of a spring and 25 m upstream of a well. The activities within this zone must be limited to those required for the operation of water resources.

Delineation of zone 2 is dependent on the hydro-geological conditions in the area. The velocity of groundwater flow is first calculated. The boundaries for zone 2 are defined as the outer limit of zone 1 and a line from where groundwater will take 50 days to flow till it reaches the source of extraction. Permitted activities in zone 2 must be limited to residential activities and organic agriculture.

Zone 3 encompasses the total groundwater recharge area for the well or spring. All activities and developments are permitted on the condition that there is full compliance with the relevant local Jordanian laws and bylaws.



All violations are reported to the corresponding authorities. The rangers and the GIZ take field trips with the authorities and have set up a water resource protection team in Amman. The team is well edu-

cated in environmental science and acts as an extension team to the 640 officers in the 16 branches in the whole Kingdom. The goal of the rangers is to have over 1000 officers in the future.

Dieter Rothenberger

Program Management of Water Resources, GIZ, Amman, Jordan

In his lecture on "Cost Reduction and Climate Change Reduction in the Water Sector – The Case of the Water Authority of Jordan", Dieter Rothenberger spoke about a project for the "Improvement of Energy Efficiency of the Water Authority of Jordan."

The project was funded by the German Ministry of Economic Cooperation and Development with 1.28 million Euro. It included how energy audits are conducted, the development of measures for reducing consumption, the development of institutional concepts and advice on implementation.

The Water Authority Jordan (WAJ) uses 15 % of all electricity in Jordan. Thus, energy costs are a major factor in the cost structure. Since the WAJ buys energy at subsidized prices, it also contributes to public spending. The energy mix in Jordan consists of 60 % gas and 40 % oil, meaning that Jordan's emission of greenhouse gases is relatively high.

The findings of the audits were:

There is a 4 % – 65 % savings potential, which is equivalent to 15,700 t CO₂ and 935,000 JD per year.

There would be a 4 to 13 year pay-back period for improved pumping equipment.

Life Cycle Costing is not applied for procurement of pumping equipment.

There are no regular inspections.

The plant in Bakoria was chosen to get new pumps. To put the energy saving project into practice, they opted for energy performance contracting meaning that a private company installs new equipment and received what is saved as a result. This type of con-



tracting is normal in Europe; it was the first time this approach was tried in Jordan.

In addition, a public private partnership was concluded between the German contractor WILO pump producer and the GIZ, in which it was agreed that the GIZ would pay 50 % thus reducing the risk for the private company to 50 %.

Since 2009, there have been staff trainings and regular meetings and the equipment was installed. As a result, an average of 35 % of energy was saved. 12 % more water was pumped with 25 % less electricity leading to a savings of 600,000 JD and a reduction in emissions of 1200 t CO₂.

The concept will be repeated by others. Six companies are now prequalified. A tender is to start in May.

Rothenberger stressed the triple win situation: for the water authority (savings), the private company (profit) and the environment.

Armin Margane

Federal Institute of Geosciences and Natural Resources (BGR), Beirut, Lebanon

In his lecture on "Integration of Water Resources Protection Aspects in the Planning of Wastewater Facilities in Lebanon and Syria," Armin Margane presented the BGR's work in the two countries.

Four projects, funded by German development cooperation (BMZ), aim to reduce the pollution risk for Jeita spring in Lebanon and Fiegh spring in Syria. The water supply of Beirut depends to a large degree (50 – 80 %) on Jeita spring. The water supply of Damascus depends to a large degree (60 %) on Fiegh spring.

Margane explained that many wastewater projects failed because the planning of wastewater facilities was not well executed and did not sufficiently integrate the need for water resource protection. The reason was often that during planning the partner institutions and the financial cooperation consultants lacked geoscientific expertise.

For this reason, the German cooperation was trying a new approach combining financial and technical cooperation projects.

Country specific problems concerning wastewater treatment in Lebanon are the rapid infiltration and high groundwater flow velocities in the karstic limestones, the high topographic gradients and the lack of continuous availability of electricity. While in

Syria, a wastewater collection system was in place and a groundwater protection zone was established in 1989, Lebanon had no wastewater collection and treatment systems yet.

Now two plants upstream from Jeita Spring are being planned. BGR is providing technical assistance in this planning process concerning the suitability of the location of the treatment plants, conveyor lines and effluent discharge site with the aim to achieve a better water resources protection. Margane concluded that priority should be given to investment in wastewater with Lebanese public spending funds.



Sanae Abdoh

Water Secretariat of the Ministry of Energy, Water and Environment, Rabat, Morocco



Sanae Abdoh recounted "Experiences from a Training Course on Communication in the Moroccan-German Water Program." "Communication is the best way to increase public awareness," she said. 20 employees from seven agencies participated in the course. The three trainers were from Germany, Morocco and France. Nine sessions were conducted over a period of one year. One aim was the creation of a working group linking the communication officers. Communication plans were designed for the seven participating agencies and a communication framework for a national water strategy was drawn up.

They also composed online and print documentation, a communication handbook, and an online

library of good communication practices in water and sanitation.

Konar Mutafoglu

Water Competence Centre, KfW, Frankfurt, Germany

In his talk on "KfW Water and Wastewater Activities in the MENA-Region in the Context of Adaptation to Climate Change", Konar Mutafoglu stressed that the MENA-Region was one focal area within water and sanitation for the German development bank, KfW. The bank promotes integrated water resources management and increased efficiency of water use as adaptation strategies to climate change. 57 % of its portfolio in the MENA-Region is devoted to water and wastewater projects. The single most important country is Egypt, followed by the Palestinian Territories, Yemen and Morocco.

As a positive example, Mutafoglu referred to a project in the Jordan Valley, which had led to an increase of available water per person and day of 20 litres thanks to the reuse of treated wastewater in agriculture.

From 2011 onwards, KfW will require a climate check for all new projects. The first step in this check will be a screening addressing both mitigation and adaptation to climate change. If required as a result

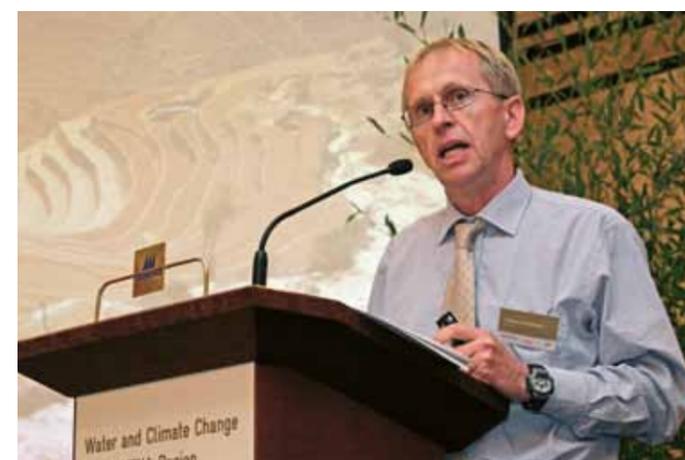


of the screening, a detailed assessment follows in order to minimize emissions and to proof the project against expected future climatic conditions.

In certain cases, special studies will be carried out. A current example is a regional climate model for the Fiegh spring in the Damascus area.

Gerhard Lichtenthaler,

Deputy Team Leader, Decentralized Water Resource Management, National Water Authority (NWRA), GIZ, Yemen



The Sana'a declaration strongly supports decentralization of water management and stresses the indigenous knowledge of the Yemenite farmers. These are some of the conclusions from Gerhard Lichtenthaler's lecture on "Yemen: The Sana'a Declaration: Business as usual or real progress in addressing water scarcity and climate change?"

The Sana'a Declaration and the recommendations of the National Conference on Water Resources Development and Management was held in Sana'a, Yemen, in January 2011, and endorsed by the country's prime minister. Lichtenthaler asserted that it,

in effect, gave strong support to functioning water management practices.

He stressed that Yemen had a rich heritage of agricultural practices to mitigate the effects of seasonal variations. Yemen is known for its terraces. They consist of small walls that channel the water. This has been practiced for hundreds of years.

Lichtenthaler affirmed that this kind of runoff agriculture was extremely important. "We fail to understand that each terrace is a little dam. If terraces were neglected we would have floods."

Yet, this type of agriculture is very time-intensive. Farmers need to plough up to ten times to make sure that the soil is rain absorbent. Therefore, Lichtenthaler recommended that terraces be subsidised because the farmers were providing an important service for the ecological balance of the country.

Community-based resource management, which was strongly supported in the Sana declaration, functioned well in Yemen according to Lichtenthaler. "Communities in Yemen are still capable of dealing with extreme water scarcity," was one of his messages. They used the traditional Marqum to reach community-based agreements e.g. about pumping water, selection of crops etc.

The basin committees are promoted by the ministry. Lichtenthaler recommended that these committees be mandated on the basin level.



Closing Session



Senior project manager at the GIZ, Ismail Al Baz, sum up the main results of the two days and pointed out in his summary the following important aspects of water and climate change: climate change will be an additional challenge in the region additionally to water scarcity, other challenge will be water management, the aspects of snow melting and rain fall can be seen in the Syrian case, water quality is very important as it was presented for the Gaza-Strip with 90% ground water contamination. The aspects of water and politics and cooperation between water institution in the region is also important and needs more efforts from decision makers in the future. The problem of corruption and lack of transparency due to increase of water scarcity will increase too.

For follow up for this conference Mr. Al Baz drew four conclusions for future cooperation:

- Water and climate should be prioritized as a highly important topic on the political agenda in the region.
- Awareness raising events and capacity building activities should be prepared and organized in the MENA-Countries.
- Applications for the financing of water related projects should be coordinated and submitted to the EU and other international donors.
- Networking and knowledge exchange should be strengthened.

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