Young Scientists and Professionals Programme 2009 in Berlin (Wasser Berlin)

March 29 – April 3, 2009

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Evaluation
Young Scientists and Professionals Programme 2009

1=very good 2=good 3=satisfactory 4=not so good

Average		**1,56**
Programme in general	1,46	
Applicability/usefulness of the programme	1,67	
29.03. Challenges	1,39	
30.03. UN-Water Decade Programme on Capacity Development: Transboundary waters	1,73	
31.03. Seminar: River Basin Management	1,73	
01.04. Training Career Day	1,83	
01.04. Excursion water works	1,68	
02.04. International Seminar: Irrigation	1,63	
Communication between group members	1,65	
Communication between guide	1,34	
Group atmosphere	1,29	
Social events	1,21	
Organization/Planning	1,73	
Expectations met?	1,59	

Report of Group I

"Tomorrow's Challenges"

Picture 1: *Group 1 with Mrs.Martens (DWA) and Mr. Heidebrecht (DWA)*

Group Guide: Fanny Arnaudova (Bulgaria)

Group Members: YWP: Fayez Abu Hilou, Aleksandra Drewko, Cristian Adrian Girbaciu, Rasha Sharkawi, Maria Temelkova, Magdalina Zaharieva, Vera Asenova, Tzveta Neltchinova, Viktor Dzhigarov, Jochen Maier and from IWA Idel Montalvo Arango (Cuba)

The 1st International Water Association (IWA) Young Water Professionals Workshop was held on 29 March 2009 at Wasser Berlin and was organized in cooperation with the German Association for Water, Wastewater and Waste (DWA).

The main objectives of the workshop were:

- Networking between Young Water Professionals, creating professional and personal relationships;
- Providing Young Water Professionals with opportunities to create a dialog with professionals from the water sector that will help them throughout their careers;
- Meeting professionals working in different sectors of the water industry;
- Learning about different career possibilities and getting information about various initiatives that could help them develop their careers.

The first presentation held by M. Eng. Rüdiger Heidebrecht was an introduction to the German Association for Water, Wastewater and Waste (DWA).

The DWA was founded in 1948 by the cities of Germany as a non-profit-non-government organization and currently has 14,000 members. The president of the DWA is Eng. Otto Schaaf. The history and the structure of the DWA association were presented. It is a platform offering information for the public (e.g. kindergartens, schools, communities) and professionals. One of the monthly magazines published by the association is called “Abwasser Abfall”. The DWA offers training and continuous learning on approximately 200 topics at all levels. It also supports the government (law-making) and is also the technical standard body. The DWA is a member of the European Water Association (EWA) and the International Water Association (IWA).

A part of the workshop was a networking session, at which everybody introduced themselves to at least four other participants, creating professional and personal relationships.

The panel on **“Meeting Tomorrow’s Challenges from an International Perspective”** looked at current problems from an economic, social and environmental point of view.

The first speaker in this panel, Mr. Jardin, gave a brief overview of global water challenges in the next fifty years. He discussed a large variety of topics, including water scarcity, water pollution, health-related problems, ever-increasing and unevenly distributed population, growing urbanization, food crisis, climate change, global acces to safe drinking water and improved sanitation coverage. He showed the interrelations between these challenges and presented his personal vision for the year 2050. He emphasized the need for providing functioning governance in the water sector. He mentioned access to safe drinking water and improved sanitation as a prerequisite for economic development. His vision for 2050 puts meeting the world's food demands on top of the agenda. Some of the aspects of his vision can be considered as controversial, e. g. "world's diet has changed", meaning that people would become vegetarians. All in all, his predictions are positive and he puts well-functioning governance first. It must be realized what current problems and challenges are and tailored solutions need to be found. Especially, water specialists and other society stakeholders need to find a common ground, and the latter need to realize the importance of water challenges and their responsibilities.

The next speaker, Mr. Pawlowski, defined the vital question of whether water can have a price. He looked at water from different points of view; as a commodity (natural good, essential for life) and as having a material value (as in the type of use by humans). The provision of water is a service and its price must be assured by the government. The same applies to wastewater management. There are many aspects of the price of water that need to be considered. On one hand, prices of water and wastewater management must be payable by all. On the other hand, price systems take social relationships and structures into account. Also, price regulation can be used to exert positive effects on the environment.

The third speaker, Mrs. Guiffant from Suez Environment discussed social aspects of global water challenges. She made a clear distinction between two cases; parts of the world where water and sanitation facilities are implemented and there they should be maintained and improved, and other countries where not everybody has access to water and sanitation and this is where the access should be assured. Mrs. Guiffant discussed the Millennium Development Goals (MDGs) with respect to water and sanitation. She mentioned that still 884 million people worldwide do not have access to portable water. However, if the current trend continues the water goal should have been reached by 2015. Unfortunately, it is not the case when it comes to the MDG sanitation goal. In particular, the problem of access to improved sanitation affects people who live in informal settlements, overcrowded peri-urban areas and of secondary average sized cities (i.e. 200,000-1,000,000 inhabitants). These areas are keys to reaching the MDGs. Also, there are significant disparities between rural and urban services. To make matters worse, water and sanitation are not on top of the political agenda. Mrs. Guiffant pointed out that water and sanitation is everybody's business and, as such, it includes many stakeholders, namely the civil society, the government, operators and financial institutions. Each of them has different responsibilities, but also various priorities. In order to tackle global water and sanitation challenges institutional capacities need to be strengthened, knowledge transfer to all actors has to be reinforced and tailored solutions that comply with local conditions need to be found. Also, appropriate and progressive technologies cannot be forgotten. Reinforcing multi-stakeholders dialog, social empowerment and citizen participation are the way to succeed.

Last but not least, Mr. Porro from Malcolm Pirnie Company presented environmental aspects of the already mentioned challenges and their interrelations. These include climate change, water scarcity, closing the water cycle, balance between human consumption and modifying behavior instead of environment. Then, he continued to discuss these environmental issues in a greater detail. Climate change affects water with respect to its quantity, quality and infrastructure. However, water also impacts climate change. As an example of trying to tackle the climate change, the speaker presented a long-term sustainability program for New York City called PLANYC, where one of the goals is to reduce greenhouse gases emissions by 30% by 2030. The real problem about trying to adapt or mitigate the climate change is its uncertainty, i.e. there exist around twenty different models envisaging the climate change. Water scarcity is directly affected by the climate change and other contributing factors include, e.g. population growth. Available solutions for tackling water scarcity are conservation, integrated water resources management (IWRM), desalination and rainwater harvesting as well as water foot printing. Mr. Porro discussed IWRM as a means of closing the water cycle. He referred to IWRM as “total water” and gave a few examples of where IWRM is being practiced, e.g. Singapore’s National Water Agency. Looking at the balance between human consumption and ecosystem the challenge is with meeting the increasing demands without negatively affecting the environment. Modifying behavior instead of the environment seems to be the most important issue and the biggest challenge at the same time. In order to modify behavior of general public it is necessary to acknowledge the minimization of the impact on the environment if behavior changes have a positive outreach. Also, water should not be considered as wastewater or used water, which would make re-use of treated wastewater simpler and better accepted. One of the most significant aspects if changing behavior of water professionals includes Life Cycle Assessment approach (LCA).

This presentation panel on global water challenges made us think about water issues in our countries. For instance, in Palestine and Jordan, there is a serious lack of water resources and their inappropriate management makes the problem even more complex. Also, sewerage system infrastructure is not in place. In Bulgaria and Romania, water losses and lack of sewerage systems and wastewater treatment plants are the biggest challenges.

In the section **"Introduction of Future Careers"** five career's representatives presented what Young Water Professionals are to expect from future careers. The presentations were based on the speakers' personal experience with consultancy work, working with the German Association for Technical Co-operation (GTZ), German Development Service (DED), and the academic as well as the public sector.

On behalf of Sachsen Wasser GmbH, Mr. Ulf Hermel presented his experience in the field of water consultancy. He started with an introduction to Sachsen Wasser GmbH, which is a consulting and operating company for water supply and wastewater. The 40-staff member company is based in Leipzig and is a part of one of the largest German water and wastewater utilities (KWL). The company has been active on international markets since 2001 with projects in many countries, including Palestine, Bosnia-Herzegovina, Albania, Turkey, Afghanistan, Vietnam, Syria, Lebanon, Egypt, Brazil and Mexico. The company's domain includes Feasibility Studies, Operational Consulting, Utility Commercial Consulting, Training and Management Contracts.

According to Mr. Ulf Hermel a consultant is an expert that provides advice in a particular area of expertise, and usually works for a consultancy firm or is self-employed with multiple and

changing clients. The working characteristics of a good consultant include: strong demand for flexibility; frequent travel/live „out of the suitcase"; frequent deadline pressures; 60 hours working week; ability to adapt to frequently changing Clients/Partners; having „5 Masters" and job satisfaction from diversity of activities. The salaries/remuneration is generally above average, but depends on a company's size/status of a consultant; for example employed Junior Consultants usually receive starting salaries of 30 to 50 T €.

Some of the typical requirements for becoming a consultant involve the following: professional qualification and relevant degree: strong analytical skills; programme development and management skills; managerial and leadership capabilities; character and integrity, social competence; good human relations with supervisors; ability to work in a team; energy, initiative, sense of responsibility, etc.

As a member of DED Administrative Board Mr. Rüdiger Heidebrecht presented aspects of a career in a development organization. The DED is an implementing organization of German development cooperation. The head office of the DED is in Bonn and has about 1150 staff members. The annual budget for 2008 is 91.5 million euro and 165 million euro (envisaged for 2009) controlled by an administrative board.

Their work is based on the international Development Policy Framework; Millennium Development Goals (MDGs), Paris Declaration (2005), Poverty Reduction Strategy Papers (PRSPs)/ National, Joint Assistance Strategies (JAS) and others. The DED tasks objectives are realized through:

- Personnel sending organization;
- Development Worker (DW);
- Civil Peace Service (ZFD);
- Volunteers program after School;
- Trainee Programme (NFP) after University.

Development Workers assigned under the Development Workers Act (EhfG):

- Development workers are experts on a limited time contract;
- They have intercultural and social competence;
- Average age 41; 5 years' professional experience;
- Assignment of coordinators for overriding tasks;
- On return: development policy educational and PR work.

Local Professionals:

- Capacity building for local specialists and managers through a technical support, salary supplement and/or payment of advanced training costs for local professionals within German development cooperation programmes supported by the DED.
- Unique Features include:
- Direct poverty reduction;
- Decentralized structures;
- Bridging function between state, civil society and private sector;
- Enhancing dialogue capability;
- Civil Peace Service (ZFD);
- Place keeper function in countries where development cooperation has been scaled back.

Trainee Programme:

- One year scholarship;
- Mentor needed;
- Test for young people;
- Approx. 100 places;
- 1/3 get longer contract;
- Open for EU-Member citizens;
- Non EU extra contract or local staff.

Another career opportunity presented by Matthias Wolf (GTZ) focused on what to expect when working with the German Association for Technical Co-operation (GTZ).

The GTZ is an international cooperation enterprise for sustainable development with worldwide operations. GTZ works for the German Federal government and other clients, public or private sector, national or international, such as the EU, World Bank or UN organisations, and for private sector companies. GTZ's main client is the German Federal Ministry for Economic Cooperation and Development (BMZ). GTZ activities in the water sector are the following:

- Water sector reform;
- Regulation and supervision in the water sector;
- Urban water resource management and water supply and rural sanitation;
- Ecological Sanitation;
- Water for food;
- Transboundary water management.

The main objective of GTZ is to transfer knowledge to partner countries. GTZ offers young professionals many ways of learning about international cooperation. It allows internships, trainee programs, positions for junior professionals, etc.

At the end of the 1st International Water Association (IWA) the initiatives for the Young Water Professionals (YWP) offered by DWA and IWA were presented.

The DWA YWP program, which usually lasts from 5 to 8 days and takes place at international events in Germany (IFAT, Wasser Berlin, IWA-World Water Conference) was presented by

Mrs. Gabriele Martens. The program started in 2001 and is an annual event. Until now there have been 400 participants from 40 different countries, who have been exchanging knowledge and experience, getting information about job opportunities, and meeting DAAD-Alumni and Ex-YWPs. The next programs are schedule to take place at IFAT 2010 and Wasser Berlin 2011.

Mr. Adrian Puigarnau presented the IWA YWP program. The structure and the activities of IWA were explained. The main aims of the YWP program are:

- Networking Opportunities, Recognition, Visibility and Career Development for young researchers and professionals;
- Professional development services for employers to attract and retain the next generation of leaders.

The YWP represents 15.5 % from all the IWA members, and from that one third are students. The IWP program helps to connect people (conferences, forums, newsletter, face book group), support and develop their career and the water sector (workshops, awards, career book and fair). The next events for YWP were presented as well. The IWA offers an internship database including list of companies, YWP, and twining companies who are willing for their employees to participate in exchange programs. There are several support groups such as: SANICON, WWWD, and Women in Water. The benefits of being a member of the IWA are discounts for conferences, publications and a free monthly copy of Water 21 magazine.

Picture 2: **Picture of group 1 before the presentation**

We would like to extend our gratitude to the sponsors of Wasser Berlin 2009, VEOLIA Water and SUEZ Environment who made this event possible.

Report of Group II

"Transboundary Rivers"

Group Guide: Prabeen Joshi

Group Members: Abeer Khair, Andreas Havemann, Habtamu Gezahegn Tolossa, Helga Fazekas, Islam Al Zayed, Michal Specylak, Silviya Stoyanova, Suraj Thapa, Tejshree Tiwari

Introduction

We define a river basin as the area which contributes hydrologically (including both surface- and groundwater) to a first order stream, which, in turn, is defined by its outlet to the ocean or to a terminal (closed) lake or inland sea. Thus, river basin is synonymous with what is referred to in the U.S. as a watershed and in the UK as a catchment. We define such a basin as international if any perennial tributary crosses the political boundaries of two or more nations. By defining these basins by their ultimate outlet, we often group systems together that are commonly thought of as separate, even when they are treated as distinct politically. This situation occurs whenever the confluence of even major river systems takes place upstream of the outlet, such as on the Tigris-Euphrates and on the Ganges-Brahmaputra-Meghna systems.

The world's 263 transboundary lake and river basins include the territory of 145 countries and cover nearly half of the Earth's land surface. Great reservoirs of freshwater also move silently below our borders in underground aquifers. With every country seeking to satisfy its water needs from limited water resources, some foresee a future filled with conflict. But history shows that cooperation, not conflict, is the most common response to transboundary water management issues. Over the last 60 years there have been more than 200 international water agreements and only 37 cases of reported violence between states over water. We need to continue to nurture the opportunities for cooperation that transboundary water management can provide. We share the responsibility for managing the world's transboundary waters for current and future generations.

Governing transboundary waters requires taking into account the political, economic, and social systems to manage water at different scales. There is great complexity in how the various systems and scales influence each other. The interconnectedness of border-crossing freshwater systems inevitably results in the interdependence of all its users and stakeholders, who share a river, lake or aquifer notwithstanding their potential diversity in many other respects. With increasing spatial and temporal interdependence like population growth and widespread environmental degradation, water allocation is a contentious issue, especially in transboundary settings. Water – related activities in one state are likely to impact the water situation in another one and water-related problems such as pollution can often only be solved through transboundary cooperation.

Case I - Rhine River

The Rhine River starts from Swiss Alps and runs through six countries. The Rhine basin area Germany (55% of basin area), Switzerland (18%), France (13%) and the Netherlands (6%) share the larger parts of the basin as shown in Figure 1. The river has a total length of 1300 kilometer and is used for several activities such as navigation, domestic, agricultural, industry, wastewater disposal, hydropower generation, fisheries, recreation and other purposes. The main problems in the Rhine basin are pollution and the flooding.

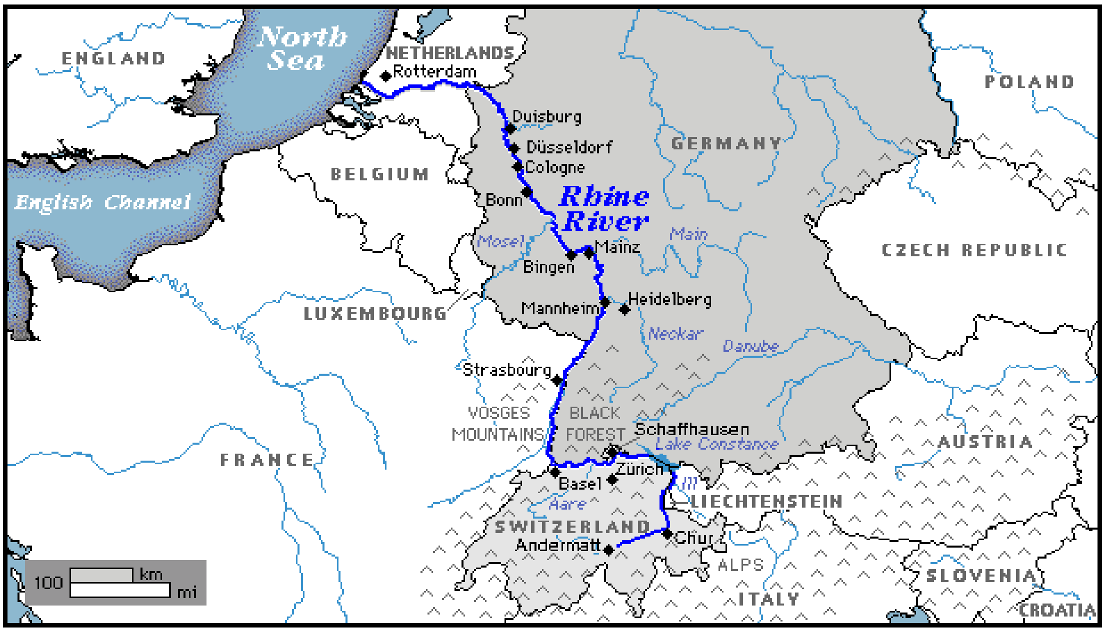


Figure 1. The Rhine river basin

Source: http://www.rollintl.com/roll/rhine.htm (Retrieved on March 30, 2009)

The Rhine is not the biggest but has a long history of cooperation. In 1815, the Central Commission for the Navigation on the Rhine (CCNR) started as Transboundary cooperation. By the end of nineteenth century, Germany, the Netherlands, Luxembourg and France established an agreement about limitations to the salmon fishery on the Rhine. The ecological sustainability was at risk. The salmon fish was disappearing as shown in Figure 2. That directed to stop the commission activities after 1950 and the International Commission against Pollution (ICPR) was established for ecological sustainability problem in the river.

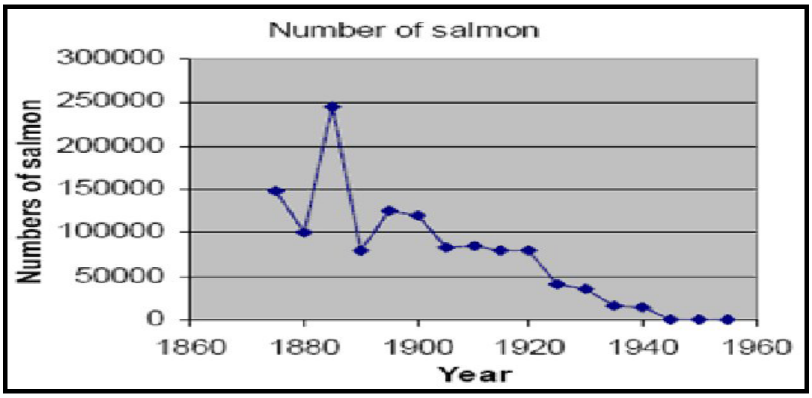


Figure 2: the decreasing of salmon fish in Rhine River

Source: http://www.ce.utexas.edu/prof/mckinney/ce397/topics/Rhine/ Rhine.htm

Many treaties were done for the Rhine committee. In 1976, Chemical and Chloride treaties were done to enhance the water quality of the river. In 1987, the Rhine active plan was created. The plan aimed at getting Salmon fish back to the river as no salmon was there at that time. In 2002, a program “room for the river” was launched seeking for improving the environmental quality. Transboundary cooperation is needed also for the flood risk management. Severe floods took place in Rhine River. In 1995, around 50 thousand people had to evacuate in the Netherlands duo to a flooding. After the flood in 1998 the action plan for flood protection was activated. The Rhine transboundary cooperation is a success story. The water quality raised dramatically and salmon fish return again. But also there are other factors as change in legislation, technologies, structure, public pressure, EU directives, and North Sea cooperation, which have to be taken into consideration. The implementation for the plans is difficult and comes into conflict with the polluter pays principles.

To achieve the right cooperation, data has to be exchanged between the countries.

- exchange data
- cooperation between scientific institution
- political will and commitment
- cooperation between states
- accidents and disasters boost cooperation
- public participation needed
- cooperation on IWRM: Water Quantity, Water Quality and Ecology

Case II - Upstream-Downstream Linkages in the Red River Basin

The Red River Basin (RRB) is the second largest river basin within Vietnam. The Basin is almost equally distributed between the People's Republic of China (PRC) and Vietnam whereby 49 percent lies in the territory of the PRC and 51 percent in Vietnam.

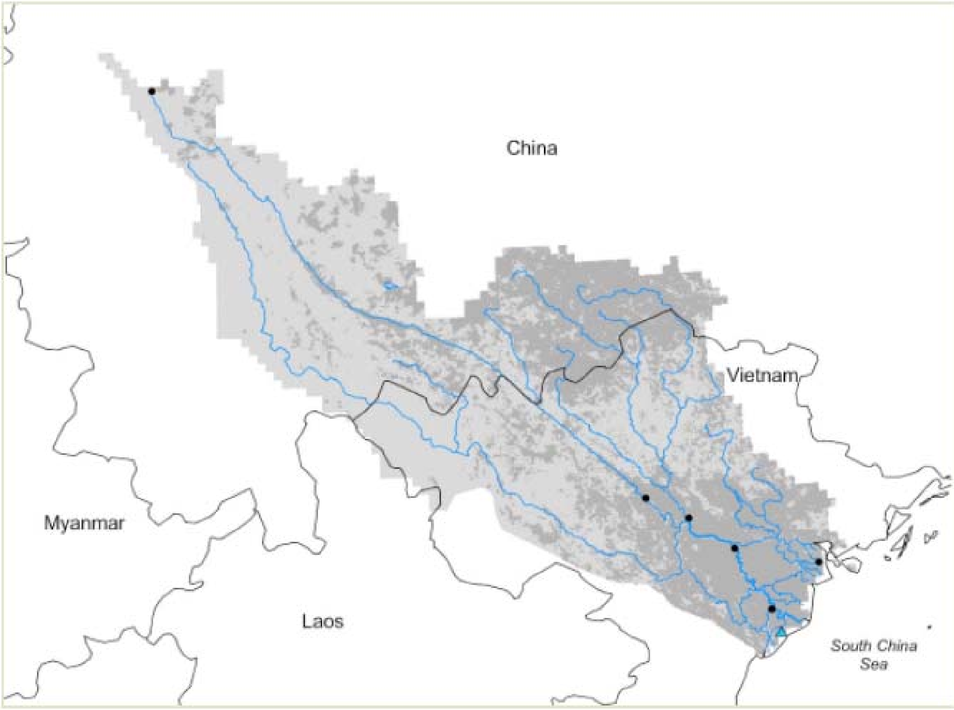


Figure 3: Red River Watershed

Source: http://kickingthorn.com/v-web/gallery/Pavo-imperator-siamensis/Hong_red_river_watershed (Retrieved on 30 March, 2009)

Located downstream of the Red River which originates in the PRC, Vietnam is affected by Chinese water management practices. Despite already existing agreements between the two nations there are several challenges to be addressed. For instance dam construction projects upstream have an impact on the water basin characteristics downstream where the direction of flow has changed. Also the water quality at the border area is in dispute. It was found that pollution with arsenic was coming from upstream polluters on the territory of the PRC. In order to pinpoint sources of pollution it is required to share information among the stakeholders. This will enable to protect the precious water resources. However until now the information sharing process between the PRC and Vietnam is still insufficient.

In order to improve Water Resources Management (WRM) in the RRB actions have to be taken on both sides. It is recommended to build Waste Water Treatment Plants (WWTP) upstream. Downstream observation and monitoring stations should be installed and water quality standards should be agreed upon. In addition the already existing river basin organisation should be reformed according the principles of IWRM taking environmental protection into account.

So far out of 180 river basins 61 percent have only shallow cooperation levels among the riparian states. The cooperation level in the case of the RRB can be also classified as shallow. Reaching a deep level of cooperation should be the goal but has certain preconditions such as the political will and commitment of all parties involved. After a common approach and vision is derived, only then sustainable solutions to the current problems can be found.

Case III - The Nile Basin Initiative

The Nile is presumed to be the longest and greatest river in the world which flows from south to north over a large part of North Eastern Africa. It originates from two main rivers, the Blue Nile which from Lake Tana in Ethiopia and the White Nile from Lake Victoria. It should be noted that the Blue Nile accounts for more than 80% of the water. This river is shared by ten countries, many of which are challenged by socio economic and environmental conditions. The basin encompasses an area of 3 million square kilometers and serves as home to an estimated 300 million people. The wide variety of natural resources provide the basis of livelihood for many people of the Nile river but there is still a big challenge to achieve sustainable socio-economic development through the equitable utilization of, and benefits from, the common Nile basin water resources.

Due to greater developmental needs such as irrigation, hydropower, water supply and the scarcity of water resource in this region, there has been a long history of conflicts in the Nile river basin. This has lead to the escalating degradation the water resource which has exasperated water scarcity issues and heightened tensions between riparian countries.

In 1999, the Nile riparian states created the Nile Basin Initiative (NBI). This historic initiative includes all Nile riparian countries and provides a basin-wide framework for cooperation. It pursues shared vision development through the equitable utilization of, and benefits from, the common Nile resource. The NBI has comprehensive programme for the development of the basin in a sustainable and equitable way through its institutional organizations. There are two main programs of the initiative which are the Shared Vision Programme and the Subsidiary Action Programme. The shared vision program focuses on creating an enabling environment for action on the ground while the Subsidiary Action Programme involves specific groups of riparian countries which are categorized into the Eastern Nile Subsidiary Action Programme (ENSAP) and the Nile Equatorial Lakes Subsidiary Action Programme (NELSAP).

This Nile Basin Trust Fund (NBTF) was established to finance the projects under the Shared Vision Program. This was initiated by the World Bank but will be handed over to the committee formed by the riparian states. There is also funding from several donors from developed countries including Germany, Japan and the Netherlands to name a few.

Although transboundary river management has come a long way for comprehensive river basin development in the Nile, there are tremendous challenges facing the implementation and the execution of the objectives of the Nile Basin Initiative. Some of the main challenges include political instability, mistrust between riparian countries and the lack of technical, economical and financial capacity. These challenges can be overcome by stressing more on public participation, cross-border collaboration, coordination on land use management strategies and political will.

Case IV- Legal aspects of groundwater management in Brazil: the challenge of the Guarani Aquifer.

Introduction

This issue is dealing with the Transboundary groundwater aquifer - Guarani aquifer in southern region of South America. It is shared by four countries with the following shared percentage:

- Brazil (71%)
- Argentina (19%)
- Paraguay (6%)
- Uruguay (4)%

The volume of water in this aquifer is between 37 and 50 thousand cubic kilometers. Brazil shares the largest part of the aquifer i.e. 840 000 km2 out of the total area of 1.2 million km^2. 400 cities in four different countries use the aquifer for water supplying.

Problems and possible conflicts

Due to lack of proper management in pollution control, deforestation, uncontrolled exploitation, lack of integrated water resource management and lack of agreement between the 4 countries the aquifer is facing various problems. This is backed up by the measured Nitrate contamination level between 4.2 and 6.8 mg/l at a depth of 75m in Sorocaba area and 3.3 and 5.8 mg/l at a depth of 450 m in Ribeirao Preto area.

Needs

In order to mitigate the above mentioned problems, the following measures are in need of implementation.

- Ground water recharge evaluation
- Hydro-geochemical characterization
- Vulnerability Evaluation
- Investigation of economic Aspects

The Brazilian Legal Framework

According to the Brazilian Constitution formed in 1988, surface (rivers and lakes) and underground water belongs to a federal state (art. 26, I). If it is shared by two or more states or with another country then it belongs to the Federal government (art. 20, III). Law 9433/1997 establishes the National Policy of Water Resources and National water resource management System but this barely deals with the groundwater issue, however there is provision for the authorization of groundwater exploitation. Mining Code & Mineral Water Code concentrate the power to the ministry which hinders the possibility to conduct investigations.

There are various negotiations running through but still not successful and there is no legal framework yet. However at international level there were negotiations within Mercosul since 2004 and it also happened to be unsuccessful. There are projects like International Shared Aquifer Resource Management – ISARM in association with UNESCO working in this sector.

Conclusion

From the above various case studies, transboundary water interaction has shown to be an inherently political process determined by the broader political context and subjected to the whims of power like all other political phenomena. A more robust and comprehensible understanding is required to formulate and analyze the nuances of transboundary water conflicts and cooperation. It is well emphasized after delving deeper into the matter that, conflict and cooperation co-exist, and more insight and understanding will be gained if they are thought of jointly in terms of interaction.

It is also identified that institutional capacity development is of utmost importance in transboundary water management. Its approach should be based on the assumption that capacity development needs to be demand-driven, in the sense that practitioners decide what mechanisms they can make use of in their specific contexts in order to ensure ownership and thereby effctiveness and sustaianability. Because of the lack of communication and less information transfer between the riparian countries, the problem of transboundary waters has in recent years risen very fastly. So each country has to keep up with the state-of-the-art facilities and jointly monitor the programs, share data and information, create warning and alarm systetems, manage water quantities and allocation between users, prevent and control pollution, deepen mutual assistance, increase public awareness and build a forum for exchange or steer and coordinate adaptation. Therefore, the need to cooperate on water issues beyond the borders of states has been broadly accepted for many years. Whether we live upstream or downstream, we are all in the same boat.

Report of Group III

“River Basin Management”

Group Guide: Karol Mrozik

Group Members:Adel Alobeiaat, Katia Fakhry, Tamas Farago, Amal Hudhud, Martin Kerres, Nadezhda Taneva, Elke Zimmermann, Liu Min, Galina Nikolova

Introduction

On the 2nd International DWA Symposium on Water Resources Management on the International Trade Fair and Congress Water and Wastewater “Wasser Berlin” our working group of the Young Scientists took part in several presentations about the river basin management. These presentations gave insights into best practices of water protection and management. In the following paragraphs we would like to give a brief summary of the congress’ lectures dealing with this topic.

1. MinDir Dr. Fritz Holzwarth, Bonn (DE): The status of Waters in Europe – Results of Analysis and Monitoring

Europe's water resources management is characterized by a sustainable and universal access to modern and safe water supply and sanitation. This is mainly due to the fact that water is valued in all its dimensions, meaning its economic, social, environmental and cultural importance. Sustainability of water resources for the current and next generations in Europe are based on an overall stakeholder involvement. In addition, water is not treated like a regular commodity since water is a sensitive resource and water supply and sanitation is a basic human right and should be accessible for everyone. Ecological and environmental as well as qualitative and quantitative aspects are considered when water management projects are designed and transboundary water sources, groundwater and coastal water are managed. Noticeble achievements could be made in co-operation within projects of the European Union, other water resources management organizations, and on a governmental level

.

Creating the culture of using water wisely, water democracy, using water technologies are the most important achievement in the European society regarding to water. Despite of the progress in water resources management in Europe, there are still some difficulties to reach the optimum situation. These difficulties arise due to the diversity of water policies and legislations of the

member states of the European Union. Governmental co-ordination of water related policies is still a challenge especially environmental aspects of water use play here a key role.

The agricultural sector still suffers from mismangement on a transboudary point of view. No considerable progress could not be made in specific geographical 'hot spots'. Also hampering is the existing data gap resulting from the enlargement of the European Union.

2. LMR Heinrich Becker, Saarbrücken (DE): Emphasis of Measures in Germany: Implementation, Public Participation and Performance Review

The Water Framework Directive (WFD) provides for a unified river basin management in Europe. The lecture describes the implementation of these regulations in Germany. It focuses hereby on public participation and monitoring of the impacts. In Germany the federal states and river basin groups issued programs which describe measures to reach the objectives set. Afterwards, those were aligned by a team of the national government and the federal states providing the basis for transmission of information to the European Commission. In the case of transboundary river basins, cooperation with other countries took place.

One main feature of the WFD is public participation, which is why each interested stakeholder is encouraged to participate in drafting the management plans. After implementation the defined indicators are monitored continuously. The drafts of the river basin management plans show that the WFD water quality objectives cannot be reached in all areas by 2015. This is mainly due to technical delays and the duration of some natural processes like the creation of biocenosis. In such cases the WFD provides for exceptional regulations.

3. Birgit Vogel, Wien (AT): River Basin Management within the International Framework for Example of the Danube – More Coordination than Specialist Work?

The Danube is the longest river in the European Union, covering 19 states in Europe. The Danube River Protection Convention forms the overall legal instrument for cooperation on Transboundary Water Management and the protection of water and ecological resources in the Danube river basin. The convention was signed on June 29, 1994 in Sofia (Bulgaria). In order to achieve good water status in the water bodies of the Danube region by 2015 and to ensure a sufficient supply of clean water for future generations, the contracting parties nominated the International Commission for the Protection of the Danube River (ICPDR). This will be the planning body for the entire Danube river basin using the principles of the EU Water Framework Directive.

The Danube river management plan will be updated every six years according to EU legislation. The management plan aims to create a program of measures to ensure that environmental objectives are met on time. Under the coordination of the ICPDR, the Danube Basin analysis shows the characteristics of surface water, groundwater and the inventories of protected areas of the Danube River Basin and the results allow the identification of four significant Water Management Issues in the DRB (organic pollution, nutrient pollution, hazardous substances pollution and hydro morphological alterations). Finally, future steps should be made by designing detailed management objectives for all the significant Water Management Issues (SWMI).

4. Dr. Alexander Schink, Düsseldorf (DE): Special Legal Regulations for the Implementation of Tasks on the Basis of River Basins

Mr. Hermann Spillecke from Ministry of Environment and Land, Nature and Consumer Protection (Nordrhein-Westfalen) has introduced the administrative structure and framework in Nordrhein-Westfalen with the example of river Rhein. Different stakeholders, including associations (fishery, hydropower, agriculture, industry, water transportation, etc.) and authorities (water, land, forest, etc.) are brought to round-table meeting by the ministry. They start from acquiring the current water information, and then draft action plans, until finally the implementation of these plans. The involvement of all stakeholders ensures the consideration of all aspects of water resources, and the balance of the benefit and liability of each organization. A so-called Action Program is established for the water bodies in Nordrhein-Westfalen, which requires that all river catchments larger than 10 km2 and lakes with surface area larger than 0.5km2 should be investigated and reported at every 6 years. The measures in the Action Program include building new water structures (water channels, pipes, retention tank), special measurements for erosion protection, and Habitat restoration, etc. The water authorities is

coordinating the Action Program, and taking responsibility for project plan and budget definition.

The presentation has demonstrated the management framework in Nordrhein-Westfalen in a very practical way. Although it may not be proper to copy the system to other countries or catchments, the idea of coordinating water resources management by round-table meeting is very valuable.

5. Prof. Dr.-Ing. Michael Weyand, Essen (DE): Interaction of Sanitary Engineering Measures and Near-natural Development Waters in the Catchment Area of the Bröl River

The Bröl is an affluent of the rivers Rhein and the Sieg. It is 65 km long what about 30% is the main basin. His renaturalization would have a big ecological potential. His quality stays now in the classes I. and II (good and very good). There are but some parts with big salmonoid concentration. These parts are not in the natural basin. It causes high-water danger and erosion with fine sediments that includes substances. They pessimate the nitrogen establishment of the river water. These effects should be minimized due water management actions like using retention soil filters. The renaturalization should reduce the diffuse emissions and due a better bank and sole structures should be helped to the bigger biodiversity. Here it is possible to give more space for the river. The water management actions and the water body development have to be harmonized to each other to have a high efficiency and to minimize the cost. This is necessary by the planning and by the construction to have a high acceptance.

In the first phase of the project happened the optimizing due 3 years with the help of mathematic models. At five places retention soil filter basins are going to be implant and all of the area of the water body development will be 10 km long. Due this planned way will be not just acted for the goals of the European Water Framework Directive (2000/60/EC), there will be in better position also the local problem of the high water safety. The renaturizing makes also for the attractivety of the province sight and for the chance of free time and tourism in the region.

6. Dr. Uwe Koenzen, Hilden (DE): Care and Development of Small Flowing Waters According to WFD (Water Framework Directive)

The status of waters today is a result of the development of water way infrastructure during the last centuries. This intensive use of the water ways asks nowadays for a high maintenance requirements of the network. To ensure discharge, flood protection and ecological sustainability of European water bodies the Water Framework Directive (WDF) was published and now legally enacted. The appraisal of European waters shows severe ecomorphological deficits. Therefore the improvement of the structure of water bodies needs to be in focus of water management. In order to assist decision makers the DWA is publishing a brochure containing informations and several case studies. With this brochure the DWA provides decision makers like municipalities, water associations and interest groups with a strategic information for reorientation of the water management. Based on the legal framework hydro-morphological circumstances will be improved with cost-efficient resource planning. This shall be done without compromising any of the complex entitlements of user groups.

7. Prof. Dr. Werner Konold, Freiburg (DE): Radiation Effect for good Ecological Status of waterbodies

Ecological protection and good chemical condition are parts of the whole process of river basin management. The good ecological condition of water bodies is a result of biological and chemical components. The source and type of radiation effect has to be examined. The biological component includes culmination, eutrofication and sedimentation.

The chemical component is a result of migration process of trace elements. Still there are no scientific studies on how long radiation paths should be. An important question is how the radiation effects the technological processes in the water treatment plants. The influence of radiation on birds and fish need the collaboration of specialists of ecology, biology and chemistry. It's crucial that ministries of ecology of different countries work together in order to control the migration of infected species. The radiation factors can be observed in the direction of the flow of the river. That means that all countries are responsible for controlling the radiation effect.

Good river basin management needs ecological transboundary. On time communication across borders is required. Renaturalization of water bodies has to be the aim of involved governments. Daily monitoring and tailored experiments are required to improve the ecological blind spots.

8. Verw. Prof. Dipl.-Geogr. Mariele Evers, Dr-Ing. Jörg Ditrich, Suderburg (DE): Decision Support Systems in River Basin Management – Experiences and Perspectives

Decision Support Systems (DSS) in River Basic Management are a specific class of computerized information systems that supports business and organizational decision-making activities.

Requirements for DSS are:

- to coordinate with other parties in river basins, for example environmental protection, spatial planning, agriculture,
- process of involvement of the public and proactive information sharing,
- cost-benefits analysis,
- multicriterial analysis
- consideration of interest.

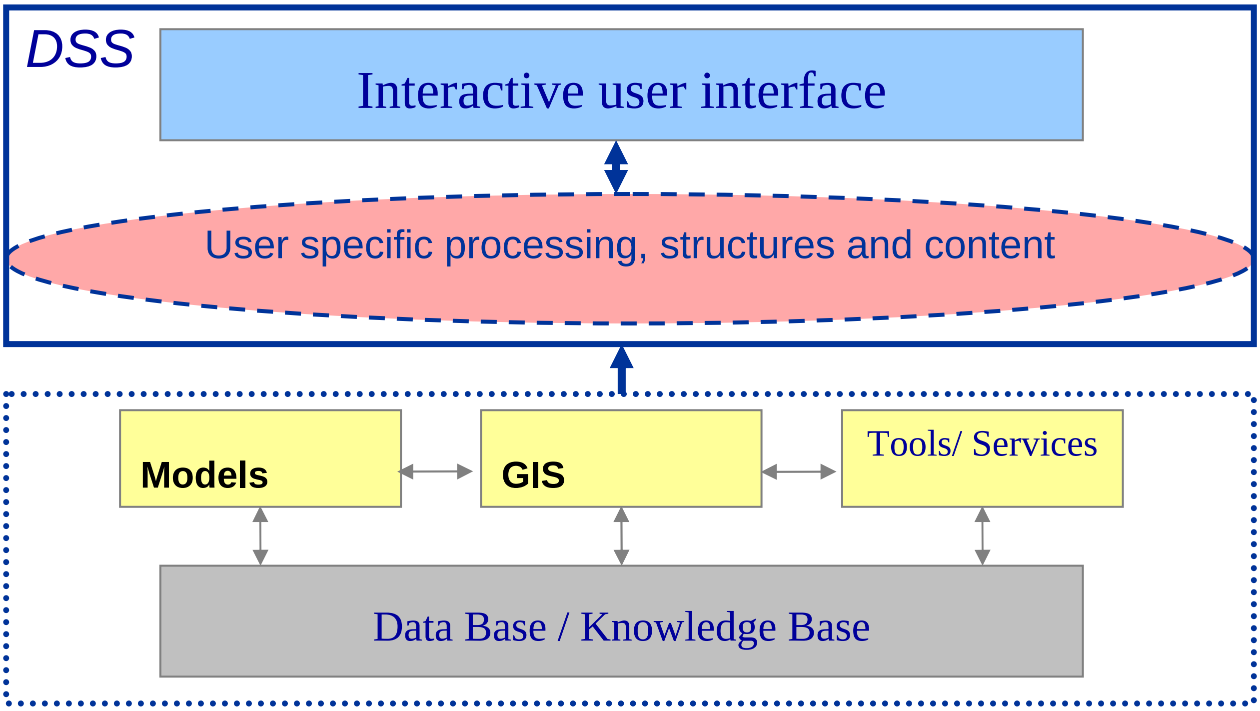


Fig. 1: The simplicated Modell of DSS [Evers 2008]

The most important features of DSS:

- what-if scenario, comparison of alternatives, evaluation
- visualisation (maps)
- define the aims for developing and identification of problems,
- smart, flexible and quick data management
- promotion of process of participation, for example platform

- Conditions und potentials of DSS:
- DSS have to be aligned with the structure of management
- political-institutional back-up
- use the professional und technical standards of interfaces (peripheral requirements)
- integration of different professional requirements
- co-ordinated with river basin data management
- to agree upon the legal requirements/aims
- to support of the process of agreement (communication medium)

9. Prof. János Fehér, Budapest (HU): Watershed and River Basin Management as the Future Water Management – Views on Perspectives

Integrated water recources management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. The available water recourses of the European countries exceed the abstracted amount. However the balance between water demand and availability has reached a critical level in many areas of Europe because of over-abstraction, prolonged periods of low rainfall or drought. Now, water problems and water stress are high on the political agendas and subject of the global forums. Increasing emphasis is given to integrated water resources management solutions and its basin scale application, called integrated river basin management.

Traditional water resources management focused on technical solutions to meet fragmented sectoral or sub-sectoral needs through isolated projects, i.e.: water supply and sanitation, irrigation and drainage, flood control, hydropower, industry. Little attention is paid on demand management and environmental and social impacts. Recognized problems which are observed: economic weakness and dependence on national budgets in most of basins' riparian states that might endanger all positive developments; the cross border cooperation is limited for "high level issues" and not tackling important threats; traditional strengths and belief in technical water management characterize decision making of water managers, while alternative soft measures and risk mitigation options are refused or weakened; Combined, multi-purpose activities, projects have limited budgets; Communication and data exchange are poor.

Water resources management has to be organized and discussed at the geographical level at which the problems occur: at local, national or transboundary river basin. It has to be based on integrated information systems identifying the resources and their uses, risk identification and monitoring of trends. These information systems constitute an objective basis for discussion, negotiation, decision making and assessment of the action taken, as well as for coordinating the financing from the various funding sources; It should allow participation in the decision, making process by the local authorities concerned, representatives of the various user categories and environmental protection associations or those working in the general interest, alongside the competent Government departments. Through a process of discussion and consensus, it is this participation that will guarantee the social and economic acceptability of the decisions reached, taking account of the real needs, the level of acceptance and the ability to contribute by the social and economic stakeholders. Decentralization is the key to water policy effectiveness.

Conclusion

The best way to protect and manage water is to enhance international co-operation of all the countries within the river basin – bringing together all interests upstream and downstream. In this session of the workshop, experts from a broad discipline have addressed the water basin management issue from different aspects, which covers legislation, ecology, monitoring, modeling, and public participation. It clearly tells us that water basin management need both trans-boundary and inter-disciplinary cooperation, in order to achieve a thorough understanding of basin hydrology, and thus a sustainable river basin management strategy.

Only for water itself, it involves already too many issues with fresh water (water supply, irrigation, industry water demand, and hydro-power) and wastewater. But today water basin management issue goes much further, beyond water quality and quantity, to ecological system, which requires an interdisciplinary collaboration to manage water resources effectively and efficiently. The reality that most rivers go through different administrative region, or even countries, makes the management issue even difficult. For trans-boundary water basin, the best way to protect and manage water is by close international co-operation between all the countries within the river basin – bringing together all stakeholders of both upstream and downstream. The Danube river basin has shown us a good example, if not yet perfect.

The European Water Framework Directive sets out how water should be managed in the European Community within river basin districts, and marks a new era in water management due to its integrative approach. Such directive and cooperation is desired in some countries, for example China, Jordan, Palestine and Lebanon, where some of our group members live. The problem is that there are still political barriers which hinder the cooperation in water resources.

Involvement of the public and proactive information sharing is crucial for river basin management. Countries like China, Jordan, Palestine and Lebanon, where some of our group members live, have shared their experience, which shows that comparing with European countries, the public awareness of water resources are still very limited.

<u>Report of Group IV</u>

“Waterworks Tegel and Beelitzhof”

<u>Group guide:</u> Phi Vo Thi Yen

<u>Group Members:</u> Antonini Samantha, Badran Mohamed Omar, Borisov Boyan, Fogorasi Magdalena, Matar Feras, Mugume Seith Ncwanga, Nikolova Milena, Omar Mohie E., Parvanova Desislava

1. Introduction

As part of the Young Scientists Programme (YSP) organized by DWA, a field visit was made to Berlin-Tegel and Berlin-Beelitzhof Water Treatment Plants to learn more about the water treatment processes and the closed loop water resources management cycle implemented by Berliner Wasserbetriebe (BWB). BWB is a public private company which is 50.1 % owned by the City of Berlin and 49.9% owned by the private sector companies like RWE and Vivendi. Due to the privatization of BWB the city of Berlin generated 1.7 billion €. This public private partnership ensures the citizens interests and satisfaction. In general the BWB serves around 3.5 Million inhabitants and is therefore the largest drinking water and sanitation service provider in Germany.

Berlin water resources

Approximately 6% of Berlin's area consists of fresh water; i.e. lakes, river-lakes, regulated rivers, and canals. The water resources are used for many economic activities, which include recreation, fishing, shipping etc. Berlin has a special water situation because it is formed on the Berlin-Warsaw glacial valley which consists of sediments - sand, gravel, marly till and clay, which created excellent aquifers in the Berlin region. Because of these unique resources, Berlin is exclusively (100%) supplied with groundwater, with a contribution of 56% from Bank filtration, 14% from artificial groundwater recharge and 30% from natural infiltration.

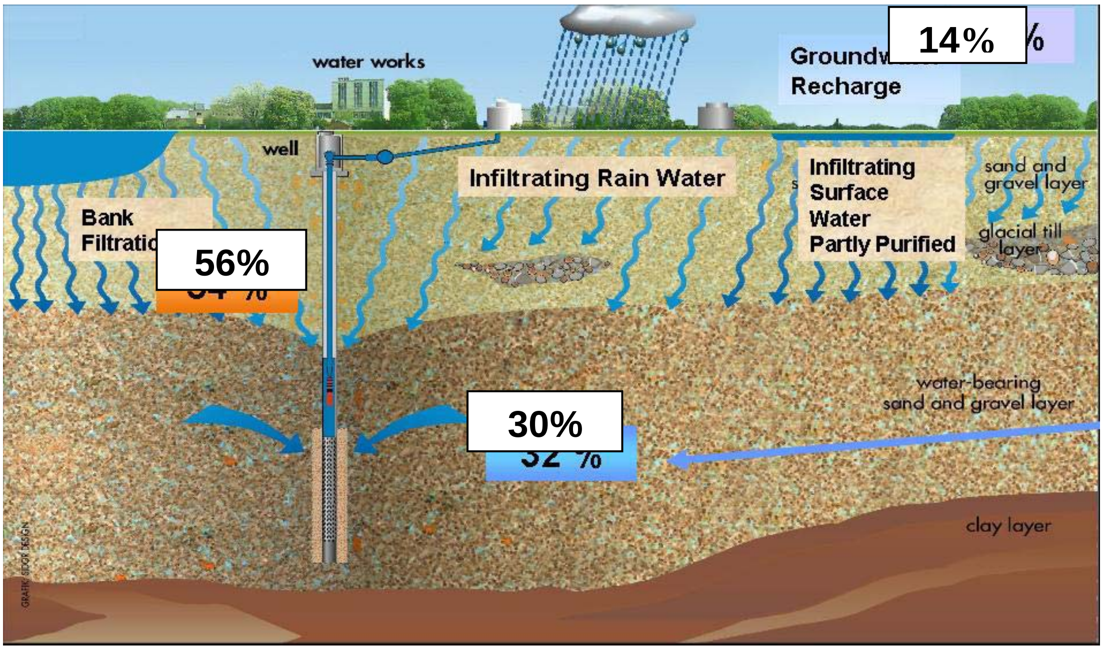


Figure 1: Scheme of Bank filtration, artificial and natural ground water recharge

Consumption

Berlin is endowed with an extractable 360 million m^3/year of ground water. Of this, only 200 million m^3/year is consumed.

Network length

The Berlin Area of approximately 830 km^2 is served by a total transmission and distribution pipeline network of 7850 km. Distribution pipes with a diameter ranging from 80mm to 300mm form the major part of the distribution network. The transmission network consists of pipes with a diameter of up to 1,400 mm. The pipes are made up of a combination of different materials i.e. gray cast iron, ductile gray cast iron, fibre-reinforced cement steel,
concrete and plastic.

Ground Water Extraction

BWB extracts ground water from about **700** deep wells. Most of them are vertical filter wells. Their depth ranges from 26 to 170 meters and their submersible pumps deliver between 40 and 250 m³ / hour of raw water to the surface. BWB operates two horizontal filter wells. Each of these can deliver up to 1600 m³/ h of raw water. After the raw water is extracted, it is delivered to the treatment plants via pipes.

2. Berlin – Tegel Waterworks

The water works Tegel was built in 1877. In the years after, the construction of waterworks channel started in order to supply drinking water to the city of Berlin. Further development of waterworks Tegel was influenced by the political and economical situation in the city as a consequence of the separation of the city in two parts in 1949. After separation, the waterworks was supplying water only for the west part of Berlin. Nowadays, Tegel plant supply drinking water for the areas Stolpe, Spandau, Kladow as illustrated in figure 2.

Figure 2: Area covered by waterworks in Berlin

Plant capacity

The daily maximum capacity of the waterworks Tegel is about 550 000 m^3. The water is pumped from 130 wells, via pipes, directly to the water-supply network without storage in reservoirs. The source of the drinking water delivered to the customer is only the ground water and its high quality does not require disinfection. The ground water source consists mainly of: groundwater (33%), bank filtration (59%) and groundwater recharge (8%). The waterworks is equipped with 30 filters (20 of them are working at the moment), aeration tanks, pumping stations and clean water tanks. In fact, with this equipment 370 000m^3/day can be treated, but the capacity was reduced to 260 000 m^3/day.

2. Berlin – Beelitzhof Waterworks

A presentation was given by Mr. Ralf Binz, the manager of Berlin – Beelitzhof water works and thereafter, the team was given a guided tour of the water facilities and infrastructure used to treat water, i.e. aerators, sand filters, clear water tanks and main pump house.

Plant Capacity

The 9 water works of Berlin have a capacity of 1.140.000 m^3 per day. Beelitzhof is one of the three main water works which controls remotely other nine water works. The water works Beelitzhof has a capacity of 180.000 m^3 per day and is the 3rd biggest water works after Tegel and Friedrichshagen. In contrary the required quantity per day is 140.000 m^3 in the area served by Beelitzhof water works. The only source of drinking water in Berlin is groundwater. The water work extracts groundwater from 75 wells with a depth ranges between 10 and 70 meters. The extraction capacity is between 50 – 250 m^3 per hour.

Water Distribution

The water is directly pumped from the pumping stations to the distribution networks to be delivered to the end users without using any water towers in order to decrease the maintenance cost of the network. The water pressure in the distribution network varies from 3 to 6 bars.

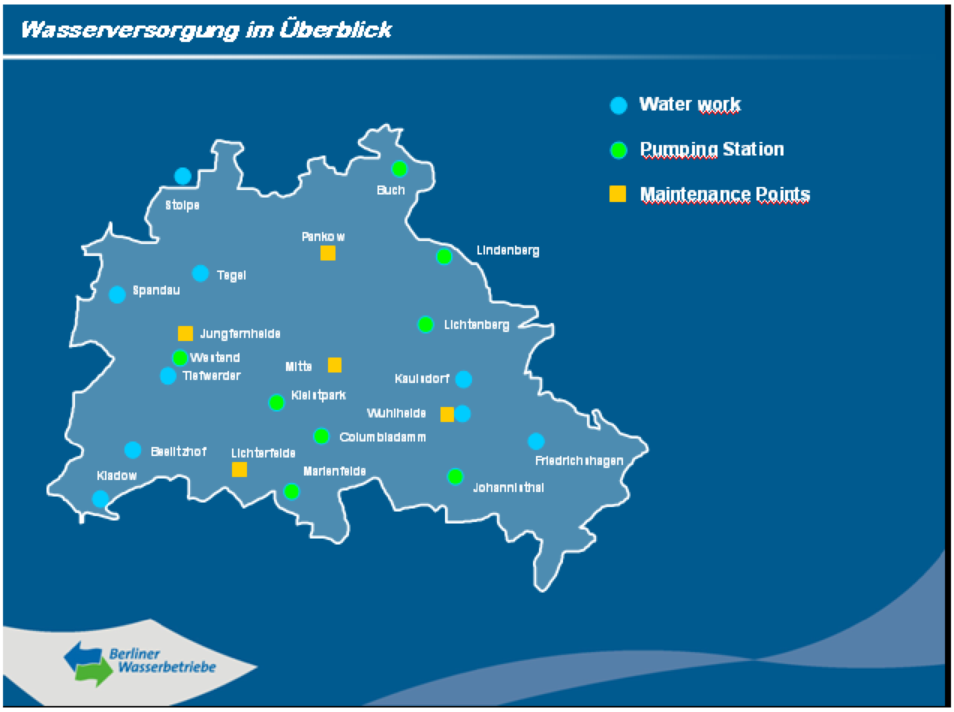


Fig.3.1: Overview of drinking water distribution system (Source: Berliner Wasserbetriebe)

Area Served

The water pressure in the distribution network is divided into 3 pressure zones covering an area extended 40 km from the West to the East and 35 km from the North to the South. The three areas with the different elevations are Teltow - Hochfläche, Barnim - Hochfläche and the Berlin – Warschauer Urstromtal. The elevations vary from 29 m to 65 m above sea level. The water pressure in the water distribution networks varies from 3 to 6 bars. The pressure is controlled only by the pumps.

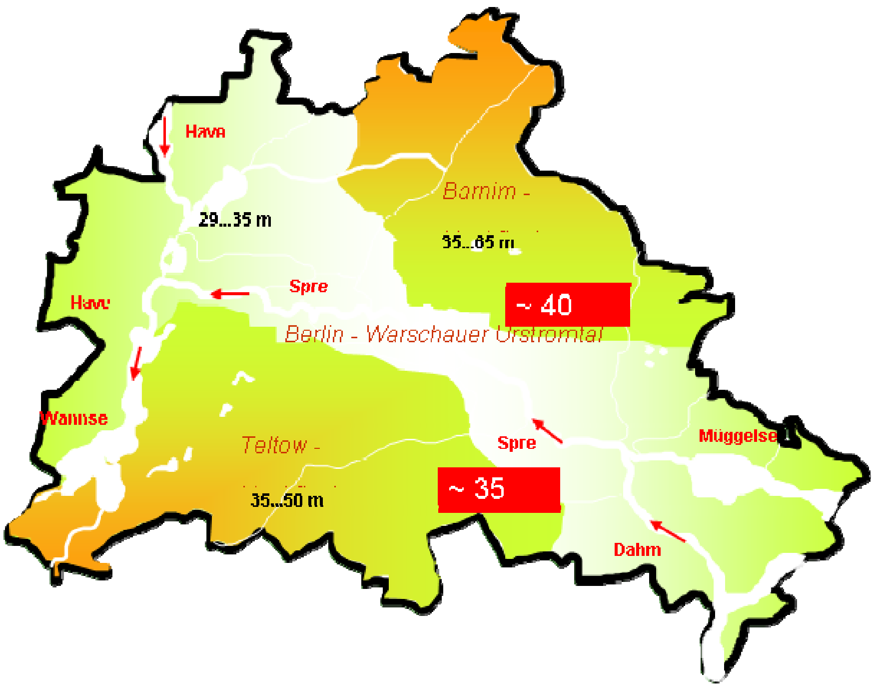


Fig.3.2: The different pressure zones of Berlin. (Source: Berliner Wasserwerke)

3. Treatment processes

The same treatment process is applied at both Tegel and Beelizhof waterworks. In addition to production of drinking water, surface water is treated and transferred to other lakes in the city to regulate the water levels.

3.1 Drinking water treatment

Aeration

Iron (Fe) and manganese (Mn) are found dissolved in raw water and must be removed to meet the drinking water standards. They can diminish the diameter of the main networks too (or drinking water supply pipes). Besides this, raw water contains no free oxygen. This is why it is sprayed into the air by nozzles in the aeration chambers (or is led over cascades). This allows the raw-water to absorb oxygen from the air, so that there is enough free oxygen for the next treatment step.

The reaction basin

The aerated raw water flows into the reaction basins. The reaction basin is a buffer for the chemical reactions. At this stage, iron and manganese form flocks. For this process, the water is detained in this section from 15 to 60 minutes.

Rapid sand filters

When the water reaches the rapid filter plant, the iron and manganese flocks can be removed. They are removed by passing the water through a two meter thick layer of gravel. Sometimes two layers of gravel are used at the bottom and a pumice stone layer at the top. Whenever the layer of gravel has become clogged with sludge, it is washed out with air and drinking water from the clear water tank in order to free it from debris.

The clear water tank

Treated water is stored in the clear water tank. Even though a relatively constant amount of raw water is extracted from the wells, it is necessary to store quantities of drinking water because consumption may fluctuate during the day. The clear water tank (or reservoir) is not only a reservoir, but also a storage tank.

Water distribution

The pumping station is equipped with clear water pumps. Berlin's average rate of domestic consumption is 115 litres per inhabitant and it is steadily decreasing. The pumps are driven either by electric motors or by diesel engines. This guarantees that water can be supplied, even in the event of a power failure.

3.2 Surface Water Treatment

Groundwater abstraction resulted in decreasing groundwater levels and thus caused a potential risk for the lakes in the Berlin area to run dry in the long term. Since 1913, the interconnected series of lakes known as "Grunewaldseen" were fed with water abstracted from the larger Wannsee with the objective of regulating the smaller lakes' water levels. However, phosphate concentrations in the Wannsee had increased to such an extent that pumping this nutrient-rich water into the smaller Grunewaldseen would lead to eutrophication of the latter. As a consequence, the Beelitzhof surface water treatment plant was commissioned in 1981. Water treatment is achieved through the operational processes of flocculation, precipitation, sedimentation and filtration.

At the works' inlet, the water originating from the Wannsee first enters an equalization chamber before it is brought in contact with an iron (III) chloride ($FeCl_3$) flocculent. This coagulant reacts with the hydroxide ion to form flocks of iron (III) hydroxide that can remove suspended materials such as phosphates. At first, the generated flocks are too small to settle down under the influence of gravity, and therefore polyacrylamide polymer is added. Trivalent metal salts like $FeCl_3$ are readily bridged by these long polymer chains. This leads to an enhancement of the flocculation rate since the small micro flocks are converted into larger macro flocks which can now settle down in specially designed sedimentation tanks. The settled water then flows through rapid sand filters and is stored in the clean water reservoir. Eventually, the treated water (phosphate conc. < 10 µg/L), is pumped to the inlet of the Schlachtensee. The settled solids generated by the treatment process are treated at a wastewater treatment plant.

4. Discussion points/Recommendations

- There is no disinfection done during the water treatment processes, because the ground water is free of pathogens.
- The entire area used for groundwater infiltration in Berlin is protected and this contributes greatly to the excellent groundwater quality.

- The water produced is supplied directly to the customers (is not stored in reservoirs) and hence the possibility of re-contamination during the distribution is minimized.

- The entire water production/distribution system is highly automated and hence making it cost efficient. However, drinking water costs 2€/m^3 in Berlin making it one the highest rates in Europe

- There is decreasing water demand due to closure of industries in East Berlin and also due to advances in the water saving technology

- There is a need to look into energy efficiency to further reduce the cost of water.

<u>Report of Group V</u>

"Irrigation as a Basis for Food-Production in the Future"

<u>Group Guide:</u> Mohammed T. Obidallah

<u>Group members:</u> Azzam N. Hamaydeh, Anne Gädeke, Georgiev Nikola Vasilski, Kratev Petar Yordanov, Mircea Negrut, Tsvetelina Simeonova, Stanislav Zahov, Valentina Vladimirova

1. Irrigation as a Basis for Food Production

Dr. Uschi Eid

Irrigation plays an increasingly bigger role for the worldwide food production. Currently, about 40% of the vegetable production is produced with the help of irrigation. Agricultural production is responsible for about 70% of the world's fresh water withdrawal and 90% of the world's water consumption. In comparison, about 20% of the world's fresh water is consumed by the industry and only about 10% for private households. In Asia and Africa, water consumption of the agricultural sector is as high as 85% of the total water consumption. Similar high numbers for water consumption for agriculture are observed in Southern Europe while in Germany agriculture uses only 3% of the total water consumption. According to Dr. Eid, the following points cause an even higher demand for food and consequently a higher water demand globally.

Climate Change

Climate Change will not affect the amount of water on earth, it will, however, effect its distribution. For example Germany is proposed that the winters will be wetter while the summer months will be drier.

Water Pollution

In many parts of the world, adequate water treatment plants are missing, therefore used water is discharged into the natural water bodies without receiving any form of treatment. In fact, about 70% of the industrial waters do not receive any treatment, while for the domestic waters is about 90%.

Population Growth

The world's population has been growing drastically during the last centuries and projections indicate, that it will continue to grow. This is especially dramatic for the African Continent, where in many parts water is already a scarce resource. In fact, already today, the water consumption in 30 countries is higher than their natural resources recharge.

Change of the Living Habits

Especially in Asia, people start to eat more and more meat. Meat, compared with vegetables, wheat, and rice needs much more water. Water consumption for irrigation becomes a real problem in areas where more water is used or abstracted than is naturally recharged. Rivers, such as the Rio Grande, Lake Aral and Lake Chad are in danger to dry out. Throughout the world aquifers are overpumped, that means that more water is abstracted than is recharged. In coastal areas this can lead to sea water intrusion into the fresh water aquifers. Another big issue concerning irrigation is the problem of soil salinization. In fact, in Iraq, about 8.5 Mio hectare of soil cannot be used anymore due to salinization. But irrigation is also an important factor for the European agricultural sector. For example, about 30% of the agricultural land in the Netherlands is irrigated.

The question is what solutions to the problems presented are possible. It remains questionable if an increase in agricultural production with the help of irrigation is possible and feasible.

- Increase of water efficiency
- Intensification of agricultural research and efficient irrigation techniques
- Consulting and educating of the rural population
- Provide easier access to food
- Waste less food

- Water reuse
- Improving of pipes, treatment plants
- Modern irrigations techniques (e.g.. drop irrigation)
- Concept of EcoSan
- IWM (Integrated Water Management – also transboundary)
- Change of consumption patterns (especially in the developed world)

2. Competition between Industry, Water Supply and Agriculture

PD Dr. habil. Frank Riesbeck

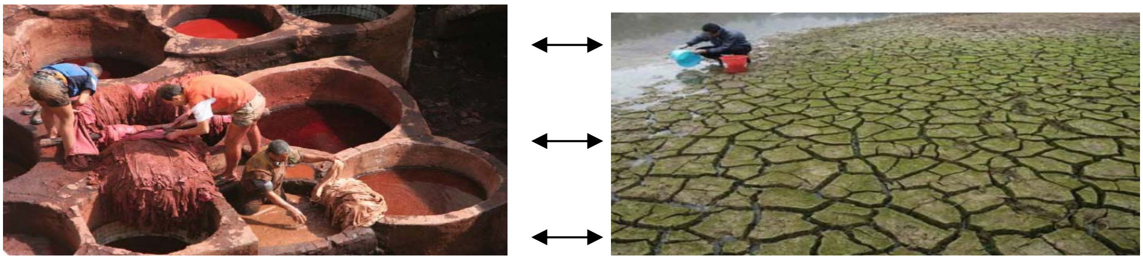


Figure 1: Different Aspects of Water Scarity and Water Use

Water is important for all sectors (industrial, agricultural, and municipal), and with the absence of water there will be no development in any sector.

The water world wide problems are:

1. Increasing population
2. Water scarcity, in particular the fresh water, which represent currently about 0.014% . The scarcity is increasing year by year, for example in 1995 it was about 3% and it is expected to be 18% by the year 2050
3. Inefficiency in water sector
4. Mismanagement in water sector

The most water consuming sectors are industrial, agricultural, and municipal.

There is a huge competition between these sectors and its expressed as the following:

- developing countries consume most of their water resources for the agricultural sector (for example Syria).
- developed countries consume most of their water resources for the industrial sector (for example Germany)
- some countries try to enhance their industrial sector, which puts a huge pressure on the water resources (such as China)

Thus, some countries want to develop their industrial sector, but they are facing the water scarcity problem in their countries. This leads some countries to decrease the suitable water quantity for their industries and this creates unhealthy environment, and causes a lot of diseases.

On the other hand, some countries want to develop their agricultural sector, which causes many problems, like high soil salinity that requires soil washing/ leaching before planting, also desertification with around 1 Million ha loss by drying, and for sure scarcity of water.

The available suggestions to this situation are as the following:

1. Increase of water capacity
2. Increase of water efficiency
3. Use of quality management and quantity product
4. Use new different methods like micro irrigation
5. improving water-use efficiency in agriculture.

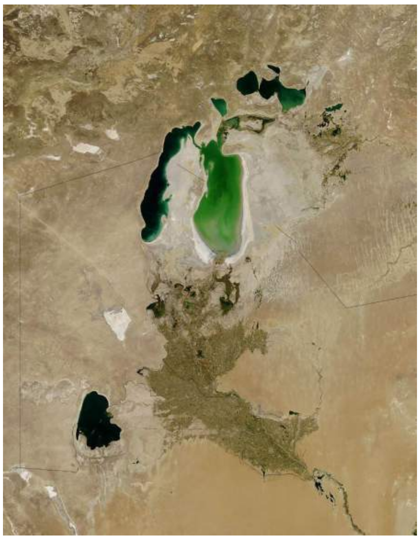
At this stage appropriate solutions need to be developed for particular physical, social and economic conditions. There is a need to increase efforts to introduce technical innovations to the social, political and institutional structures that can encourage farmers to adopt the improvements. If this is achieved, more areas of the world would be able to produce the food they need for the presence and for the future.

3. Aral Sea: Cause – Effect – Problem Solution

Prof. Dr. Paul L.G. Vlek J. P. A. Lamers

The sixth presentation of the day held by J.P.A. Lamers, was a case study about "The Aral Sea Basin: Causes and Effects, and Options for sustainable, irrigated agriculture". The Aral Sea has once been one of the 4 largest lakes in the world according to the surface area in 1960. This case study presents the facts that what has happened in Central Asia Republics in the Aral Sea Basin with agriculture soil exploitation and water use for irrigation. These countries made huge investments in irrigation for agricultural exploitation.

Figure 2: Overview Aral Basin (Mickling, 2007)



The large expansion of irrigated agriculture for producing cotton has occurred on the expense of natural water resources bodies with huge consequences on landscape, ecology and people. This development occurred within several decades, unfortunately this has been just newly recognized and it is known now as the Aral Sea Crisis. Human actions induced threaten to the livelihood, food security and human health. Statistics show that about 40 million of rural people inhabiting in the irrigated lowlands.

Yet the overexploitation over decades has seriously affected soil productivity (soil salinization increased and arable land had to be abandoned). These facts also affected the Aral Sea, recording the data between 1960 until 1992:

	1960	1992
Surface (km2)	66.900	30.900
Watervolume (km3)	1.056	255
Salt concentration (g/l)	10	40

Table 1: Aral Sea Surface Reduction

- Size reduced till 45%;
- Water volume reduced to 20%;
- Salt concentration is 4 times higher.

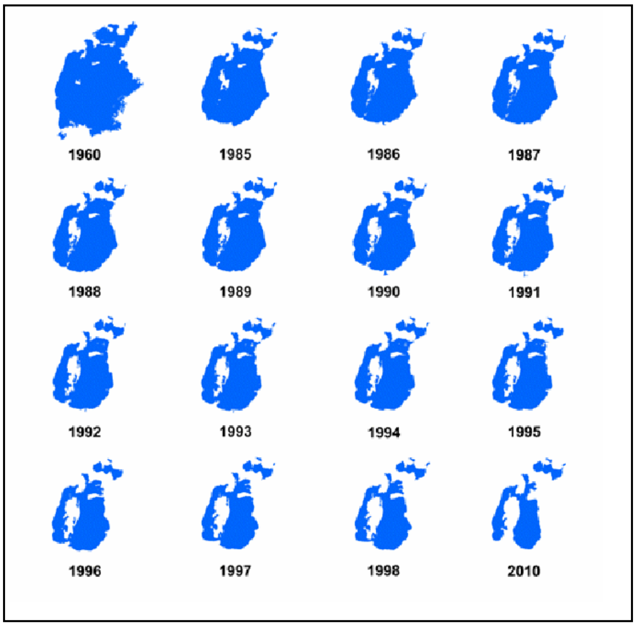


Figure 3: Aral Sea Surface Reduction (Ivanov et al. 1996)

The Aral Sea cannot be saved anymore, but the region cannot be abandoned. In 2000, Center for Development Research initiated a collaborative programme (2001-2012) with the University of Urgench with the aim to improve rural livelihoods in the Khoresm region by providing sustainable development options based on integrated and sustainable resources utilization. This program (ZEF/UNESCO Project) promotes the concept of setting aside marginal agricultural lands for alternative uses, the development of options for improving irrigation efficiency and reducing water wastage and salinization. Also, this program includes the introduction of tree plantations for producing renewable energy. As a result of the program, soil fertility increases.
Benefit of tree plantations:

- High biomass production
- Good calorific value
- Good feed value
- Contribution to soil N and C
    - N-fixing trees!
- Biodrainage potential

The introduction of cultivation practices, such as conservation agriculture and laser-guide land leveling has reduced irrigation application time from 39 days to 22 days and water saving of up to 30%, furthermore it shows the real promise to improve water management. in addition, institutional and economic analysis is carried out to estimate the feasibility of the water, land and natural resource management option. This work is closely coordinated with government institutions.

Irrigated agriculture in the Aral Sea Basin is critical, it is important to ensure the food security, develop a sustainable irrigated agriculture feasible in a very unstable climate and to allow millions of poor rural farm families to survive and live in relative decency, having access to sufficient drinking water and healthy food.

4. Water-saving Irrigation Technologies

Dr. Heinz Sourell

Almost 70 % of global area is irrigated. The purpose of development of irrigation technology is to investigate the possibilities to reduce the amount of water and energy. In this case it is necessary to use the correct irrigation system to save energy and water.

There are three types of irrigation systems

1. Stationary sprinkled systems which are rather expensive and not accepted by the mass. There are difficulties to construct and to de-construct this system. Reducing distance: to save more water and energy used, it is necessary to reduce the distance from the source of water. In this case it is more efficient to use water

2. Mobile sprinkler systems, with these irrigation systems the losses and the pressure are reduced and also the labor and efforts are decreased. It is even more efficient when it is combined with mobile circle machines and in this case only one mobile sprinkler system with different diameter is used. The safety of water is 20 % and 50

% of energy. It is good for the plants too, because they are not always wet and not get deceased.

3. The third one is connected with different type of irrigation in different type of soil and different plants.

The benefit is that the soil is wet from 50 to 80 % and there is enough water only for the plant need.

The technical development is very important but the management and choice of pipe system is also very central to give the right direction, for searching new possibilities to make water and energy more efficient. A very interesting research on the linkage between irrigation, climate change, water, food production and land use for Africa over the long term was presented by Joseph Alcamo from the Center for Environmental Systems Research (CESR), University of Kassel, Germany.

He discussed changing water stress and implications on irrigation and the impact of expanding food production and agricultural land on forest and natural land in Africa.
An integrated analysis, which included coupling of 3 global models – IMPACT, LandSHIFT, WaterGAP and model experiments – Calculations for 2050 using socio-economic driving forces from GEO-4 scenarios, was used.

The following important conclusions were made regarding the impact of climate change on irrigation:

1. Climate change does change things - higher temperatures leads to higher irrigation demand; water availability decreasing in hot spot regions leads to decreased availability for irrigation.

2. The biggest influence on increasing water stress, however, is pressure to increase domestic and industrial withdrawals.

3. An appropriate infrastructure to provide water should be developed.

4. Irrigation sector would have very strong competition over water use.

Regarding water and irrigation the study showed that:

1. Water availability declining in hot spot areas which leads to less irrigation water.

2. Water availability increasing elsewhere could lead to more irrigation water for crops affected by increasing temperatures.

3. Water stress increasing over continent is main factor for increasing domestic and industrial withdrawals. This will lead to competition of water use with irrigation.

For food production and land use could be concluded:

1. Large changes in land usecover in Africa between 2000 & 2050, grazing land: 60% - 100%, Cropland 55% to 65%.

2. Expansion of food production comes at expense of natural land which will lead to deforestation rate. For instance in Africa continues at current or higher rate up to 2050.

3. Expansion of food production also plays a big role in continental water balance which ranges between 70% to 90% increase in evapotranspiration from cropland.

4. Evapotranspiration of water from rain fed cropland (green water) is six times (in future 10 times) larger than water requirements of irrigation (blue water).

5. Worthwhile to increase water productivity not only of irrigated agriculture, but also of rain fed agriculture.

5. Improvement of water quality: Hygiene and chemical requirements

Irrigation water resources could be extracted from groundwater and from surface water withdrawn from rivers, lakes or reservoirs or non-conventional sources like treated wastewater, desalinated water or drainage water.

Nearly all waters contain dissolved salts and trace elements, many of which result from the natural weathering of the earth's surface. In addition, drainage waters from irrigated lands and effluent from city sewage and industrial waste water can impact water quality. This could bring to infection of the water with potentially pathogens like heavy metals, organic pollutants and various pathogenic microorganisms. Some of them could lead to accumulation in soil, plants, animals and after that in humans, via food chains.

It is recommended that waters with high concentration of salts should be mixed with other clean water.

Problems in irrigation:

1. Less irrigation gives poor salinity control that leads to increase soil salinity and which builds up toxic salts on soil surface in areas with high evaporation. This requires either

leaching to remove these salts and a method of drainage to carry the salts away or use of mulch to minimize evaporation.

2. Over irrigation because of poor distribution infirmity or management wastes water, chemicals, this may lead to water pollution.

3. Deep drainage (from over-irrigation) may result in rising water tables which in some instances will lead to problems of irrigation salinity.

4. Irrigation with saline water or high sodium water may damage soil structure.

There are no uniform standards concerning monitoring, legislation and procedures. However it is highly recommended to conduct permanent monitoring of irrigation waters in ensuring good quality management.

6. Conclusion

We can only improve **agricultural water management** and at the same time increase food production by improving water-use efficiency. It means producing the similar or a bigger amount of food with a lesser amount of water. While improving water-use efficiency relates mainly to water quantity, improving or maintaining water quality is also a fundamental task for agricultural water management. Whereas the increase of food production is the most urgent issue in many countries, the safeguarding and improvement of water quality is of main concern in others. We can improve water-use efficiency through different ways:

1. modifications in agricultural tillage practices
2. changes in crop type
3. reduction of soil evaporation
4. optimized crop selection
5. technological improvements
6. pricing policy
7. awareness and education

As water is one of the most important natural resources, in future stronger and stronger water use competition between irrigation and other water consuming sectors would be expected.