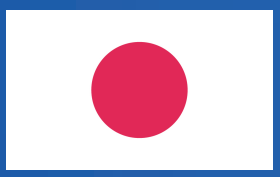
Internship to Tunisia and France

July 12th to July 22nd, 2011

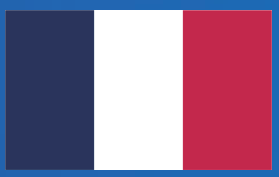
Tunisia-Japan International Symposium

Co-existence of humanity and Nature
-The Roles of Environmental Leader in Arid Region-
July 20th, 2011

Tunisia



Japan



France

Environmental Diplomatic Leader Education (EDL) Program

Master's Program in Environmental Sciences
Doctoral Program in Sustainable Environmental Studies
Graduate School of Life and Environmental Sciences
University of Tsukuba

University of Tsukuba

Strategic Funds for the Promotion of Science and Technology

Preface

Tunisia is situated in the north of the African continent and is characterized by a climate that varies from sub humid in the extreme north to semi-arid and arid towards the south. For many decades, lack of water resources has been considered the main limiting factor for growth and development, particularly agricultural development. Indeed, rain fed crop production varies considerably from north to south and over the years, acute famine has affected many citizens. Various water harvesting techniques have been developed and utilized since ancient times to cope with climate variability in the dry areas and its negative impact on production. They played a major role in the development of rain fed agriculture in addition to providing other ecosystem services.

With the prospect of climate change increasing, utilization of these systems/techniques would be very useful. Therefore, they need to be considered in national/regional strategies of adaptation to climate change.

"Water harvesting" is the general name used for all the different techniques to collect runoff or flood water for storage in the soil profile or in tanks so that it can be used for the production of crops, trees or fodder. "Water harvesting" can also include the collection of runoff water for human or livestock consumption. The benefits of water harvesting are not only to secure and increase crop production in semi-arid regions where rainfall is normally high enough for crop production or to make crop production possible in regions where rainfall is normally insufficient, but also to stop soil erosion and to recharge aquifers tapped for irrigation.

Water harvesting techniques are often ingenious and well adapted to the climatic conditions. For instance, in Tunisia, these techniques include north - south gradients leading from big dams to small cisterns.

During travel from Tunis to Jerba through the Sahel, the internship participants discovered a wide range of water harvesting techniques practiced in the different climatic stages as well as their impact on local and regional development. The quasi- continuous olive tree cover from the north to the south gives the impression of being in the same climatic stage; this could never be the case without the implementation of well adapted water harvesting practices by Tunisian citizens. Even though it was possible to appreciate the wonderful results of such practices, it is still difficult to imagine the work and labor undertaken by farmers and citizens in order to collect and to use water.

For all participants, Japanese and Tunisian students and personnel the visits offered occasions to learn more, to discover and to exchange ideas as well as experiences.

The visits were accomplished with the help of Tunisian local authorities and technical directors, may I address my great thanks to all engineers and staff who made everything easy for us.

To my Japanese colleagues, may I say *you are welcome again and again* in Tunisia; your vision will permit us to improve many things and to overcome big challenges.

Dr. Jamila TARHOUNI
Professor of Water Resources National Agronomical Institute of Tunisia

Participants of Tunisia and France Internship Program

Tunisia

1. Prof. Jamila TARHOUNI,
   National Agronomical Institute of Tunisia (INAT)
2. Prof. Mohamed KSIBI, *ISSBS*
3. Dr. Isam NOUIRI I, *INAT*
4. Dr. Haifa FEKIH, *INAT*
5. Ing. Ines NSIRI, *INAT*
6. Ing. Rahma BRINI, *INAT*

Japan

1. Prof. Maki TSUJIMURA
2. Prof. Naomi WAKASUGI
3. Prof. Takahiro ENDO
4. Prof. Xiaogang SUN
5. Hao FANG
6. Shengjiong YANG
7. Gonchig GANTULGA
8. Natsagdorj NATSAGSUREN
9. Khishigsuren NYAMSAMBUU
10. Dat Tien PHAM
11. Tung Thanh HOANG
12. Naoto AIZAWA
13. Ayako HOSHINO
14. Thu Thi NGUYEN
15. Wataru YAMADA
16. Mizuho TAKAHASHI

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Chapter 2: Abstract of Tunisia- Japan International Symposium

CHAPTER 1

Daily Reports of Internship to France and Tunisia

Schedule and Route map

Date	Time	Location	Objective	Accommodation
12 JUL (TUE)	00:35 06:20	Tokyo (Haneda) Paris(CDG)	Departure(AF283) Arrival, check in hotel Visit UNESCO HQ	Hotel Montpensier – Paris
13 JUL (WED)	 21:05 22:35	Paris Paris Tunis	Visit Pasteur Institute Departure(AF1784) Arrival	Hotel Belvedere – Tunis
14 JUL (THU)	08:30	Tunis	Pasteur Institute in Tunis	Hotel Belvedere – Tunis
	11:00	Tunis	Tunisian International Center for Environmental Technologies (CITETE)	
	13:00	Tunis	Visit to Romain aqueduct and Carthage	
15 JUL (FRI)	8:00	Tunis	Direction of Rural Engineering and Water Use	Hotel Belvedere – Tunis
		Tunis	National Agency of Solid Waste (ANGED)	
		Bizerte	ANGED - Solid Waste treatment plant of Bizerte	

16 JUL (SAT)	9:30 -11:00	Monastir	Visit of Fisheries Farming	Hotel Andalous – Sfax
	15:00	Sousse	Visit of Olive Institute at Sousse	
		Sousse → Sfax	1 night in Sfax	
17 JUL (SUN)	9:00	Sfax	Visit of wastewater treatment complex of Sfax	Hotel Haroun – Djerba
	11:00	Skhira	Visit to Taparoura coastal depollution project	
	16:00	Sfax → Djerba	1 night in Djerba	
18 JUL (MON)	9:00	Djerba	Observation of the urban water supply	Hotel Anis - Gabes
	11:00	Djerba	Visit of the desalination plant of Jerba	
	16:00	Djerba → Gabes	1 night in Gabes	
19 JUL (TUE)	9:00	Gabes	Visit to Chenini Oasis	Hotel Belvedere – Tunis
	11:00	Gabes	Geothermal production	
	16:00	Gabes → Tunis	1 night in Tunis	
20 JUL (WED)	8:00 -16:00	Tunis, INAT	Tunisia-Japan International symposium and Workshop	Hotel Belvedere – Tunis
21 JUL (THU)	08:00 13:30	Tunis Paris	Departure(AF1785), Transit in Paris (AF276)	
22 JUL (FRI)	08:00	Tokyo (Narita)	Arrival at Narita	

The Route of Tunisia Internship

Day 1: UNESCO

July 12 2011, Paris, France
Reported by Hao FANG

Content:

1. **Visit to General Constructions of UNESCO**
2. **Lecture of UNESCO's International Hydrological Programme Phase IHP-VII (2008-2013)**

1. Visit to General Constructions of UNESCO

First of all, we saw the equal proportion models of the UNESCO building in the hall of the main building. The staff told us the word "UNESCO" is the United Nations of Education, Science and Culture, and when the Y-shaped building opened in 1948. The three point means science, education and communication. UNESCO was founded in 1945 and during this time, it was also located in the center of Paris, France. UNESCO is one of the agencies of the United Nations. Also the letters of UNESCO are imprinted in the mind of people, meaning that we all are eager for peace. Education means there are many programs for education. Communication means to improve the communication of information. Science means dedication to nature and science. The budget of UNESCO is made up of two parts: the basic part is 600 million dollars, the contribution of which depends on the GDP of each member country; the supplementary part is another 600 million dollars, which is donated by individuals and groups.

After hearing the introduction about UNESCO, we were guided outside and saw some famous symbols, donations and the architecture of UNESCO Paris. One donation for decoration is made up of 10,000 rolls, which shows the great cooperation between the members of UNESCO. From that view point, they surround UNESCO like a kind of instrument with several cycles. In a sense, they are more likely a kind of intangible symbol. Later, we saw some spiral staircases' between two main buildings. Although the staff did not tell us the meaning of them, I believe they may represent the road leading to truth and peace, which looks zigzag and tough, but always tend to go upward. After that, we came to the front of a great stone wall. The six or seven meter high stone wall is likely a peace wall, on which following sentence was written: since wars begin in the minds of men, it is in the minds of men that the defenses of peace must be constructed. The staff explained there are six official languages used in UNESCO, but we found there were ten different languages on the peace wall. He was not sure how they choose the languages but the most important thing lies in that all the ten languages on the wall were together like a sign of peace. In addition, there is a tree from a Japanese garden in front of the wall. This kind of object can help us meditate for peace. We could see the coordination, ecology and nature better in the Japanese garden. At the back of the tree, we could see some stones from different countries under a pane of glass. It means that we have different backgrounds and cultures but we could be together equally. After crossing the Japanese garden, we could see the fountain of water on the other side which represented the founding of peace. The word "peace" in Japanese was written in reverse. It means that you can only read it correctly when it was reflected into the water.

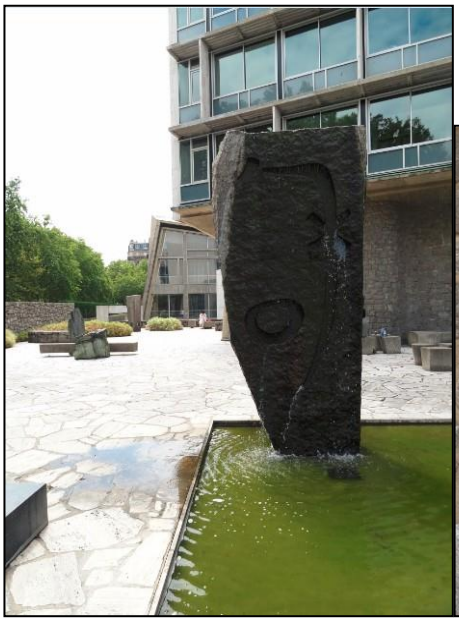


Figure 1.1 Peace water

Figure 1.2 Angel of Nagasaki

On the outside wall of one building we saw a stone carving called the angel of Nagasaki. This donation was for the memory of the great pain in the war and the hope that atomic bombs will never be used again. Another donation here from Japan is the room of meditation. When you go inside, it is not very large. Also the chair there is not very comfortable because it is for meditation. The room's structure means that all people are supposed to be very close. It is also like the work at UNESCO because they have different nationalities and backgrounds but they have the same desire for peace. Inside the building, we saw two interesting walls which were painted by the famous Spanish painter Joan Miro. The staff said we could consider one as the wall of death, and the other is the wall of life. Miro painted some logical crops and some abstract lines on the wall just after the Second World War in 1958. During that time, life was very tough and he slept there and began to paint something abstract to forget the pain of the world war. There was a sun on another wall which means that life always defeats the death. After the walls were painted, the building was constructed outside. Here in another room, we were shown a statue, named "a walking man". It was made by the artist of Alberto Giacometti. It is very interesting that you can see he is not very happy and is walking tiredly. But the glory of this lies in that he never stops to walk. It represents that even though the road is very tough, humanity never stops.

Figure 1.3 A walking man

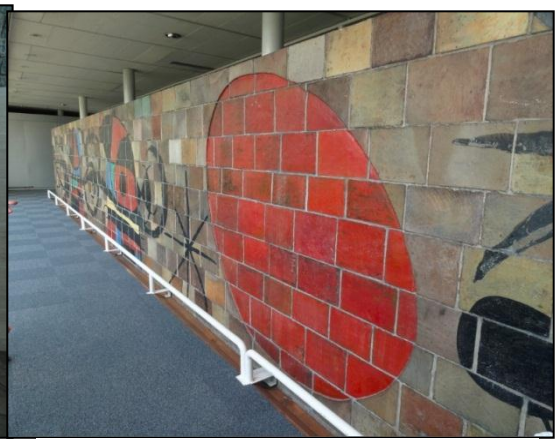


Figure 1.4 Wall of life

2. Lecture of UNESCO's International Hydrological Programme Phase IHP-VII (2008-2013)

Firstly a professor in the Division of Water Sciences in UNESCO introduced some programs about water science to us. For example, when the tsunami happened in 2004 in Indian Ocean, UNESCO helped to coordinate the building of the Indian Ocean Tsunami Water Systems, which is almost completed. It also researches the oceans. UNESCO participated in lots of international networks about managing the oceans, which consist of oceans, land and water. They have full inter-governmental science programs to deal with the environment and the earth sciences, which is called the International Geoscience Program. They encourage cooperation between different countries in projects between governments. It is almost 40 years old, and they have a lot of experiences and published materials and references. They also made some geo-parks in many countries which may help the development of local industries. For example, China has many geo-parks for tourism.

Figure 1.5 Introduction of UNESCO's IHP

After that, Doctor Sarantuyaa Zandaryaa gave us a wonderful presentation about UNESCO's International Hydrological Programme. Her presentation was all about water issues and focused on the following 4 parts: International Hydrological Programme (IHP); World Water Assessment Programme; UNESCO-IHE Institute for Water Education; Network of UNESCO Water Centres and Chairs. According to her introduction, International Hydrological Programme was created in 1975 after the International Hydrological Decade. It is the only global, inter-governmental scientific program within the UN system, devoted to water science, research and capacity building for sustainable water resources management. So being an inter-government program, they have to respond to the needs and priorities of the UN member states. They have an inter-government consultant, which is elected by the general conferences of UNESCO and 6 countries from each region are elected to join the consultant. She mentioned that the World Water Assessment Programme is hosted by UNESCO and this program is an UN-wide program, which produce a world water development report every 3 years on behalf of the United Nations. So all 27 UN agencies contribute to this program and UNESCO through this water assessment program gives assessments of the water resources on a global level and also highlights the issues and challenges, proposing solutions and approaches to deal with those challenges. The third topic was UNESCO water related Centres and Chairs. Within the centres and chairs they have two different categories:

category 1 is UNESCO Institute for Water Education, which has existed about over 40 years. All the education programs of this institute are related to water issues and over 90% of the students came from developing countries. Those students also go back to their countries and apply what they have learned in UNESCO; category 2 is linked with UNESCO but hosted by local governments. They contribute to UNESCO activities and goals in specific areas, so the centres have specific focuses on specific areas or specific topics. They are not part of UNESCO but they cooperate with UNESCO and contribute to UNESCO. That is why they have the name of UNESCO Centres. As for the chairs, mostly whom are hosted by universities, they have a smaller part compared to the centres but they usually promote very specific research and also contribute strongly to UNESCO activities. UNESCO really has a good framework to deal with water issues.

Day 2: Pasteur Institute and Musée Pasteur

July 13 2011, Paris, France
Reported by Shengjiong YANG

Content:

On the second day, we visited the Pasteur Museum, which was very satisfying visit especially for us with an interest in history and science.

1. Louis Pasteur

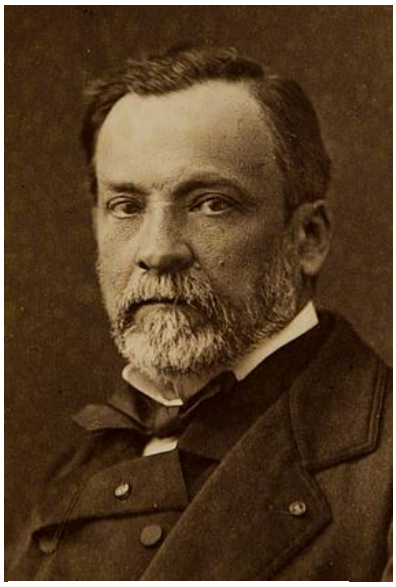


Figure 1.6 Louis Pasteur

Louis Pasteur was a chemist and microbiologist from Dole, Jura in France. He achieved great remarkable accomplishment in diseases preventions, causes and successfully defeated many communicable diseases such as puerperal, fever, rabies and anthrax[1,2]. The vaccine for rabies and anthrax was his greatest academic achievement and also a huge step for human development, it symbolized that human beings have enough abilities to resisting germ disasters to save themselves. Louis Pasteur also created a method to sterilize microorganisms from milk and wine which named pasteurization, meanwhile make a contribution to food security at the age of communicable diseases boomed.

At present, regions in many developing nations were also covered by infective diseases especially in Africa. Maybe it is our mission and duty to enhance academic exchange between nations to defeat these diseases because we are Environmental Diplomatic Leaders. As Louis Pasteur's last word: One must work; one must work. I have done what I could.

2. Pasteur Institute

The Pasteur Institute was founded on 1887 based on the achievement of Louis Pasteur and the research of Pasteur Institute mainly concentrated on microorganisms, vaccines and diseases [3].

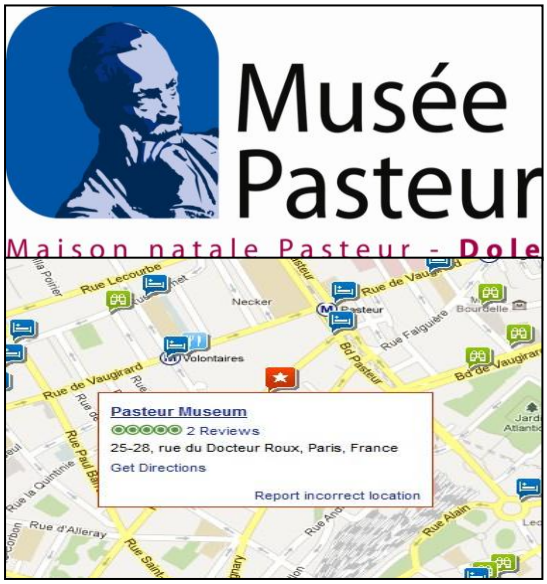
From 1908 on, eight Pasteur Institute researchers awarded the Nobel Prize in medicine and physiology, and the 2008 Nobel Prize in Physiology or Medicine was also shared by Françoise Barré-Sinoussi from Pasteur Institute and Luc Montagnier from World Foundation for AIDS Research and Prevention together[4]. At present, the elite scientists from many nations around the world gathered here to push the advance in medicine and

physiology. Working in an institute like Pasteur Institute is our dream, although my major (wastewater treatment) is much different with it, I also want to take part in a municipal institute to continue my work and develop more effective techniques in wastewater treatment if possible.

3. Pasteur Museum

The Pasteur Museum was founded in 1936 to commemorate Louis Pasteur and his contribution for human development. It located at 25-28 rue du Docteur Roux, Paris, France [5].

We took an afternoon tour with a group (Professors and student of Environmental diplomatic leaders) of 13 people and lasted about two hours. The Pasteur Museum kept and reconstructed the Pasteur's laboratory and apartment with his original experiment equipments and many notes of his discovery.



We arrival at the Pasteur Museum at 13:50 pm on July 13 2011,and this picture was taken on the road which outside of Pasteur Museum, a typical of the ancient European architecture, full of solemn and quiet; I just saw this kind of structure on the street of Paris and this would be my first time to enter it. After a short rest and we met with our guide Mr. Johann Chevillard, a staff worked at Pasteur Museum, and we entered Pasteur Museum with him.

Figure 1.7 Location of Pasteur Museum

Figure 1.8 The building of Pasteur Museum

First, we visited the equipment room, there kept many original equipment, reagent and note which Louis Pasteur used and also, the equipment of pasteurization which slows microbial growth in food and the equipment of the experiment which Louis Pasteur proved that microorganism really exists were exhibited there. I strongly admired his talents and creativities at the age of diseases boomed, especially for the creativities that we are lacking. We should and must keep on going with his spirit on science pursuing.

After we visited the equipment room, we went to Louis Pasteur's apartment, many pictures and furniture of Louis Pasteur and his families could be founded there. Candles, big mirrors and many art and craft were set in the house, full of European style; I have a little chance to contact with European culture in my life, and this is my first time to close with a European style life. It makes me feel more like a castle as the movie said but a scientist's apartment and the portrait of Louis Pasteur also make me feel that he was also an earl at meantime.

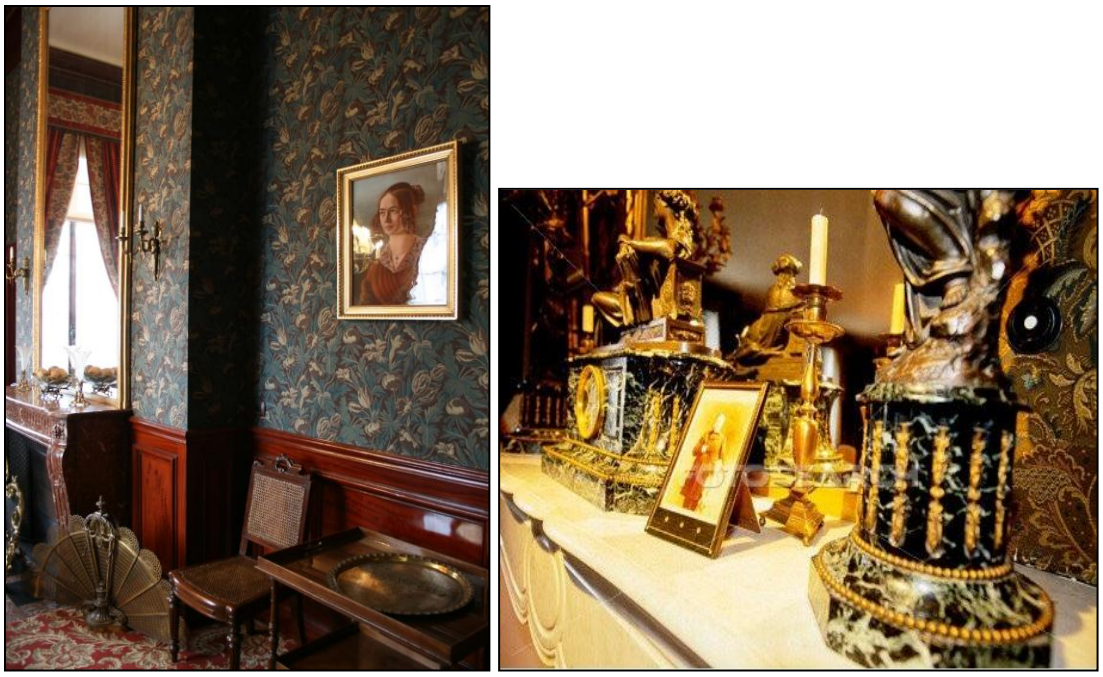


Figure 1.9 The picture of equipment

On Sep 28, 1895, Pasteur slept near Saint-Cloud in Paris forever. He was buried at Paris; we also visited his tomb in a basement crypt of Pasteur Museum, a heavenliness place (Photography was forbidden in the basement crypt, the picture is cited from 'Find A Grave Memorial' [6]). At last, we visited the library and awards exhibition room, many awards and accomplishment which awarded by Louis Pasteur and Pasteur Institute were exhibited there to be a witness for their hard work, especially for several Nobel Prize. It gave us huge spark on our own research way, as his last word: One must work; one must work. I have done what I could.

Finally, we sent our best solution to this great scientist. He and his spirit existed at human beings' memorial forever.

Figure 1.10 The tomb of Louis Pasteur

4. Itinerary

12:30: Departure from hotel.
13:50: Arrival at the Pasteur Museum
13:55: Met with our guide Mr. Johann Chevillard
14:00: Enter the Musée Pasteur
14:05: Got the tickets, 5€/person.
14:10-14:55: Visit the reconstructed Pasteur laboratory and apartment.
15:00: Viewed the library and awards exhibition room
15:20: End of tour and back to hotel.

References:

[1] The introduction of Louis Pasteur, Wikipedia,
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[5] Google map, http://maps.google.co.jp/
[6] Louis Pasteur, Find A Grave Memorial,
http://www.findagrave.com/cgi-bin/fg.cgi?page=pv&GRid=1644&PIpi=76977

Day 3: Institute Pasteur of Tunis and Tunisia International Center for Environmental Technology (CITETE)

July 14 2011, Tunis, Tunisia
Reported by Gonchig GANTULGA

Content:

On the first day of our visit to Tunisia, we went to the Pasteur Institute of Tunis. Dr. Ali Bovattour head of the department of entomology, welcomed us and gave an introduction about his own research activities. His departments research objective is the relationship between anthropods and humans. He said that the mosquito is the most important research target in transmitting infectious desease. The transmission of viruses, bacteria and parasites are by migratory birds. Birds carry a desease and then a mosquito's bite will transmit the virus into horses and humans.

He told us other interesting information which regarded the change of insect living conditions. They conducted research in the Tomporary zone which is located in the north of Tunisia. In this place a dam was constructed for agriculture irrigation purpose. Around this dam area there has been increased air humidity and this situation seems to be an ideal condition for *Flemitomus* (a small insect about 1 mm). This insect population covered certain areas and distributed some infectious diseases. One of his colleagues conducted this research and successfully completed it in the last three years.

Dr. Helmi Mardassi, head of laboratory of microbacteria and a research director, presented us with an to the introduction of the Institute Pasture of Tunis (IPT). First of all, he talked about Charles Nicole who established the IPT in 1893, and received the Nobel Prize in 1923. Historically, IPT used to be important place to teach about microbiology and vaccines. IPT is part of an international network Pasteur Institutes. The International Pasture Institute network has 12 funded agencies, 66 ongoing research projects and it includes more than 75 partners in 28 countries.

He mentioned that this institute mainly concentrates on research development, training, biomedical analysis, public health activities, production of therepantic sera and BCG vaccine for *Mycobacterium tuberculosis*.

He said that this institute has organized a 4 year medical study program for students. This programm funded by Minisry of High Education of Tunisia. International research publications are increasing year by year at IPT.

Research activities are:

1. Infectious diseases
2. Molecular biology
3. Vivulence and evolution of infections agents
4. Immunity and infection

5. Molecular Epidemiology

Laboratories are:

1. Clinical and fundamental Immunology
2. Study of diseases caused by a genetic defects
3. Development (biotechnology) design of vaccines and therapeutic molecules by the means of venemsan toxins
4. Bioinformatics and mathematical modeling
5. Entomology
6. Clinical epidemiology and control

1. Institute Pasteur of Tunis

Figure 1.11 Institute Pasteur of Tunis

Laboratory of Water & Food Control

National Center of Salmonella, Shigella & Vibrio spp.

Dr. Al-Gallas Nazek associate professor of biology welcomed us and shared information about her laboratory.

Laboratory of water and food control mainly focused on following activity:

1. Food born pathogenesis
2. Water control (drinking water, sewage water, irrigation pursosed water)
3. Export and Import food control
4. Research activity (Ph.D and Master students work in this laboratory)

The National center have been collecting and analizing 3000 samples per year from different places. Most of them contain salmonella, shigella and other bacteria. All this analysis is free of charge, but it is costs about 180 million Euro.

The Laboratory and the National Centre is member of:

1. Global Foodborne Infections Network (GFN) - International Program – since the year 2000.

2. E. Q. A. S Program (External Quality Assurance System) of the W.H.O. since the year 2000.
3. PulseNet Program of the W.H.O., EMRO since year 2006.

They organized Global Foodborne Infections Network (GFN): An international workshop in their research center in 2010.

During the last five years (2005-2009), a total of 8960 Salmonella strains have been identified by the National Centre.

The most frequently isolated serotypes of Salmonela enterica during the years: 2000-2004,

HUMAN	ANIMAL	FOOD	ENVIRONMENT
Enteritidis	Enteritidis	Anatum	Anatum
Corvallis	Corvalis	Corvalis	Corvalis
Livingstone	Anatum	Enteritidis	Enteritidis

The most frequently isolated serotypes of Salmonela enterica during the years: 2005-2010,

HUMAN	ANIMAL	FOOD	ENVIRONMENT
Enteritidis	Enteritidis	Enteritidis	Enteritidis
Anatum	Anatum	Anatum	Anatum
Typhimurium	Zanzibar/Kentucky	Zanzibar	Zanibar
Amsterdam	Gallinarum	Amterdam	Kentucky

2. CITETE (Tunisian International Center for Environmental Technology)

We were received at CITETE in the afternoon. They introduced us to Innovation and Technology Transfer.

Project: Energy recovery from the organic waste from the wholesale market of Bir El Kassaa: This pilot project aims:

1. Production of electricity from organic waste by biomethanisation technology and convert it into biogas and then electricity.
2. Treatment of a daily amount of waste 50T (25 tonnes coming from the wholes market of Bir El Kassaa and 25 T from major markets of Tunis.
3. The annual electricity production : 2.1 GWh

They said it cover 100% of the electricity needs of the market. The surplus electricity will then be sold to STEG. It also saves about 500,000 T/ year considering the cost of waste transport, landfill disposal and electricity.

Project: Lighting of the Tunis Yasser Arafat Boulevard by a Hybrid Wind-photovoltaic system using track and LED lamps:

This project can provide: The supply of electricity for lighting 1600 m of public street stretching from the Tunis airport to the GP9 using a roadway hybrid wind-photovoltaic-system traking and LED lamps.The total power of the lighting system is 51 KW (30 KW turbine wind , 21 KW photovoltaic).

DAY 4: Rural Engineering and Water Use, National Agency of Solid Waste (ANGED) and Landfill

July 15 2011, Tunis, Bezirte, Tunisia
Reported by Natsagdorj NATSAGSUREN

Content:

1. **The Direction of Rural Engineering and Water Use**
2. **National Agency of Solid Waste (ANGED)**
3. **Landfill on the Field (Bezirte)**

The international group of the University of Tsukuba's EDL internship students visited on our second day in Tunisia the Direction of Rural Engineering and Water Use, ANGED (National Agency of Solid Waste) and the solid waste treatment plant in Bizerte. Prof. Jamila Tarhouni from the National Institute of Agronomy in Tunisia (INAT) had arranged the visit and accompanied the group. The head of department introduced us to the water supply situation in Tunisia's rural engineering irrigation sector under the Minister of Agriculture and Environment.

1. The Direction of Rural Engineering and Water Use

The Rural Engineering, water and forestry department is responsible for education and research in hydrology, hydraulic engineering, water management and related subjects, the use of water in agriculture and irrigation, drainage, and water and soil conservation.
This department has following components:

- Water resources
- Construction management
- Water consumption

In Tunisia, total water resources are 36 million m^3 per/year and 45% of the water comes from the surface, while 55% is ground water. However, the surface water is much more salinated and totals 2.7 billion m^3. They have a plan for the future: they will develop integrated water resource management, protection, and waste water reuse. Tunisia has put in place systems and legislation to assure access to drinking water for the majority of the urban and rural population and to provide supplies for agricultural irrigation. Polluted water, not only salinated, and even iron was found and that's why the maintenance of wells is controlled by the health services.

In irrigation system transports water to Sahal and this private area is 180000 ha. A public 225000 ha network provides consumption for agriculture. Each farmer is connected to the well water and has a system for their own field. That's why there are many problems for the national program on irrigation management. Therefore, the implementation of a permission system to use ground water legally will require payment like a tax. Farmers can get permission for up to 50 m well for legally. Increased rural drinking water consumption has led to the creation of sanitation and resource protection programs.

The next presenter was Mrs. M.Ghanmi Dhanhi. She introduced the exploitation of pump

geothermy. Geothermy produces electricity near volcanos and can be an alternative to produce electric power. There is a 2^{o}C temperature increase every 100 m till it reaches 250^{o}C. This energy source is renewable, very clean for the environment and provides lots of energy. Tunisia started to use it beginning in 1986 for heating systems and since 1993, new strategies have been implemented. From September to June this year it was used to cool rather than irrigate to agriculture instead of for heating.

We finished this presentation at 11am and moved on to ANGED.

2. National Agency of Solid Waste (ANGED)

The director, Mr.Adel Guetat, made an introduction about The National Waste Management Agency of Tunisia (ANGED). He's explained that the ANGED project consist of 9 new landfills. The Tunisian population is over 10.4 million, with a disseminated density of 65% urban, 35% rural. This operation began in 2007 as a part of the National Waste Management Programme over the Tunisian territory. The total waste capacity is 3,300 tons per/day and 1.2 million tons of waste per/year.

The Department's Main Objective is:

- To ensure to suitable treatment in the elimination of the industrial and special waste, by respect environment standards and the regulations in force.
- To make producers and/or holders of industrial and special waste respect the law and legal framework for the suitable elimination.

Figure 1.12 Visit ANGED

3. Landfill on the Field (Bizerte)

We accompanied a French expert to the landfill field near Bizerte. Bizerte is located north of Tunis. The landfill's main problem is wind which carries a smell from the liquid from the waste

before it has been completed. They call it juice. The landfill gas recovery uses a membrane filter. By doing so, the project will reduce the impact of the landfills on the soils and on the ground water resources, and thus preserve the environment.

Figure 1.13 Visit Landfill at Bizerte

Day 5: Aquaculture and Fishery Farming

July 16 2011, Sousse,Tunisia

Reported by Khishigsuren NYAMSAMBUU

Content:

1. Introduction

During the internship program in Tunisia, on July 16, 2011, we made a field trip to the Ruspina Fish Company together with Professor Maki Tsujimura, Professor Takahiro Endo, Professor Naomi Wakasugi, and Professor Xiaogang Sun from the capital, Tunis, to Sousse, Tunisia. Professor Jamilia from the INAT (National Agronomical Institute of Tunisia) and EDL student Anis Chkirbene also joined our field trip. The general manager of the company Mejdi Lahmar and other staff all welcomed us and gave a brief introduction about the aquaculture project activities. Students and staff of the company then exchanged questions and answers.

Figure 1.14 Staff of the company is giving a brief introduction before the trip

While observing the aquaculture field, our aim was to obtain as much useful information as possible about the utilization and conservation of the aquaculture farm land at the Ruspina fish company. In particular, we tried to understand the development of aquaculture farming and its utilization in Sousse, Tunisia.

This report consists of four main components. The first component describes a brief introduction about the trip to Ruspina Fish; the second part is focused on the background of the case study at Sousse based on natural conditions; the third sub-component touches on the issues of products and marketing; the fourth part includes technology and capacity issues. The final section includes promotion and management of the aquaculture sector in Tunisia.

2. Background to the Case Study Sousse

Sousse is a sub-prefecture of Tunisia. As the governorate capital, Sousse has a total area of about 1012 square miles or 5.53% of the total territory of Tunisia. Located in a subarctic zone it is mainly located in the Eastern part of the country, on the Gulf of Hammamet, which is a part of the Mediterranean Sea. It is located 140 km to the south of the capital Tunis. The city is a sizeable city

with around 173,000 inhabitants (2004).

The economy is based on transport equipment, processed food, olive oil, textiles and tourism. Sousse has a long history, over than 2800 years, with its own specific features and traditions. Both marine and inland species are currently being farmed in Sousse. The main marine aquaculture production zone is the Governorate of Sousse.

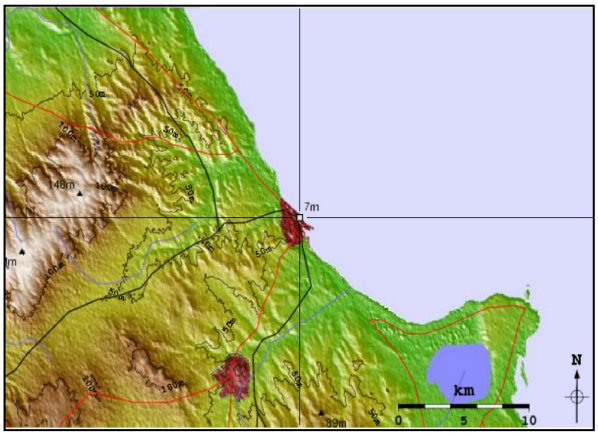

Figure 1.15 Location of the Sousse, Tunisia

Figure 1.16 Environmental condition around the aquaculture

3. Company's Products and Marketing

In December 2009, this aquaculture project in this Strictly Protected Area of Tunisia was established by the Loups and Daurades of the Monaster. EDL student's questions were mainly focused on the Marine aquaculture products, their markets and the capacity issues of the company.

Some species have been introduced in this aquaculture in Tunisia, namely sea-bass, sea-bream and tuna. The company produces natural fresh products. Fish grow corresponding to their natural environment in the seawater. In order for the fish to reach larger sizes quickly, the additional chemical nutritional supplements are not used. They offer many different sizes of feeders used for the aquaculture farming. Farmed marine fish such as sea-bass and sea-bream are sold entirely in the domestic market of Tunisia. These types of fish have a relatively big share of the domestic market. Thus, due to a sufficient domestic demand for fish, there is no need for foreign consumer markets. Among the consumers of the

Figure 1.17 The company logo

Figure 1.18 Retailers of fish

aquaculture products are hotels and large restaurants oriented toward foreign tourists, as well as household consumers in Tunis, Sousse, Sfax, other small towns and villages close to the dammed lakes.


Figure 1.19 Large restaurants are also big consumers

Consequently, this fish is then transported to the retail markets in the towns and villages under statutory health hygiene conditions. It should be pointed out that the selling price for this fish is more beneficial to the producers in the Tunisian market than those in the European ones.

4. Company's Technologies and Capacity

This company has produced 852 tons of fish products in 2009, and 1100 tons in 2010. As it was planned, the company is seeking to enhance its capacity to reach 1300 tons of fish products. Likewise, as planned, the value of the exploitation of the product is expected rise when 1300 tons of fish per year are caught in 2011.

Figure 1.20 Different sizes of fishnets

There are three different depths to catch fish in this aquaculture company: particularly small fish from 6m, middle-sized fish from 8 m, and fish of a larger size from 12 m of depth. Five ports have applied to catch the fish. The most important ports are concentrated on flue fish and sardines. After catching the fish, the fish are kept on ice in storage. The amount of capacity per day depends on local demand and according to consumer requirements. Particularly, among the consumers are the restaurants which have specific demand requirements with several technical parameters. As was mentioned by the company's staff, harvesting does not depend on the season. The level of production by the company has to satisfy a capacity of 2 tons per day of sea-bream, oysters and sea-bass. This figure varies between 110 and 120 thousand tons of fish per month. The actual level of production is lower when compared to the identified potential however. 17 – 20 thousand fish are often caught in one net. In order to bring feed for the fish from another country, it takes an hour by air, and nine hours by ship (from Italy to

Figure 1.21 Fish feeder

Tunisia). Both environmental and technical studies are conducted by the company since the Ministry of Agriculture of Tunisia gave permission to implement this project. According to a question from Professor Naomi Wakasugi, they usually import fish vaccines from Italy and France. Infectious fish diseases such as the vibrio species exist there, but vaccines are not used yet. One of the EDL students asked if there are any effects and influences from global warming. According to the answer, today's temperature is 28^{o}C -30^{o}C and it is not much of a problem currently. Interestingly, during the night time, a big boat is used to keep security and safety around the sea and beach and the company has insurance in the case of hazards and any accidents.

Figure 1.22 Environmental pattern of the aquaculture field

5. Promotion and Management of the Sector

Over seventy people are employed on a full-time basis in the aquaculture project such as senior managers, technicians and laborers.

Experts from the company highlighted comprehensive qualitative studies of the environmental impact and technical assessments. The problem is not technical but they do have an economical problem.

The organization that is responsible for aquaculture is the Ministry of Agriculture and Water Resources. Health monitoring and control for the aquaculture project implementation is the responsibility of the Directorate-General for Veterinary Services, under the supervision of the Ministry of Agriculture and Water Resources, while monitoring the environmental impact of aquaculture projects and environmental protection is the responsibility of the National Agency for Environmental Protection in Tunisia. For marketing strategies, marine aquaculture in the Mediterranean Sea is facing a lack of cooperation between the producers and research centers/institutes, a low level of species diversification and competition for space with other coastal users. The high cost of environmental monitoring and protection systems are becoming an obstacle to implement environmental monitoring and protection.

Day 6: Taparura Project (Restoration from Industrial Pollution)

July 17 2011, Sfax, Tunisia

Reported by Dat Tien PHAM

Content:

1. Taparura Project

Introduction

Sfax is a coastal city on the Mediterranean in which industrial activities began since 50 years ago (Samir Medhioub et al., 2008). However, those activities created a huge amount of solid waste, sediments and liquid wastes. Phosphogypsum has been stored in an uncontrolled landfill along the coast and was discharged directly into the sea, which led to serious coastal pollution and environmental impacts on the sea (Bart Callaert and Jan van D. Bogaert, 2009). To solve the environmental problems in Sfax, the Taparura project was implemented in April 2006. The total budget of this project was about 140.5 million Dinars (86.86 million Euros) funded by the European Investment Bank.

The purpose of our visit to the Taparura project in Sfax was to help us understand many efforts of the Tunisian authorities in solving serious environmental problems and learn from their experiences as well as to get involved in a global action program.

Problems of the Coastal Zone in Sfax

Mr Ramzi HALOUANI, who is a director of the project area, explained to us the situation of Sfax 50 years ago. He said that this city in the past had many food and chemical industries. The chemical industry specialized in the transformation of phosphate and the production of fertilizers. These activities developed and a huge amount of solid waste was discharged into the northern coastline of Sfax city. The activities resulted in many environmental impacts on human health. In addition to the degradation of the natural environment, a huge amount of phosphogypsum was deposited on the Northern coast of this city, accounting for approximately 50 hectares covered by a phosphogypsum layer extending for 90 hectares. As a result, a variety of negative environmental impacts for Sfax took place; therefore, the coastal zone in this area was seriously polluted by harmful chemicals substances.

In 1970, the Tunisian Government decided to stop the chemical industry in Sfax city. After that the northern coast of Sfax became a prohibited area. Until the year 1997, the Taparura project began and involved many organizations. According to Mr Taoufik GARGOURI, who is a general director of the Agency of Environmental Protection in Sfax, the Taparura was a global action program put together by the Tunisian authorities to solve the environmental pollution and improve the water quality of the Sfax region. This project aims to restore the beaches of the area from the impact of polluting industries and set up a new seaside town. The project was fully financed by the European Investment Bank with a total budget of 140.5 million Dinars (86.86 million Euros). Many international consulting companies have provided their technical assistance for this project.

Details Information of the Taparura Project

There was a lot of interesting information about the Taparura project that we were very impressed to hear during the visit.

First of all, the mission of the Taparura project is mostly in charge of the supervision of the works of decontamination and the rehabilitation of the area performed by many companies. This mission is committed for the duration of the work on the site, but it also ensures the follow-up, through some missions a two year guaranteed period. It consists of a head of mission, experts engaged upon request, and onsite control executives and technicians.

Mr Ramzi HALOUANI emphasized that the Taparura project aims at the decontamination of the northern coast of the city of Sfax, the rehabilitation of its beaches and the creation of 420 hectares of ground recovered from the sea in order to extend the urban area in the zone starting from the commercial port of the city to the open air theatre of Sfax located on the road of Sidi Mansour. On the other hand, this project aims at a successful realization of environmental design and the sustainability must be integrated and achieved in the project.

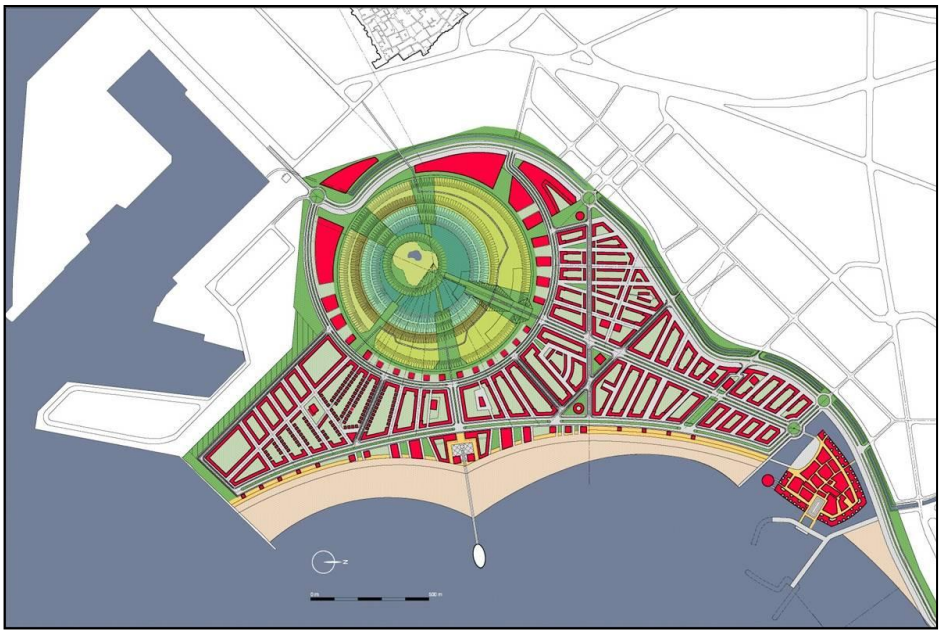

Figure 1.23 Project area in Sfax city Tunisia
Source: http://www.taparura.com/english

Secondly, during the survey in Sfax, he also explained in details two phases of the Taparura project. In fact, there are two phases of this project that are already done. The first phase was related to the decontamination of the zone and recovering land from the sea.

The origin of the sea sand used in the project was obtained from the canal on Kerkennah Island. The unique sea sand was transported to the site by big boats (Fig 1.24).

Figure 1.24 Unique sea sand transported by boat from Kerkennah Island

The decontamination and rehabilitation works of the Taparura project were successfully completed.

The second phase, according to Mr Ramzi HALOUANI, was about management of the zone and the development of a new urban center including the equipment of the zone with the basic infrastructures, the construction of the principal roads including the access roads, and the crossroads as well as the minor roads with a cornice road along the coast. He mentioned that this phase has been going on and supervised by the government authorities.

Current Situation

At the present, the situation in the coastal zone is quite good. In some coastal regions, Tunisian citizens can enjoy swimming.

In addition, many kinds of trees were planted to prevent soil erosion (Figure 1.25). A water supply system for those trees was also established (Figure 1.26).

Figure 1.25 Different types of trees were planted to prevent soil erosion

Figure 1.26 Water supply system

Future plans

According to Prof. Mohamed KSIVI, who is a director of Institute of Biotech, University of Sfax, his research group has developed a new bio-technology based on the roles of micro-organisms. The group pays close attention to studying new techniques related to treatment plans and finding suitable micro-organisms that can be grown well under the hard conditions along the coast of Sfax city.

2. Visit the Air Monitoring Station in Sfax city

After visiting the Taparura project, Mr Taoufik GARGOURI introduced us to the air monitoring station in Sfax. The aim of the visit was to understand how people monitor different types of inorganic substances. The air monitoring station can be analyzed in three parameters: SO_2, CO_2, NH_4. This station is very useful to help city authorities realize the air situation in Sfax city. It is necessary to prevent air pollution especially in arid and semi-arid regions like Tunisia.

Figure 1.27 Air monitoring machine in Sfax city

This machine above can automatically measure three parameters daily and the results of the measurements are recorded and sent to a computer. However, a limitation of air measurement is that this machine could only measure the three air parameters. Air monitoring needs to be further developed to prevent air pollution more effectively.

3. Conclusion

The Taparura Project in Sfax is a typical example of sustainable coastal zone management including the decontamination and the rehabilitation of a former industrial site, along with the clean-up of the sediments and restoration of the coastal areas of Sfax, Tunisia. The project forms part of a global action program put together by the Tunisian authorities to solve the environmental pollution and improve the water quality of the Sfax region. Moreover, the air monitoring station is a typical example of air measurement and it needs to be further developed in the future to prevent air pollution.

Acknowledgments

We would like to express our sincere thanks to Mr Ramzi HALOUANI who is a director of the project area and Mr Taoufik GARGOURI who is a general director of the Agency of Environmental Protection in Sfax. They spent time introducing the TAPARURA Project to us. We are thankful to Prof. Mohamed KSIBI – director of Department of high biotechnology, University of Sfax who assisted us during the trip in Sfax city. Especially, we would like to thank Prof. Jamila Tarhouni from the INAT (L'Institut National Agronomique de Tunisie) who took care of us during our time in Tunisia. We really appreciated their time.

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Day 7: Desalination Station

July 18 2011, Jerba, Tunisia

Reported by Tung Thanh HOANG

Many countries in the world face a serious water scarcity, so they try to overcome this problem by exploring many different source of water. Desalination is a new method to produce drinking water from seawater. When this technology is popularized and utilized in Jerba Island, it will provide a significant amount of water for daily life and tourism industry. Since the 80s, Tunisia has resorted to brackish water desalination via membrane techniques such as reverse osmosis to supply the traditionally deficient regions with potable water and to come up with a solution for industrial water utilities.

Figure 1.28 A representative and technician discuss desalination station operation

The rising population and consumption is characterized by seasonal fluctuation ranging from a level in winter to the quadruple in summer. With a nominal capacity of 12,000 m^3/d intends to increase the production capacity to 15,000 m^3/d. It is fed from an artesian well with a water salinity of 5.500 g/L and a conversion rate of 75%. It produces water that contains a TDS equal to 0.200 g/L.

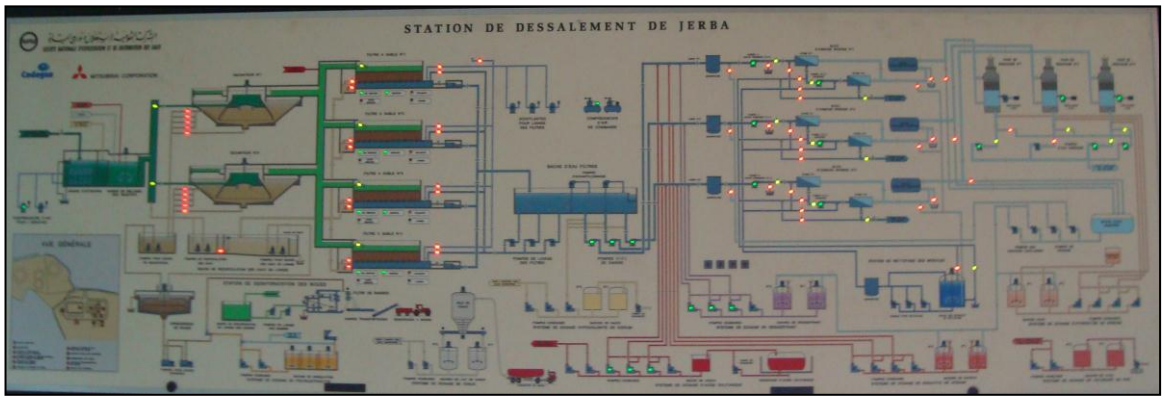


Figure 1.29 Operation system of desalination station in Gualala, Jerba

Figure 1.30 Overview of controlling water use in desalination station

Supervision of water consumption is also the best way to predict the demand for water in the future, and then purifying it to confront with water scarcity in the arid area likes Jerba.

This system also allows supervising the use of water at certain time of the day as well as during the different,

Figure 1.31 shows that the change of water uses during one week of summer. There is similar tendency water use, in the morning the people have a high demand for water use and then reduced. It continually increases at noon and diner time. Because this system is controlled automatically, it can ensure to provide water efficiently. However, the desalination plant of Jerba Isle has revealed difficulties related to fouling problems. Membrane fouling has become a major difficulty in achieving efficient energy and causes operational problems to the membrane due to an increase of pressure drops and decreases of flux. Fouling increases operating costs and reduces the quality of produce water.

The quality of water is also of much interested. This system ensures Tunisia standard in terms of salty level and other standards related to water quality. Therefore, the water is always tested to ensure a high water quality.

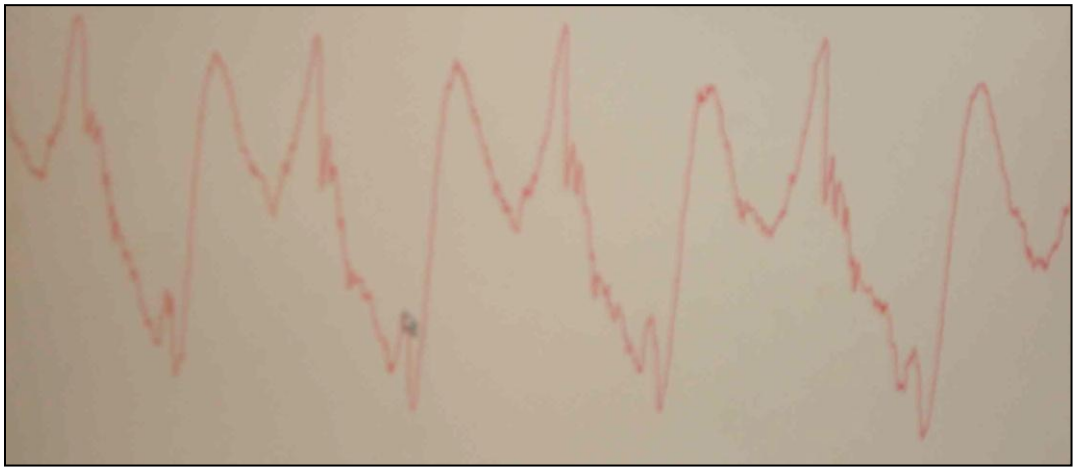


Figure 1.31 The change of water use in Jerba in one week

The whole process of desalination use modern technology thought out the entire process makes sure that the quality of water is suitable for daily life.

Figure 1.32 Water quality control laboratory

Figure 1.33 Use membrane filter under high pressure

Figure 1.34 Chemical treatment equipment

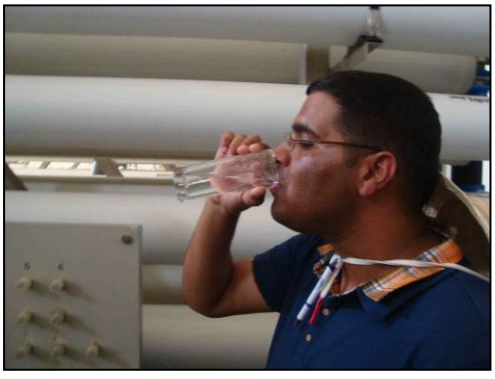


Figure 1.35 After all processes, water can be drunk

Day 8: Oasis System, Geothermal Production, and Local Water Resources Management

July 19 2011, El Hamma, Tunisia
Reported by Naoto AIZAWA

Content:

1. Itinerary

We left Gabes city on the morning of July 19 to visit the El Hamma Oasis where we firstly visited a farm, La 5ème Saison (The 5th Season). After the visit to the farm, Prof. Jamila guided us to the wells and explained the irrigation system of this region. After leaving the oasis, a lecture was held by a professor who is involved in the technical support of the farm. After that, we traveled to Tunis. On the way to Tunis, we enjoyed grilled mutton, prepared in the Tunisian traditional way.

2. Farm, Geothermal Production, and Local Water Resources Management

El Hamma Oasis is situated in the region of Gabes, near El Hamma city, in the Southeast of Tunisia. Together with Jerba Island, the region of Gabes is the most arid area we visited during the internship. After passing through El Hamma city, the landscape remained very arid for a while. When the trees of oasis area started to appear in the distance, we saw a herd of camels along the way (Figures 1.36 and 1.37).[1] We travelled through the oasis and then visited a Tunisian-owned farm, La 5ème Saison. We were welcomed by Mr. Mohamed Ali (Science Agronomic Engineer) and Mr. Kamel (General Director).

According to their explanation, since 1987, the farm has kept increasing its production by making good use of the water from the oasis and the heat this water contains. The farm hires about 500 people as permanent workers this year, and for the next year, they expect to increase this

Figure 1.36 Arid area near El Hamma

Figure 1.37 Arriving at the oasis

[1] By accident, this was the only time we saw a herd of camels.

number to 1,000. Contrary to our expectation, according to the explanation made by Mr. Ali, this area was a desert before the construction of wells followed by the creation of the oasis.

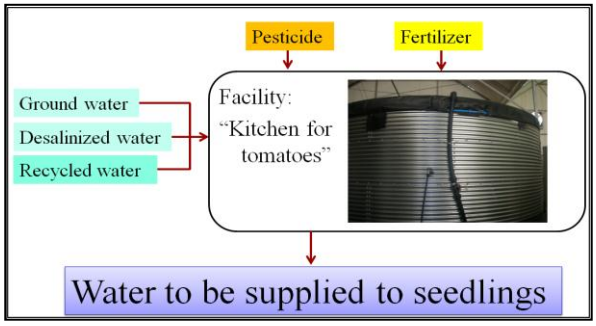


Figure 1.38 Kichen for tomatoes (source: reporter)

When the farm started, they cultivated crops, watermelon, pepper, and vegetables with a partner company of Saudi Arabia. Today, their cultivation specializes in tomatoes under cooperation with a Spanish company, San Lucas,[2] the cooperation beginning in 2008. 99% of the production consists of several species of tomatoes (about 5 to 6 species).[3] They choose tomatoes because the brackish water of the oasis makes tomatoes sweeter and the price of tomatoes during their harvest period (October to June) is stable.[4]

Tunisia is generally scarce in water. Like many other places we visited during the internship, this farm also makes several efforts toward efficient water use. They make good use of the hot water with a high salinity which "flows out"[5] from the deep wells for the aggregation of value to the tomatoes produced here (i.e., improvement of product quality and differentiation of harvest season). This farm has three sources of water.

1. Geothermal water: The water flows out from a depth of more than 1,000 meters. Because of the depth, the temperature of the water is high (around 70℃). The farm uses this heat for energy generation and cultivation, to warm up the temperature of the greenhouses during the winter (> 12℃), and also to control the humidity (from 12 to 75%). They emphasized that, by adopting this process, they only use the heat of water. After the removal of the heat, the water is distributed through water pipes to villages and cities in the region, e.g., Gabes, El Hamma, etc.
2. Desalinized water: This water comes from wells also. The water is desalinized by reverse osmosis. The ground water here also has the same problem which we saw the day before in Jerba Island: a high salinity in the water. Due to its nature, the water cannot be used for cultivation without treatment and therefore the high salinity needs to be reduced.
3. Recycled water from drainage: Drainage water is also used for cultivation after treatment. This helps to reduce the amount of water necessary for cultivation. The recycling of drainage water started in 2010.

All three kinds of water are mixed properly in a facility which was introduced to us as the "kitchen for tomatoes." The use of recycled water in this process is very important because this water contains nutrients which can be utilized as fertilizer. Mr. Ali explained that they succeeded in replacing part of the fertilizer by the nutrients remaining in the recycled water. Also, other chemical elements (pesticides and fertilizer) are then added. Then, the water containing all

[2] San Lucas commercializes tomatoes exported from South America and Central America as well.
[3] 1% of the production are raspberries.
[4] They mainly export their products to Europe, mainly to Germany, Austria, Italy and France, where the season for tomatoes is summer, i.e., the harvest period for La 5ème Saison, and the price becomes higher in the market.
[5] I use this expression, not "extracted" because they do not use possess any pumping system. After the installation of the wells, the water has been automatically gushing out.

necessary elements are supplied to the seedlings (Figure 1.38). As mentioned above, the number of permanent employees this year is about 500. Females are predominant and make up about 80% of all the employees.[6] The reason why females are predominant on this farm was explained by Mr. Kamel. According to his explanation, this is not because of a wage gap. Female labor is considered better than male because women tend to be able to manage the more delicate work needed for this cultivation. Apart from permanent labor, the farm hires temporary labor during the period of harvest. The number surprisingly reaches 300% of that of the permanent employees. During the harvest, students also are hired for about two months as temporary workers. According to the lecture held after the visit, the farm creates about 12,000 jobs for the residents of El Hamma (including both direct and indirect employments).

Despite the large scale administration and number of workers, the farm does not have any dormitories. The employment system seems to be relatively flexible; employing temporary labor when necessary and allowing workers to go home when temperature is too high.[7] The labor is brought from El Hamma city which is located within about 15km from the farm. The farm owns four busses for the transportation of the labor. Mr. Kamel explained that they expect to add two more busses for the next year.

After leaving the farm, Prof. Jamila explained the irrigation system of this oasis and showed us the wells. We visited two wells which are currently in use and have a depth of 700 meters (Figure 1.39). Beside these wells, a new well was being constructed. Two men working there explained to us that the new well would have a depth of 1,100 meters and become a substitute for the two old wells (Figure 1.40).

Figure 1.39 The well currently in use

Figure 1.40 The well under construction

[6] After the harvest, the number of male workers increases. They are in charge of the construction of the facilities.

[7] Just one day before our visit, the temperature at the farm reached 44.9 ℃ and all the workers were sent home.

Day 9: Tunisia- Japan International Symposium
Co-existence of Humanity and Nature - The Roles of Environmental Leader in Arid Region -

July 20 2011, Tunis,Tunisia
Reported by Thu Thi NGUYEN

Session 1: Environmental Problems related to Humanity and Nature

The symposium was held in INAT (National Agronomical Institute of Tunisia) and it was about the co-existence of humanity and nature and the roles of environmental leaders in aid regions of Tunisia. The symposium consisted of two sessions with session 1 being the introduction and a discussion by professors from Tunisia and the University of Tsukuba about environmental problems related to humanity and natures. Session 2 was a workshop about the roles of environmental leaders with presentations by students from INAT and the University of Tsukuba. The symposium aimed to inform the international internship participants about water environmental problems, and the impact of human activities on the natural environment and their effects on human health, particularly in arid region such as Tunisia. Through the symposium everybody deepened their understanding about the coexisting relationship between nature and humans, and how to find some solutions.

9:00-9:30: Introduction for the Symposium
9:00-9:05: Prof. Jamila Tarhouni the co-organizer of the internship from INAT welcomes and thanks the attended experts and audience, and hoped us to enjoy and learn something from this symposium.
9:05-9:30: Introduction Environmental Diplomatic Leader Education Program in the University of Tsukuba, Japan
Presenter: *Maki TSUJIMURA, University of Tsukuba*

Prf. Maki Tsujimura is an Associate Professor of the University of Tsukuba and also the leader of this international internship. He introduced the organization of the University of Tsukuba explaining such things as education organization, number of faculty members, and its international relationships. One of many programs operated in the University of Tsukuba is the "Environmental Diplomatic Leader" program, which is called by short name EDL. The EDL program aims to help students become equipped with analytical and problem-solving skills in environmental issues in three central fields: water resources/water treatment/water policy; biodiversity/bio-resources; and public health in Asia and Africa. It is not only simply acquiring knowledge about these relevant sciences and technologies, but also skills in advising about environmental ethics, policies, management, international relations, and interpretation. The presentation showed the image of a tree with EDL with Roots: ethics, respect, and vocation/ justice. The trunk consists of skills, wisdom, and insight, and the branches are application, balance, and performance. The fruit is solutions, interaction, and maintenance.

9:30-10:10: Groundwater Resources in Tunisia: From Survey to Sustainable Management

Presenter: *Jamila TARHOUNI, INAT*

This topic introduced the situation of the comprehensive water resources in Tunisia with a total of 4.8 Bm^3 including 2.7 Bm^3 from surface water and 2.1 Bm^3 from groundwater. 95% of the surface water is a potential resource, distributed mainly in the north of Tunisia, but now it is faced with a significant reduction of surface water resources. Groundwater is found mainly in the center and the South, but it is faced with pollution and specially salinization risks which are very high and is renewable lowerly (10% per year) to fossil in the south. Along the coastal area, saline water intrusion created a concentration of salt in the water at a level of 1.5 g/L. Over pumping rate of 100-200% in shallow aquifers causes some shallow aquifers to completely vanish such as at the Kairouan plain. However, the groundwater recharge is very low with an estimated 97% of the recharge amount is lower than the pumping volume. It caused concern that the aquifer is in constant depletion. She offered the solutions that aquifer recharge and water balances at basin scale are keys to ensure sustainable water resource management:

1. For that it is necessary to carry out field prospection focused on piezometer survey, water sampling and surface flow measurement.
2. Characterize the surface water- groundwater interactions.
3. Establish a distributed model to estimate the recharge
4. Perform a groundwater model flow for the aquifer system.

This model should reflect the spatial-temporal variation of the piezometer levels, the groundwater flow and mainly the flow on the boundaries.

Then, the effects of climate change and water demand scenarios the future scenarios were reviewed.

Discussion: Prf. Maki Tsujimura advised that Tunisia has to prepare for the near future and also to maintain a sustainable environment of water resource Tunisia has to find some good technologies for saving and recycling water. In addition to that he believed that it has to have a policy to organize water use. He gave the example of the water solid waste management plant, where the Tunisian government is trying to apply a waste separation system, but it is also necessary for residents to recognize the importance of waste separation at the source collection. Therefore, to save or recycle water resources, and also improve the technology of the water recycling system, the Tunisian government needs to foster and share the information regarding water management programs and technologies with the populace more.

10:10-10:40: Eco-technology and Impact of Human Activities on Environment
Presenter: *Mohamed KSIBI, ISSBS*

The topic presented the inclusion of research on the negatives effects of the development of industrial activities in Tunisia ad especially in the Sfax region. The goal is to find a means to evaluate the existing concepts for dealing with habitat change and identifying problems related to effective management including major existing knowledge gaps. It is also desired to identify promising technologies for the recovery of habitats through the development of environmental technologies that are focused on the coastal environment.

10:40-11:10: Water Management Model of Zeuss Koutine (Southeastern area of Tunisia)

Presenter: *Dr. Isam NOUIRI I, INAT*

This presentation was WEAP-MODFOW DSS for the Zeuss Koutine aquifer in Tunisia, an evaluation of climate change and the use of sea water desalinization scenarios. The WEAP-MODFLOW DSS is used to simulate groundwater flow in the Zeuss Koutine aquifer by applying aquifer characteristics, hydrological data, and recharge data .Moreover, three different possible cases of climate change are; the increase of domestic and agriculture water use and of evaporation in parallel, the decreased rates of the recharge from rivers to groundwater due to the expected decrease of rainfall. The result of the research demonstrated that the simulated climate change produces an important drawdown in the aquifer. Sea water desalinization can constitute a solution to stop the uniform observed drawdown and increase the water table level. Even if strong climate change conditions occur in the region, the use of the desalinization solution can maintain the water table of the Zeuss Koutine aquifer at acceptable levels and preserve the aquifer from sea water intrusion. The topic added that the created database and the WEAP schematic of the study area showed an easy input modification and output display, and comparing scenarios is another advantage of the use of the WEAP- MODFLOW DSS.

11:10-11:30: Hydrological Mapping
Presenter: *Dr. Haifa FEKIH, INAT*

This presentation was about rainfall mapping for the optimization of a monitoring network using geostatistics in Tunisia. The North of Tunisia has a humid climate with a high rainfall, but the center and South of Tunisia has an arid climate with low rainfall. Rainfall data are an essential input for many simulation models. Since the accuracy of the simulation depends strongly on the available data, the task of optimizing the monitoring network is of great importance. Using a geological statistic methodology to make a rainfall map plays a decisive role in the developing an application for the management water resources. Simultaneously with estimating the monthly rainfall map, error maps are provided to allow the optimization of the network by value reduction.

11:30-12:00: Coffee Break: Enjoying some drinks ad cakes, and exchange of opinions between presenters and students.

12:00-12:30: Environment and Human Health - Global Infectious Diseases, History and Now -

Presenter: *Naomi WAKASUGI, University of Tsukuba*

She spoke about the relationship of the environment and its effects on human health. The factors of climate change such as air, water, food, disasters, environmental refugees and infectious diseases and the estimated impact on human health was shown by specific figures in her presentation. The environmental effect was malnutrition which leads to an immunity decrease in humans along with other environmental issues such as air pollution and temperature increase. Simultaneously, water contamination, flood and drought caused occurring pathogens such as microbes and bacteria which lead to an increase in infectious diseases such as cholera, and it is one of main causes of increased death in low-income countries. Thus, she suggested, it is

necessary to think of human health in the context of the community or all of society and take not only medical but also social measures to reduce harm and promote the health of people. She also spoke of classic public health successes and the achievement of preventing infectious diseases. She explained the condition in the world of notable infectious diseases such as AIDS, tuberculosis, and malaria, which is the cause of 5-6 million deaths annually. The program of Global Initiatives to Combat Global Infectious Diseases started with 8 goals and is signed by 189 countries.

12:30-13:00: Water Management in Arid Areas - California Drought Water Bank -
Presenter: *Takahiro ENDO, University of Tsukuba*

This topic introduced the management of water resources in California by applying a model of the California drought water bank. The average annual rainfall in California is approximately 501.6 mm, and Los Angeles is 300 mm; is similar to Tunisia. The water resources condition and demand in California is separated by two gaps with a space gap of about 75% of natural run-off taking place in the Northern area, but about 75% of demand concentrated in the central and southern area. The time gap is that it rains and snows in winter time but demand is at its peak in summer. Thus, the Drought Water Bank was establish as a system of water transaction in the state water project (SWP) which is operated by California department of water resources. This project aimed to provide drinking water for 23 million people and irrigation water for 2800 km^2 by the Oroville dam, which has a maximum amount of storage of 43×10^3 m^2/4362 million m^2 and in the catchment area it holds 9324 km^2). The water allocation is applied by two methods; an allocation regulatory approach, and the voluntary transaction of water. The Drought Water Bank reallocates water in accordance with demands both low and high. Although drought water bank still has some shortcomings and needs some improvements, it is seen as an example of adaptive water resource management. Drought is natural phenomenon, but water deficiency may be a social phenomenon, so inefficient use of water resources causes' further economic loss. We can mitigate drought problems through the construction of infrastructure (hard-path) and the creation of institutions (soft-path). The combination of a hard and soft-path and the water bank system in a limited area are necessary solutions where infrastructure is not sufficiently built.

Session 2: Workshop - Roles of Environmental Leaders

13:00-15:10 Presentations of Tunisian and Japanese students

15:10-15:40
Discussion and Comments

Almost students felt very interested in the course. Thanked to this course, we had a chance to learn the management of waste and water resources of Tunisia, also learn the use of water in arid-regions such as Tunisia. Thanked to Dr. Jamila Tathouni and Mr. Anis Chekirbene for their kind helps. We were always warmly welcomed by every agency or department we visited.

15:40-16:10 **Symposium Closing**
Jamila TARHOUNI, INAT

Dr.Jamila TARHOUNI from INAT closed the syposim. She hoped the international internship will be continued next time and also wanted to have chance for exchange of students between the University of Tsukuba and Tunisia.

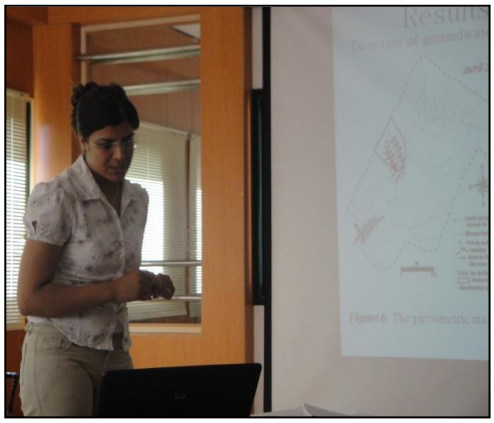


Figure 1.41 Tunisia- Japan International Symposium

Chapter 2

Abstract of Tunisia - Japan International Symposium

Co-existence of Humanity and Nature
- The Roles of Environmental Leader in Arid Region -

PROGRAM

Venue: INAT (Institut National Agronomique de Tunisie) 43, Av Charles Nicolle Tunis, Tunisia

Time: July 20, 2011

Session 1

Environmental Problems related to Humanity and Nature

Chair: **Maki TSUJIMURA**, *University of Tsukuba*

9:00-9:20 Introduction for the Symposium
Maki TSUJIMURA, *University of Tsukuba*

9:20-9:50 Groundwater Resources in Tunisia: From Survey to Sustainable Management
Jamila TARHOUNI, *INAT*

9:50-10:20 Eco-technology and Impact of Human Activities on Environment
Mohamed KSIBI, *ISSBS (High Institute of Biotechnology),University of Sfax*

10:20-10:30 Water Management Model of Zeuss Koutine (Southeastern area of Tunisia)
Dr. NOUIRI, *INAT*

10:30-10:40 Hydrological Mapping
Dr. Haifa FEKIH, *INAT*

10:40-11:10 Discussions

11:10-11:40 Coffee Break

11:40-12:10 Environment and Human Health - Global Infectious Diseases, History and Now -
Naomi WAKASUGI, *University of Tsukuba*

12:10-12:40 Water Management in Arid Areas - California Drought Water Bank -
Takahiro ENDO, *University of Tsukuba*

12:40-12:50 Discussion

Session 2

Workshop - Roles of Environmental Leaders -

Chair: **Anis CHEKIRBANE**, *University of Tsukuba*

13:00-13:10 Does Pyocyanin Production Correlate to Quorum Sensing System in *Pseudomonas Aeruginosa* Clinical Isolates?
Hao FANG, *University of Tsukuba (China)*

13:10-13:20 Pollutant Removal from Municipal Wastewater through Vertical Multilevel Soil Infiltration Treatment
Shengjiong YANG, *University of Tsukuba (China)*

13:20-13:30 The Establishment of Sustainable Farming Extension in Mongolia: Challenges and Possibilities of Integrated Governance
Gonchig GANTULGA, *University of Tsukuba (Mongol)*

13:30-13:40 Evaluation of Factors Affecting the Soil Moisture in the Semi Arid Regions in Mongolia
Natsagdorj NATSAGSUREN, *University of Tsukuba (Mongol)*

13:40-13:50 Pastureland Use in Bayan Soum, Mongolia Using Remote Sensing Data and GIS Application
Kishigsuren NYAMSAMBUU, *University of Tsukuba (Mongol)*

13:50-14:00 Monitoring Mangrove Forest Using Multi-temporal Satellite Data in the Northern Coast of Vietnam
Dat Tien PHAM, *University of Tsukuba (Vietnam)*

14:00-14:10 Break

14:10-14:20 Policy for Risk Management in Rice Value Chain to Adapt with Climate Change in Vietnam
Tung Thanh HOANG, *University of Tsukuba (Vietnam)*

14:20-14:30 Management of Freshwater Fish Resources in Brazilian Amazonia
Naoto AIZAWA, *University of Tsukuba (Japan)*

14:30-14:40 Effective Interaction between *Clethra barvinervis* and Root Endophytes on the Heavy-metal Resistance
Ayako HOSHINO, *University of Tsukuba (Japan)*

14:40-14:50 Arsenic Contamination of Groundwater and the Dynamic State of Groundwater in Tay Island, Dong Thap Province, Viet Nam
Thu Thi NGUYEN, *University of Tsukuba (Vietnam)*

14:50-15:00 Characterization of Forms and Origins of Nitrogen in the Water of an Agricultural Watershed: the Case of Kamech Watershed (Cap Bon, Tunisia)
Ines NSIRI, *INAT (Tunisia)*

15:00-15:10 Groundwater Characterization in Sbiba - Kasserine, Central Tunisia
Rahma BRINI, *INAT (Tunisia)*

15:10-15:40 Discussion and Comments

15:40-16:10 Symposium Closing
Jamila TARHOUNI, *INAT*

Session 1: Environmental Problems related to Humanity and Nature

1. Introduction for the Symposium

Maki TSUJIMURA
Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan
mktsuji@geoenv.tsukuba.ac.jp

Global environmental issues are not only about the direct natural environmental aspects but also include governances of food security, natural resources management, energy sustainability, health, development & urbanization, economy and other social matters such as ethics, etc. Therefore, it is cardinal to encourage the human resources development of person's having multidisciplinary talents with capabilities in environmental science and technology, principles of environmentology, and common sense based on science and culture, should be necessary to alleviate environmental issues. The education program of Environment Diplomatic Leader (EDL) consists of a curriculum corresponding to these necessities. The curriculum includes a master's course (2 years) and doctoral course (3 years), and the trainee can get the title of Senior Environment Diplomatic Leader (doctoral course) and Environment Diplomatic Leader (master course) in addition to their doctoral and master degrees, when he/ she completes the program.

A steering committee chaired by the president of the University of Tsukuba is has been established to organize the EDL program. Under the direction of the president, a Major in Sustainable Environmental Studies, Graduate School of Life and Environmental Sciences, University of Tsukuba, is taking the initiative for the program in cooperation with the Graduate School of Humanity and Social Science, Graduate School of Comprehensive Human Sciences, Alliance for Research on North Africa, International Center for Central Asian Research and Education, University of Tsukuba, and Research Institutes in Tsukuba Science City. Also, the program proceeds in collaboration with international Institutes such as UNESCO's Paris office, the UNESCO office in Beijing, the Institute of Geo-ecology and Institute of Meteorology and Hydrology, Mongolia, Institute of Geographical Sciences and Natural Resources and Institute of Genetics and Developmental Biology, China, as well as the Bogor Agricultural College, Indonesia. The steering committee will establish a Tsukuba Environmental Diplomatic Leader International Consortium (TEDLIC) which consists of the institutes within Tsukuba Science City, counterpart institutes/colleges overseas, and private companies to perform an international internship, and an international/domestic excursion and workshop. The TEDLIC will include institutes, which are counter parts, to send students to the University of Tsukuba, and the TEDLIC can support the students after they complete the program and go back to their home country. Also, the TEDLIC is going to publish an on-line journal for science, culture, and policy communications. The EDL program will work well within the framework of these organizations.

筑波大学 University of Tsukuba

Tunisia-Japan International Symposium

20th July, 2011; Institut National Agronomique de Tunisie (INAT), Tunis, Tunisia

Introduction

Environmental Diplomatic Leader (EDL) Education Program in the University of Tsukuba, Japan

Maki TSUJIMURA, Ph.D.

EDL Program Leader
Associate Professor in Hydrology
Graduate School of Life and Environmental Sciences
University of Tsukuba, JAPAN
Vice President, International Commission of Tracer, International Association of Hydrological Sciences (IAHS-ICT)
Co-Chairholder, UNESCO-Chair on Sustainable Groundwater Management in Mongolia

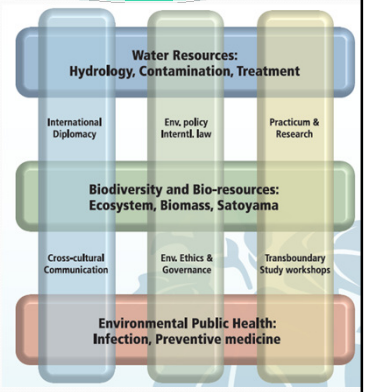
University of Tsukuba

- Established: 1872 (re-organized in 1973)
- Education Organization: 9 Schools/20Colleges in Undergraduate Courses, 7 Graduate Schools
- Number of Faculty Members: 1,674 (including 69 International Professors)
- Number of Students: 16,828 (10,051 Undergraduate/ 6,777 Graduate)
- Number of International Students: 1,994 from 104 countries and regions
- Academic Exchange Agreements: 195 Agreements in 52 countries and regions

UNESCO-Chair

What's EDL?

- Analytical and problem-solving skills in environmental issues germane to water resources, biodiversity/ bio-resources, and public health in Asia and Africa.
- Env ethicks, env governance, policy making, management, and interpretation



EDL Program, U Tsukuba

EDL should be a intern negotiator?

EDL should learn skills of negotiation and debate, but not need to be a negotiator

EDL → Global issues, Sci info, Culture ← Negotiator

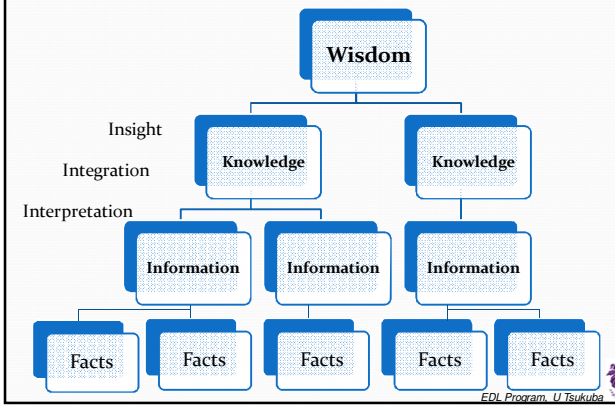
Regional Interest — National Interest

Source: Earth Negotiations Bulletin (ENB); http://www.iisd.ca/climate/cop16/

EDL Program, U Tsukuba

Facts to Wisdom

-We should think based on facts but fact is not always truth-



EDL Program, U Tsukuba

Wisdom Infrastructure

Global Environmental Issues

- Complex causality
- Trans-boundary problems

The abilities to coordinate various stakeholders can be exerted well where there is **"wisdom infrastructure"**

EDL Program:
Fostering wisdom based on natural/social/human sciences

No wisdom infrastructure

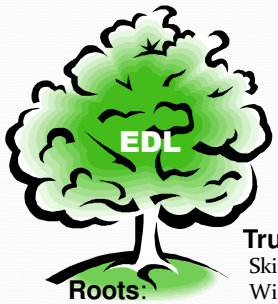
Wisdom infrastructure

Source: Dr. Endo

EDL Program, U Tsukuba

A tree of EDL

Branches:
Application
Balance
Performance



Fruit:
Solutions
Interaction
Maintenance

Trunk:
Skills
Wisdom
Insight

Roots:
Ethics
Respect
Vocation / Justice

Revised from
Gordon & Berry (2006)

EDL Program, U Tsukuba

TEDLIC

(*T*sukuba *E*nvironmental *D*iplomatic *L*eader *I*nternational *C*onsortium)

EDL Program, U Tsukuba

2. Groundwater Resources in Tunisia: From Survey to Sustainable Management

Jamila TARHOUNI
National Agronomical Institute Tunisia

Groundwater resources are estimated at 2.1 Bm^3/year and represent nearly 42% of the total available water resources. They constitute the main resource in the center (62%) and the south (81%). They are layer renewable (less than 10% per year) or fossil as in the case of the intercontinental aquifer in the south. Over pumping for irrigation and drinking water as well as pollution and salinization constitute the main constraints in groundwater sustainable management.

In shallow aquifers, the pumped annual volume often exceeds the renewable volume and the exploitation ratio can reach very high levels (100% to 200%); for instance, at the El Haouria plain in the northeastern area of Cap Bon, the ratio is 200%. The consequences are diverse and result mainly from the high decrease in piezometric levels:

- Depletion of groundwater resources
- Limitation of the access to water
- Increase in water pumping costs
- Decrease in water withdrawal
- Salinization

The salinization hazard is due to:

- Saline water intrusion along the coastal areas of Shott and Sebkhat
- Concentration of salt and recycling by irrigation, for example, the use of water with 1.5 g/L for irrigation may induce an accumulation rate of 5 Tons of salts per campaign.

The interpretation of available data on water balance confirmed the fact that the shallow aquifers are often in continual depletion:

Table 1 Example of water balance ((10^6 m^3) for the northeastern coastal aquifer of Cap Bon

Date	IN	Out	Variation
Oct-72	-	-105,8	
Oct-77	87,25	-71,09	-18,50
Oct-82	47,83	-120,0	-23,26
Oct-87	121,3	-095,8	**1,31**
Nov-92	87,32	-125,1	-8,52
Mai-97	87,62	-224,7	-37,43
Sept-02	-		

For the northeastern coastal aquifer of Cap Bon, The estimated recharge on the basis of the

available data is very low and it is nil for 58% of the cases.

Table 2 Estimated volume of recharge for the northeastern coastal aquifer of Cap Bon area for the 33 year period (Oct 1972- Sept 2002)

Total volume of recharge (10^6 m3)	Nombre d'années	%
0	19	58
VR< 10	4	12
10<VR<20	3	7
20<VR<30	3	7
30<VR<40	1	3

Consequently, the piezometric level shows a continual decrease:

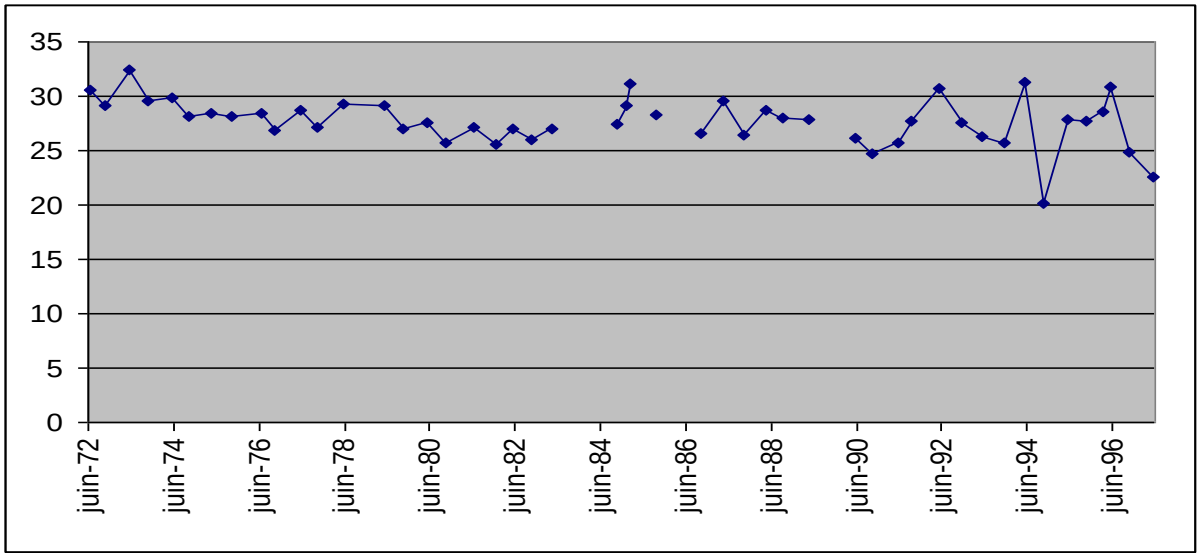


Figure 1 Example of piezometric level decrease in the northeastern coastal aquifer of Cap Bon

The recharge occurrence and rates are also very low and are related to flood period; this is particularly the case in the center of Tunisia.

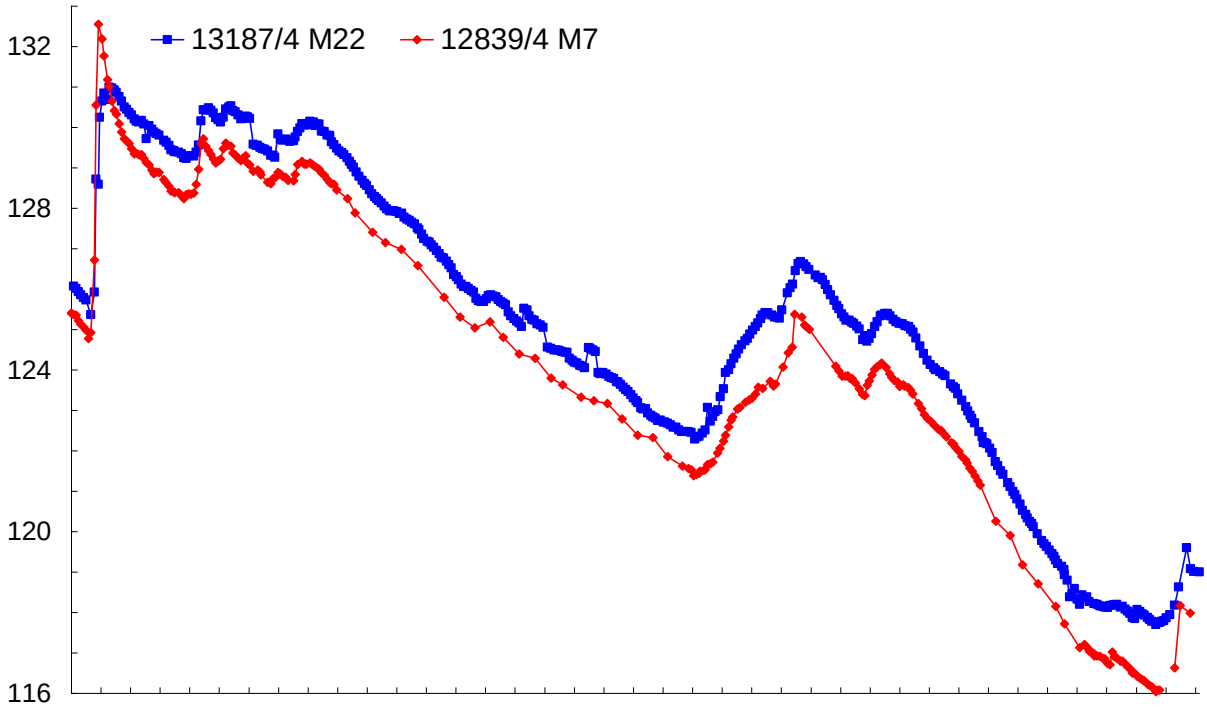


Figure 2 Recharge of shallow aquifer limited to flood period (case of Kairouan plain) from 1969 to 2006

From this figure, one can deduce that the piezometric level is in continual decrease, the increase is very rare and related to flood activity.

Aquifer recharge and water balance at a basin level are keys to ensure a sustainable water resource management system. To achieve this, it is necessary to:

- Carry out field work and analysis focused on piezometry survey, water sampling and surface flow measurement
- Gather all available data relative to water balance components
- Characterize the surface water – groundwater interactions
- Establish a distributed model to estimate the recharge
- Perform a groundwater model flow for the aquifer system
- This model should reflect the spatio-temporal variation of the piezometry level, the groundwater flow and the boundaries flow

3. Environment and Human Health
- Global Infectious Diseases, History and Now -

Naomi WAKASUGI
Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan
nwakasu@envr.tsukuba.ac.jp

The sense of crisis on the sustainability of the environment and energy has caused us to question the content and the future direction of the development of our society. New concepts of human development and human security have been presented in place of mere economic development or state centered security which has led people to reconsider the meaning and the value of protecting human health. In fact, three out of eight targets of the Millennium Development Goals are related to health issues such as the control of global infectious diseases including HIV/AIDS, malaria and tuberculosis, and the reduction of maternal and child deaths. The Earth's environment is irreplaceable for the survival of human beings since each of us needs every day 15 m^3 air, 2-3 liter water, and 1000-2000 kcal food. As for the impact of environmental changes on human health, the World Health Organization (WHO) recently estimated an annual death toll of; 1.2 million to air pollution, 2.2 million from diarrhea from unsafe water and poor sanitary conditions, 3.5 million from malnutrition, 60 thousand to natural disasters, 800 thousand to war and violence, and on top of these, 12 million due to infectious diseases, which are responsible for a quarter of the world's annual human deaths.

Infectious diseases are created as a result of the interaction of microorganisms with humans, and have existed since the beginning of human history. There has long been no way for humans to control infectious diseases until the modern age. Only in the 19th century, for the first time, human beings had the arms to fight against infectious diseases shortly after the discovery of microorganisms as their cause which was then followed by the invention of vaccinations and antibiotics, etc. Thereafter, many victims with infectious diseases have been saved. We can see some brilliant victories in the past such as the eradication of small pox in 1980 for the first time ever in human history. It was achieved by a vigorous effort from the WHO in collaboration with worldwide researchers and public health workers. The poliomyelitis program is expected to follow the small pox success and perhaps the eradication will be announced in near future.

It should be noted that the public health approach and its way of thinking plays an important role as a key in the success. Not only just having the measures, but also applying these weapons in a social health policy, has been essential. Public health is to think of human health in the context of the community or the whole of society and take not only medical, but also social measures, to reduce harm to human health. It deals with the preventive rather than simply the curative aspects of health. Dr. John Snow's success of cholera control in 1854 in London by identifying and closing off the contaminated water resources is a well-known public health classic achievement. Global infectious diseases people are now facing as a global threat in the 21st century should also be tackled in a socio-environmental context by learning from past public health successes.

Environment and Human health

—Global Infectious diseases, History and Now—

20 July 2011

Tunisia-Japan Symposium

Pr. Naomi WAKASUGI

University of Tsukuba EDL program

Climate change :
Estimated impact to Human health

- **Air**

  High air temperature increase air pollution,

  Causing ***1.2 million/ year*** *deaths mainly by increasing mortality from cardiovascular and respiratory diseases.*

  Heat wave; 70,000 excess deaths (Europe 2003)

- **Water**

  People under water stress(Heavy rain・ Flood) increase from ***1.5 billion(1990) to 3-6 billion(2050)*** , on the other hand , Drought increase ***10-30 fold by 2090***

  ➜ Water contamination and worsening sanitation

  ➜ Diarrheal diseases increase ➜ ***2.2 million death***

- **Food**

  Crop yields decrease (by up to 50% by 2020 in some african countries) ➜ aggravate ***malnutrition*** of people which currently causes ***3.5 million deaths /year*** by intensifying vulnerability to diseases especially infectious diseases.

- **Disaster**

  Whether-related disaster increase➜ ***60,000 deaths***

- **"Environmental refugee"**

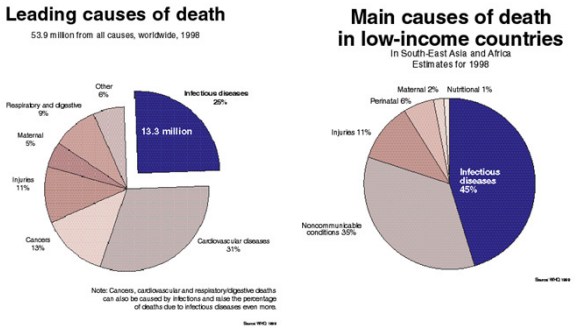
  100 million people a year loose their shelter by Sea level rise by 2080. Conflict and violence increase.

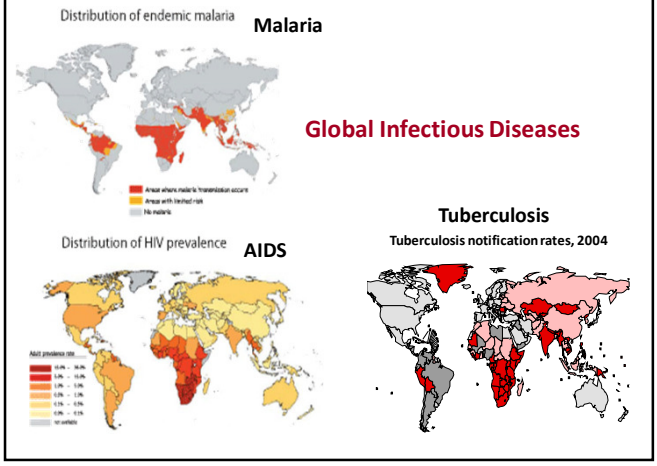
- **Diseases (Infectious diseases)**

  1.2 million deaths (one quarter of world deaths) from infectious diseases will be modified and increased.

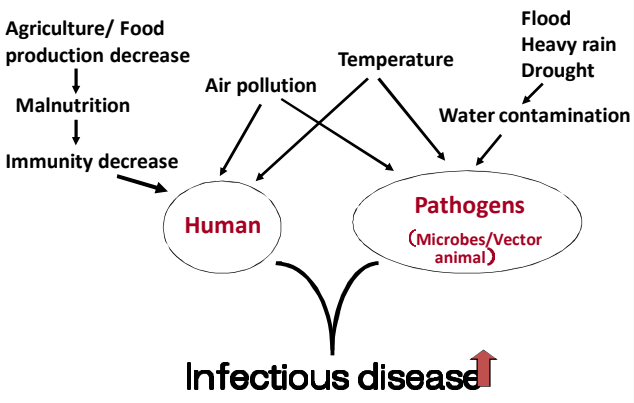
WHO 2009

Importance of Infectious Diseases

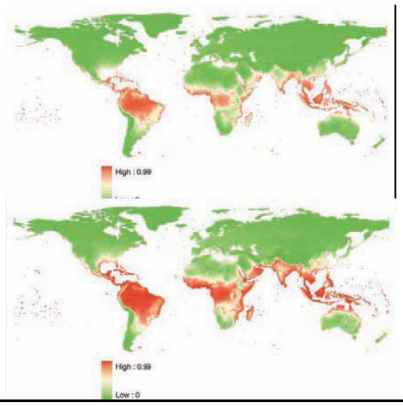




How Environment modify Infectious disease?



Estimated increase of Dengue Fever cases



1990

2 billions increase

2080

出典：Protecting Health from Climate change WHO2009

Health impact of climate change might reflect preexisting vulnerability.

Economic gap and Health gap in the world

	GNP (US$/person)	Life expectancy (Y)	Infant Mortality Rate (/1000)	Under 5 Mortality rate (/1000)	Maternal mortality rate (/10000 birth)	Adult literacy rate (%)
Developed countries	26214	74	5	7	13	99
Developing countries	1154	62	62	90	440	70
LLDC	277	51	95	158	890	49

WHO, UNICEF,WB,UNESCO. 2002

Public Health is

- To think human health in the context of ***community or whole society*** and take not only ***medical but also social*** measures to reduce harm and to promote health of people.
- It deals with ***preventive*** rather than curative aspects of health
  It deals with ***population-level,*** rather than individual-level health issues
- The science and art of preventing disease, prolonging life and promoting health ***through the organized efforts and informed choices of society***, organizations, public and private, communities and individuals.

(1920,Winslow)

Classic of Public Health success Cholera in 1854

On the cholera outbreak in London in1854, he identified the cause as polluted water supply by making cluster map of victims and succeeded to cease the epidemic.

Dr.John Snow's Cholera Map
1854 Soho London

It was 30 years before Koch discovered *Vibrio cholerae* as pathogen of cholera.

Water company	Population(1851)	Death	Death rate
Southwark	**167,654**	**844**	**0.5%**
Lambeth	**19,133**	**18**	**0.09%**

The first ever in history success of eradication of Infectious disease with human hands.

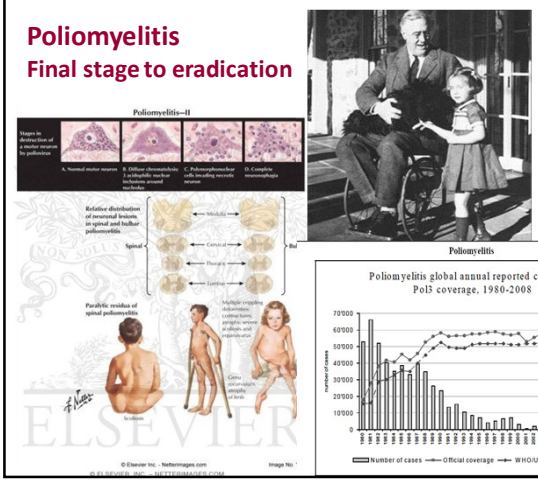
- **Small pox :**
  Jenner succeeded prevention using "Vaccinia"(1798)
  But still there were 50 million patients a year in 1950's.
- **WHO launched an intensified plan to eradicate smallpox in 1967.**

Mass vaccination (National Immunization day, school vaccination etc)
+ Active finding patients and containment.

…..And finally declared eradication of smallpox in 1980.

- Since 1978 smallpox vaccination has been stopped.
  Although eradication programme spent a lot of money,
  a huge amount of vaccine cost was and is being saved since then.

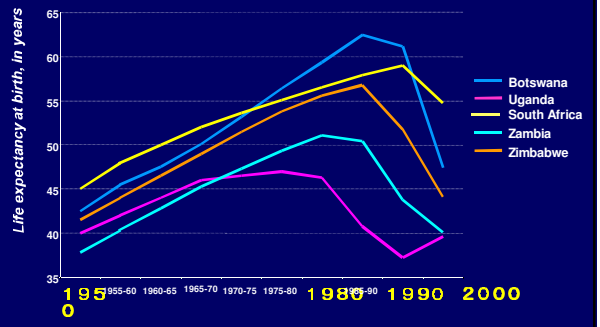
Poliomyelitis
Final stage to eradication



The rage of AIDS

- 30% of the loss of Health of the people worldwide （DALYs ： Disability-Adjusted Life Years) is due to Infectious diseases.
- The greatest cause among them is AIDS.
- DALYs by AIDS corresponds to 74.5 million years, and to 28 million death of people at 35 years old.
- 60 million people have been already infected with HIV, 3 million people die from AIDS every year, and 20 million died since the beginning of AIDS emergence.

Change of Life expectancy in African countries

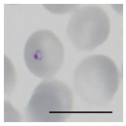


Source: *United Nations Population Division, 1998*

Malaria

The oldest pandemic still uncontrolled.
Very related with ecology (DDT debate)
Every year 300 – 500 million people in more than 100 countries are infected among which 1.5 – 2.7million die, mainly children.

- **Pathogen** ： plasmodium (Enter human red blood cell and liver)



Plasmodium falciparum,
P.vivax, P.ovale, P.malarie

- **Vector** ： Mosquito(Anopheles Arabiensis, female)
  Sucking blood of malaria-infected human(A)

⇒plasmodium replicate in stomach, blood and saliva of mosquito
⇒ enter into non-infected human(B) when mosquito is sucking blood of B.

- **Symptom** ： regularly repeat of high fever, chill, headache, nausea, unconsciousness, death(10% of severe malaria(falciparum). Often recurrent.
- **Latent period** ： 7 ~ 14days. Sometime more than 6 months.

Fighting Words From WHO's New Malaria Chief

HELP SAVE AFRICAN BABIES AS YOU ARE HELPING TO SAVE THE ENVIRONMENT

Dr Arata Kochi （古知 新）
Director, Global Malaria Programme, WHO
He promoted reuse of DDT(Indoor spraying) and received strong resistance movement of ecologist.

Mr. Hiromasa Yonekura（米倉弘昌）
Director general of SUMITOMO CHEMICAL Co.
Now president of KEIDANREN
Develop OlysetNet and donated technology freely to WHO, made usine of Olysetnet and employed 4000 african.
The part of profit is being used to make schools in Tanzania.

Tuberculosis(TB)

One third of world population, 2 billion people are infected.
10 ~20% of infected people become ill (symptomatic)during whole life.
1.6million people die annually (2005).

- Pathogen ： Mycobacteriun tuberculosis
  Airborne infection
- Symptom ： Lung, Bone, Brain, Kidny,Whole body
- Diagnosis ： tuberculin test(Koch), microscopy of sputum smear, chest X ray
- Treatment ： Anti-tuberculosis drug DOTS strategy
- 95% of TB patients live in developing countries. But there are TB patients even in big cities like NewYork, Osaka, Shinjuku…
- Increase TB because of spread of HIV infection (HIV/TB dual infection)
- Multidrug resistant TB increase.

DOTS

Directly Observed Treatment, Short-course

- **WHO established a world TB control policy package named DOTS in 1991 and started a global program under the direction of Dr. Kochi.**
  Before, TB has been considered as "incurable disease" and the treatment of majority of poor patients has been ab
- **DOTS has been identified by the World Bank as one of the most cost-effective health strategies available.**
  DOTS costs only US $3 - $7 for 1 patients treatment. DOTS get people back to school, work and their families. Between 1995 and 2003, more than 17.1 million patients were treated under the DOTS strategy

5 components of DOTS

- **Political commitment with increased and sustained financing**
- **Case detection through quality-assured bacteriology (sputum smear for people with coughing more than 3 weeks)**
  Standardized treatment (4 months taking 4 TB drugs under direct observation), with supervision and patient support
- **An effective drug supply and management system**
- **Monitoring and evaluation system, and impact measurement**

4. Water Management in Arid Areas - California Drought Water Bank -

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Increasing attention is now paid to water issues in many parts of the world. Drought is a water-related disaster that has such a huge influence on human society and natural environment that how to cope with the problem is a global concern. Water shortage triggered by drought has so far been regarded as a natural disaster. But it is also a man-made disaster if economic and environmental damages get severe by humane causes such as inefficient use of water resources. The latter aspect of water shortage problem can be mitigated by legal and institutional responses. The purpose of this paper is to clarify the effectiveness of legal and institutional responses against water shortage problem that have been paid less attention to.

The State of California is located in semi-arid region, but it consumes water the most among 50 States in the United States. Moreover, water demand is predicted to grow still further in accordance with population increase. For this reason, California has suffered from chronic water shortage and various measures have been taken experimentally against this problem. It includes construction of dam and aqueduct, groundwater banking, water conservation, water recycling and water transfer. In this paper, drought water bank, an example of water transfer, is focused on among these measures.

California drought water bank has played an important role at drought situation in California since it was firstly established in 1991. Generally speaking, in drought, the problem arises on how scarce water resource should be allocated among different sectors, including agricultural, industrial, domestic and environmental sectors. This allocation problem is often resolved by governmental mandates or negotiation between water users without any pecuniary deals. But, in drought water bank, this problem is solved by voluntary water transactions between water users with less governmental regulations. In sum, drought water bank is an institution for water transfer that incorporates some elements of market mechanism.

Drought water bank was highly evaluated as a mitigation policy, but it also has many drawbacks. Those drawbacks are remedied through institutional change. And drought water bank is operated based on huge infrastructure for water delivery. In this sense, drought water bank can be a good example that shows the importance of combinations between legal institution and technology against water shortage problem.

EDL Tunisian internship symposium@INAT (2011.7.20)

Water Management in Arid Areas -California Drought Water Bank-

Outline

1、Water resources in California
2、Drought water bank
3、Settings behind drought water bank
4、Conclusion

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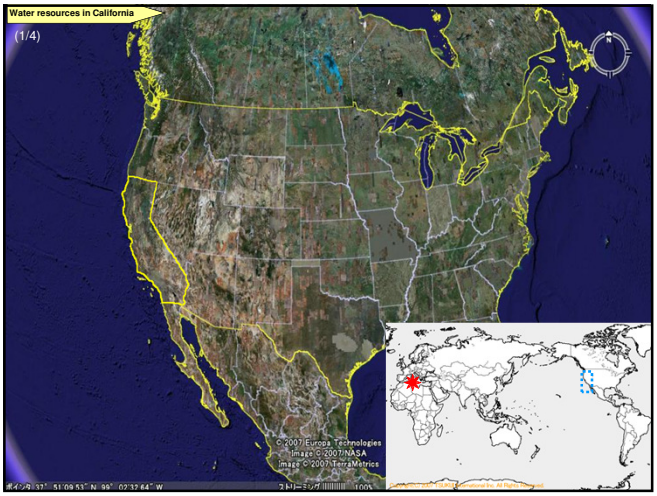
Graduate School of Life and Environmental Sciences, University of Tsukuba

1

Water resources in California

(1/4)



(2/4)

< Average rainfall / year >

Statewide : 501.6mm

Los Angeles : 300mm

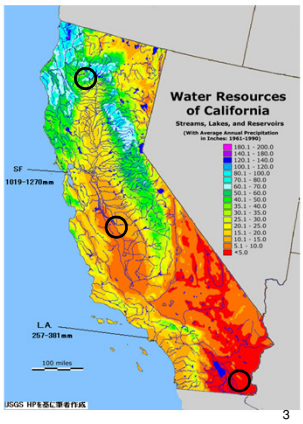
Japan : 1718mm

North Tunisia : 384mm

Middle Tunisia : 289 mm

Southern Tunisia 156 mm

(Ministry of Agriculture and Environment, Tunisia)



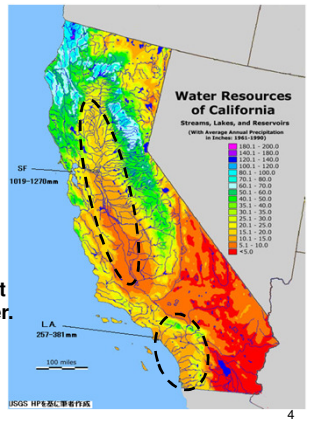
3

(3/4)

Two "gaps" in California

1. Space gap
About 75% of natural run-off takes place in northern area. But about 75% of demand concentrates in central and southern area.

2. Time gap
It rains and snows in winter. But demand is at its peak in summer.



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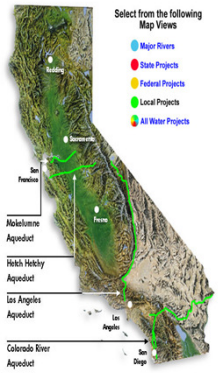
Water development

1910's(Local)



1930's(Federal)

1950's(State)

5

DWR S.Kashiwada氏 提供

Drought water bank

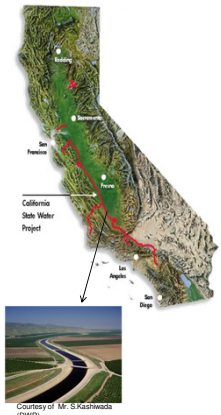
(1/6)

Drought Water Bank = A system of water transaction in SWP

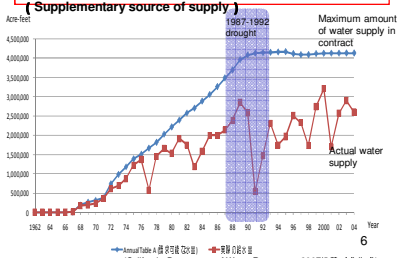
State Water Project(SWP)

- **Operated by California Department of Water Resources**
- **Oroville dam (maximum amount of storage: 43×10⁸ ㎥ / 43.62億㎥, catchment area: 9324 km²)** (Littleworth and Garner 1995:21)
- **29 SWP Contractors = Water District (wholesaler of water)**
- **provides drinking water for 23million of people and irrigation water for 2800 km²(= 280×1000ha)**

(Supplementary source of supply)



Courtesy of Mr. S.Kashiwada (DWR)

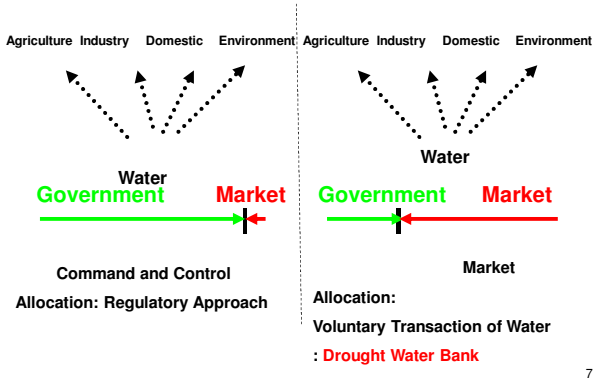


(California Department of Water Resources, 2007に基づき作成)

6

(2/6)

Two Methods of Water Allocation (O'Brien 1988,p.1166)



Command and Control

Allocation: Regulatory Approach

Market

Allocation:

Voluntary Transaction of Water

: Drought Water Bank

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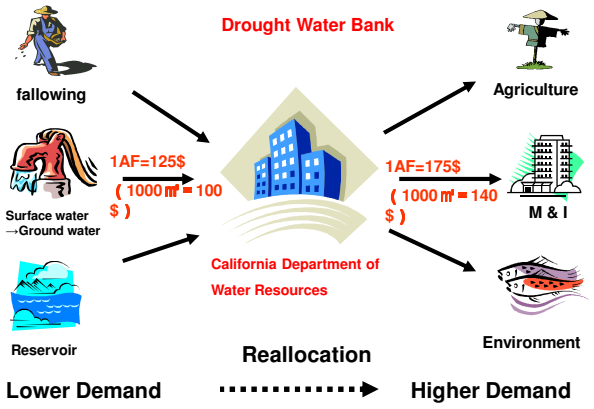
Drought Water Bank



*Reallocation of water in accordance with demand

→Uniform reduction of water supply causes further economic loss.

8

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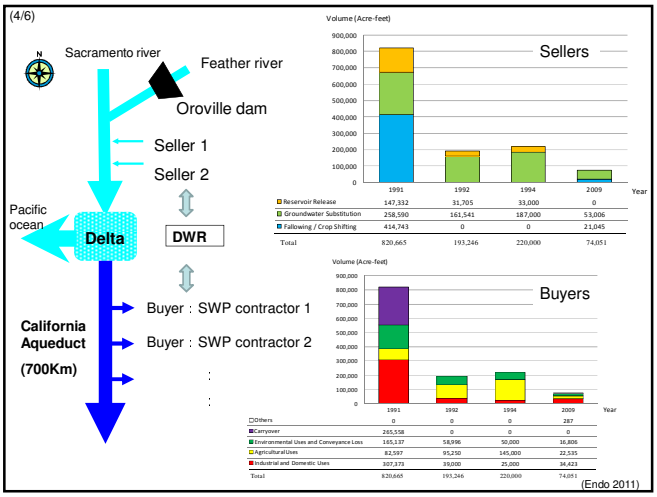

(Endo 2011)

(5/6)

Agriculture in California

10

(6/6)

Shortcomings of drought water bank and institutional changes

shortcoming	Remedy (institutional changes)
Economic impacts on water selling regions	Restriction on fallowing and crop shifting
Excessive pumping of groundwater	Extensive monitoring system
Conflict with existing water rights	Consumptive use approach
Conservation of bio-diversity	Direct water purchase by government
Criticism of "closed deal"	Letter, phone →magazine→internet

Drought water bank as an example of adaptive management

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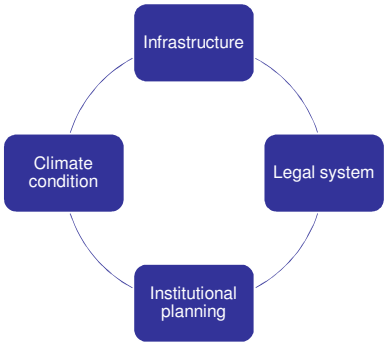
Settings behind drought water bank

(1/6)

Settings behind drought water bank



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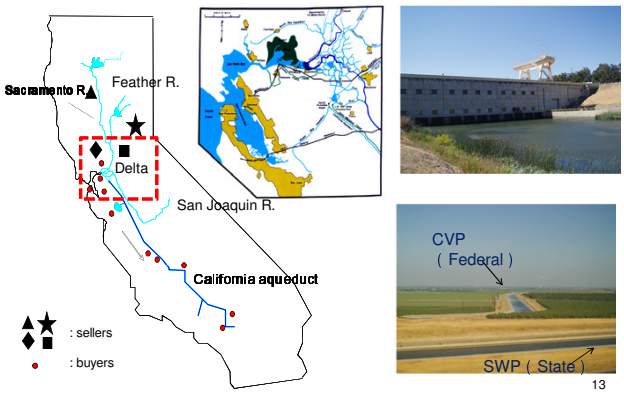
1, Infrastructure



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Tunis – Jerba: 462km

Delta ~ Lake

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2, legal system

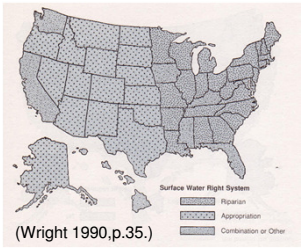
- East: Riparian Rights System

:A landowner whose property borders a river has a right to use water from the river.

- West: Appropriative Rights System

:The first to claim and beneficially use a specific amount of water has a claim superior to the late appropriators.
("First in Time, First in Right")

- California: Dual System
  →Riparian + Appropriative System



(Wright 1990,p.35.)

Water Law / Water Rights System

"Hidden" Stumbling Blocks against Water Trading

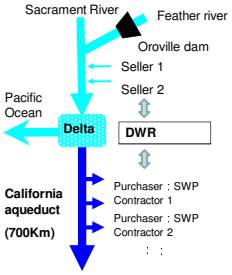
Water Allocation Method ⇨ **A Role of Government = Removal of those blocks**

(5/6)

3, institutional design

- Compulsory taking and anxiety for lawsuits
- Multi-year drought
- Demand for innovative policies

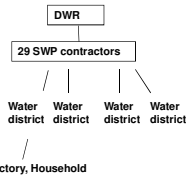
⇨ Drought water bank



Government as a transaction broker

→It simplifies water deal and reduces transaction cost.

→From "individual" deal to "collective" deal



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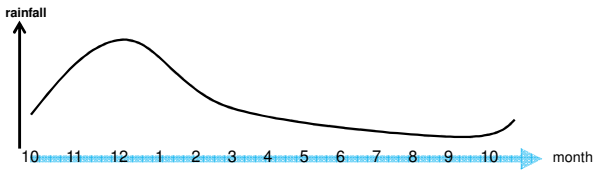
(6/6)

4, Climate condition



~Oct.1/ SWP contractors submit water demand for the current season.

Dec..1/ DWR releases initial allocation plan of SWP water.

DWR releases final allocation plan of SWP water for the current season.

(DWR Bulletin132-03 Appendix.E)

Wet winter and dry summer makes it easy for water users to predict water supply conditions before irrigation season.

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Conclusion

(1/1)

Conclusion

1, Drought is natural phenomenon, but water deficiency may be social phenomenon.
→Inefficient use of water resources causes further economic loss.

2, At least, there are two ways to mitigate drought problem.
→Construction of Infrastructure (Hard-path) and Creation of institution (Soft-path) (Gleick 2003)

3, Water transfer can be an alternative (in part) to building additional infrastructure.
→Increasing water supply is not the only solution. This kind of soft-path can play a role in area where construction of new dams is hard to be done.

4, It is hard to implement water transfer policy where infrastructure is not sufficiently built.
→Combination of hard and soft path is necessary. Water bank system works in a limited area.

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Session 2: Workshop
- Roles of Environmental Leaders -

1. Does Pyocyanin Production Correlate to Quorum Sensing System in *Pseudomonas Aeruginosa* Clinical Isolates?

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Pseudomonas aeruginosa is a ubiquitous Gram-negative bacterium that is capable of surviving in a broad range of natural environments, although it is best known as an antibiotic resistant human pathogen associated with hospital acquired infections and as a leading cause of death in cystic fibrosis (CF) patients. Cystic fibrosis is a common recessive genetic disease which affects the entire body, causing progressive disability and often early death. It is caused by a mutation in the gene for the protein cystic fibrosis transmembrane conductance regulator (CFTR). Pyocyanin (PCN) is a blue redox-active secondary metabolite that is produced by *P aeruginosa.* PCN is readily recovered in large quantities in sputum from patients with cystic fibrosis who are infected by *P aeruginosa.* Despite *in vitro* studies demonstrating that PCN interferes with multiple cellular functions, its importance during clinical infection is uncertain. In addition, few cellular pathways that are affected by PCN are known.

This presentation gives an investigation of biofilm formation and pyocyanin production of several *Pseudomonas aeruginosa* clinical isolates, which were isolated from human patients and mouse blood. The results showed clearly that during the static culture condition in 37℃, when the culture time was more than 24 hours, the mouse blood strain produced hyper production of pyocyanin. In addition, after 48 hours culturing, other clinical isolates also produced pyocyanin. Since *Pseudomonas* quinolone system (PQS) is one of the most important parts in quorum sensing system, we did the PQS assay to check the relationship between pyocyanin production and quorum sensing system. The results indicated that pyocyanin production did not correlate to PQS production.

The *Pseudomonas aeruginosa* clinical isolates produce pyocyanin especially in static culture conditions after 24 hours. There is no obvious PQS production in clinical isolates during the static culture. The pyocyanin production in these clinical isolates does not correlate with the PQS system. In the future we will make the *pqsA* and *pqsH* mutant of these clinical strains to confirm this result. Besides, we will also check *lasI* and *rhlI* gene expression to learn if pyocyanin production is related to other parts of quorum sensing system.

Keywords: pyocyanin, quorum sensing, clinical isolates, PQS

2. Pollutants Removal of Municipal Wastewater through Vertical Multilevel Soil Infiltration Treatment

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1. Introduction

A soil infiltration system has proved to be a good solution when considering efficiency and cost for wastewater treatment. It only demands a large amount of land area but no requirement of perfect municipal sewage system. Its application is suitable for the wastewater treatment in suburban. At present, Soil infiltration systems have been widely used for reuse and wastewater treatment in France, United States, Israel and other countries. In the soil infiltration system, organics, nitrogen, phosphorus and SS were effectively removed through infiltration, sorption, percolation, chemical reaction, biotransformation and predation. The removal of COD and SS were greater than 80%, but the removal of nitrogen is comparative difficulty.

Based on this situation, the soil infiltration system was improved by combining the stuffing (zeolite, active carbon, sawdust and scrap iron) and then set for a multilevel developed Vertical Multilevels Soil infiltration system (VMSI).

The design and application of the VMSI with an effective depth of 0.5 m is necessary for the consideration of a laboratory study, and its feasibility regarding various wastewaters should also be taken into consideration.

The objective of this article was to concentrate on the ability of pollutants removal in wastewater by a VMSI system through a 5-month laboratory study. In this study, we tested the effects of soil content, and aeration depth, on pollutants removal.

2. Methods

2.1 Wastewater Characteristics

Tap water mixed with suitable mount of glucose, ammonium sulfate and potassium dihydrogen phosphate to simulate wastewater, and municipal wastewater was also used (diluted before treated by tap water when loaded with sufficient pollutants). The ranges of major water quality indices for the influent are shown in table.1.

Indices	Concentration range（mg/L）
COD	328.51（295.6-378.2）
NH_4^+-N	42.47（36.9-47.1）
NO_3^-N	4.86（3.21-5.27）
TN(total nitrogen)	47.02（39.04-50.19）
TP(total phosphorus)	7.52（6.68-8.34）

Table .1 The ranges of major water quality indices

2.2 Laboratory devices

A polymethylmetharcylate column (30 cm*20 cm*50 cm) labeled as C1 was used in the study.C1 utilized with both biological and abiological effects to simulate the ability of the pollutants removal abilities of this system, which was packed with soil and quartz at a suitable proportion (1:2(v/v)) to avoid blocking, then intensified by combined stuffing with zeolite, active carbon, sawdust and scrap

iron (VMSI).

3. Results and conclusion

This study revealed the pollutants removal capacity of the VMSI system, the following conclusions could be obtained:

COD from the wastewater was absorbed at first by the combined stuffing and degenerated by organisms in VMSI system. It was effective in removing COD with an average removal percentage of 92.25%, the abiological effect accounted for about 52-61%.

The NH4+-N removal rate was 98.16% of average efficiency.

The removal efficiency of TN was directly associated with the nitrate removal. Anaerobic, the deoxidized area and an efficient external carbon source were the main factors in TN removal.

TP removal was excellent in the VMSI system, it may be removed completed, and high removal efficiency may last for a comparatively long-period because of the removal mechanism.

Biological and abiological effects should be performed together to maximize the pollutant removal capacity.

3. The Establishment of Sustainable Farming Extension in Mongolia: Challenges and Possibilities of Integrated Governance

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Mongolia, geographically, contains both belongs to arid and semi-arid regions. Traditional mobile pastoralism has adapted to these climatic conditions. Today, however, livestock farming suffers from overgrazing, climate change and a loss of traditional knowledge. The reasons for these problems can be attributed mainly to urbanization and the expansion of agribusiness industries in both crop and livestock farming.

This presentation clarified the current situation of farming in Mongolia. The main crop farming area is mainly located in the north central part of Mongolia. Historically, the Mongolian people have had little information about crop and vegetable cultivation. In the last fifty years, however, Mongolia has introduced crop farming practices from Russia. This practice has resulted in soil erosion, lowered yields, and pest and disease problems. Despite these problems, the Mongolian government has maintained large-scale agribusiness practices. The most recent agricultural reform programs such as the "Third Campaign of Virgin" (2007) have used abandoned land for crop cultivation by introducing modern machinery and scientific farming methods. 80% of Mongolian's total land area covered is by pasture land. Pasture productivity had been decreasing in the last 30 years because of less experienced people attempting livestock farming. This change in farmer experience has destroyed traditional livestock farming practices such as seasonal grazing movement, traditional breeding methods and changing the livestock herd's type and content.

Mongolian agriculture seems to be unsustainable due to the above problems. Therefore, the Mongolian people need to reconsider traditional livestock farming practices for environmental conservation, healthy food and the farmer's traditional knowledge. Sustainable agriculture development not only considers a traditional lifestyle but it is also necessary to learn sustainable farming management and practice from some leading countries. Future consideration should identify more clearly the possibilities and challenges of establishing sustainable farming extension in Mongolia by examining the practices and lessons from leading countries.

Keywords: Sustainable farming, traditional knowledge, livestock, crop, farmer

4. Evaluation of Factors Affecting the Soil Moisture in the Semi Arid Regions in Mongolia

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Land cover with insufficient and unstable soil moisture is predominant in north-eastern Eurasia. This is true especially in the arid and semi-arid region which covers Mongolia with an annual precipitation ranging from a few mm/y to 300 mm/y. Therefore, the development of an integrated approach to evaluate the soil moisture is key for a better understanding of the natural potential during climate change. The observed data are quite useful when investigating the soil moisture change in both the spatial and the temporal distribution and they should be analyzed with the observed soil moisture data.

The previous studies in hydrology and climatology suggest that the soil moisture might have an influence on the climatic conditions in Mongolia; however there were few papers to investigate the relationship between the soil moisture and climatic conditions, especially for the prediction of soil moisture. For this purpose, a step regression analysis of the soil moisture for the long time period is necessary using the observed soil moisture and the meteorological data.

The objective of this master's thesis is to predict the temporal and spatial distribution of soil moisture content through a correlation analysis using the observed data and to make clear the important factors affecting the future soil moisture conditions.

Firstly, a correlation analysis of the observed soil moisture data in the selected stations is performed to make clear the relationship between the soil moisture certain parameters such as: precipitation, temperature, humidity in the atmosphere, and then to predict the soil moisture in the future. A preliminary regression analyses for four different natural zone's stations were performed. For example: A forest steppe area (Bulgan) has more correlated forecasted May air temperature and previous years soil moisture (before frozen). Steppe region area; forecasted May's precipitation and beginning of April air temperature (Darkhan, Undurkhaan). Desert gobi area; can predict previous year's September soil moisture and forecasted May precipitation.

I will continue to regression analyses of other stations. After the correlation analyses, a spatial distribution map of the soil moisture will be produced for every variety of the natural zone. The results of the present study would contribute much to the construction of a prediction system to improve the agriculture and nomadic activities in Mongolia.

Keywords: soil moisture, prediction, air temperature, precipitation, step regression

5. Pastureland and Use in Bayan Soum, Mongolia Using Remote Sensing Data and GIS Application

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The semi-arid steppe of Bayan in the central eastern part of Mongolia was chosen for field investigation in this study. In this area, grassland occupies 96% of the whole area and the economy strongly depends on livestock production. Therefore, the land is mainly used for grazing as it constitutes around half of the population's livelihood. In recent years, unmanaged pastureland use has caused many issues in the area.

In order to improve problematic land use in the grassland, it is important to understand the spatial distribution of the aboveground biomass. We studied the characteristics of the spatial distribution of the aboveground biomass in the Bayan soum area using the percentages of grass coverage of the field as sampling data. Land cover surveys were carried out at 200 sites in the ground survey area in the summer of 2010. Photos of ground cover areas of $1m^2$ in size were taken to compute the percentages of ground surface components such as green grass, senescent grass, bare soil and shadows.

Geostatistical analysis was conducted to examine the spatial correlation of the aboveground biomass and the values of the vegetation index. Comparing the characteristics of the spatial distribution of both the aboveground biomass on ground survey areas and vegetation index values on satellite images, an appropriate spatial resolution of satellite images were determined. The results indicated that remote sensing at high resolutions, such as spatial resolutions, is less than 130 m and are necessary for land use planning based on the aboveground biomass, particularly with a green grass cover. The semivariograms also illustrate clearly that the spatial distribution of the aboveground biomass is related to different soil types and elevations.

Key words: Aboveground biomass, Geostatistics, Pastureland, Semivariogram and Vegetation index

6. Monitoring Mangrove Forest Using Multi-temporal Satellite Data in the Northern Coast of Vietnam

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The vast majority of the population in Vietnam lives in the lowlands and near the coastal areas, which are vulnerable to rising sea levels and tropical cyclones. Mangrove forests play a vital role to protect the dyke systems and prevent shoreline erosion as well as defend from the impact of storms and floods. Nevertheless, these forests are under severe threat due to the rapid growth of the population, intensive shrimp and crab farming as well as a migration to the coast. The objectives of this research were to analyze mangrove changes using different sensors and to examine the driving factors leading to the losses of mangrove forests in the Northern coast of Vietnam. In order to monitor mangrove changes, satellite based mapping is used. An object-based classification was used to improve the accuracy assessment of the post satellite image processing. Moreover, Geographic Information System (GIS) and Remote Sensing data were applied to analyze how the mangroves have changed throughout the different periods between 1990 - 2006. The research may provide appropriate solutions for mitigation and adaptation to climate change through improved management of mangroves along the coast and proposed long terms strategies to protect and enrich the livelihood and the security of people living in the lowland in the coastal zones of Vietnam.

Keywords: Mangrove change, GIS, Satellite remote sensing, Object-based classification, Vietnam

7. Policy for Risk Management in Rive Value Chain to Adapt with Climate Change in Vietnam

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Rice is the most important crop in Vietnam; it is the livelihood of over 50% of the population. Rice has an enormous role in ensuring national food security and partly contributes to world food security due to its exportation. Rice production, recently, had to face increasingly difficult problems due to climate change, which has caused an extraordinary loss for rice production, especially in the Mekong River delta and the Red River delta, which dominate more than 70% of the total rice production area. The government has clearly recognized that climate change adversely affects rice production, yet it does not have any specific policies for risk management. This research aims to promote risk management, which focuses on risk identification, risk assessment, risk analysis and the adaptation measures and policies. The ultimate objective of risk management is to mitigate losses may occur in rice production and that market. This requires close cooperation of the public and private sector along with community. To achieve this objective, a literature review, a key stakeholder interview and meetings with experts are deliberately conducted to collect information about what is considered as risk in the rice value chain, how present farmers, stakeholders, and government respond to risk and what kind of policy measures should be implemented. The research will also establish a simulation model to quantitatively evaluate the most dominant factors among those affecting rice productions such as precipitation, temperature variation, fertilizer use, etc.

The total rice production area in 2009 was about 4.7 million hectares; this area has been reduced because of land use change and seawater intrusion. Rice is mainly produced in the Mekong River delta where it accounts for 52.1% of the total rice production area and produces almost all the rice export quantity. The rice export volume increased from 3.48 million tons to 6.05 million tons between 2000 and 2009. Thus the role of rice production in food security has grown internationally, rather than just nationally over the past decade, making Vietnam become the world's second largest exporter just behind Thailand. However, although the rice yield gradually increased in all regions, it is significantly fluctuated from 2000 due to extreme weather events such as unusual flood flows, heavily precipitation, and typhoons. More seriously, farmers seem to not have benefited much from remarkable achievement in rice production and exportation. The problem is that the more rice farmers have produced, the less profit they have received; the profit they get is much less than other stakeholders in the value chain, while they are the most vulnerable and disadvantaged people due to climate change.

The problems in rice production and the market in the context of climate change require reforming current policies and proposing new risk management mechanisms and institutions to ensure equally allocate and a shared risk and value all participants in the value chain. Besides, government policies should promote the positive cooperation of community, both private and public sectors, to confront the increasingly negative impact of climate change on agriculture production in general and rice production in particular.

Keywords: Risk management, Value chain, Climate change, Institutions

8. Management of Freshwater Fish Resources in Brazilian Amazonia

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Depletion of aquatic resources has been serious a problem in several parts in the world. In Brazilian Amazonia, a region considered as a less developed area where the federal government promoted economic development, this problem began intensify in the 1950s after the introduction of modern fishing tools such as nylon lines and boats equipped with diesel engine motors.

This presentation introduces the problems and measures which appeared together with fish resource depletion.

One of the most serious problems that occurred because of the depletion of fish resources were conflicts between local fishermen, who captured fish using traditional ways near their village, and industrial fishermen. The former claimed that industrial fishing had caused the depletion. Then they refused access to industrial fishermen in the lakes where the fishery was to be managed based on agreements among the local people. This scheme started to be legally enforced in the 1990s.

At the same time, aquaculture has been receiving special attention as a form of fish production which does not depend on natural fish resources. This activity is roughly categorized into two types: saltwater aquaculture and freshwater aquaculture. The latter has been predominant in this region. This activity is considered sustainable because of its low pressure on the environment. The activity also possibly increases employment opportunities, which is expected to improve the economy especially in rural areas.

Several schemes and projects have been implemented by not only state governments, but also by the federal government in order to develop aquaculture. However, most fish farmers continue to practice it as a side business and on a small scale. This situation suggests that there exist several problems which have prevented the development of this activity. My research aims to identify which problems have been obstacles for freshwater aquaculture in this region.

Keywords: Fish, resource management, Amazonia, community based resource management, aquaculture

9. Effective Interraction between *Clethra barvinervis* and Root Endophytes on the Heavy-metal Resistance

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Clethra barvinervis is a naturally growing species found in mine sites, especially copper mines such as the Asio mine. In Japan, *C. barvinervis* is distributed across the country. *Clethra barvinervis* cannot live in a heavy metal polluted site without root-endophytes (Watanabe, 2008) which help to inhibit the extreme absorption of heavy metals. Also, *C. barvinervis* would absorb Cs-137 through a similar mechanism like that of heavy metal uptake. The purpose of this study is to clarify the effective interaction between *C. barvinervis* and root-endophytes on phytoremediation for heavy metals as well as Cs-137.

We will collect *C. barvinervis* growing in the mine site. In the Nasu area near the Asio cooper mine, there is a high radioactively polluted area called a hot spot. We are going to the Yaguki mine, the Asio mine, and the Hitachi mine, which are 35km, 150km and 90km, respectively apart from the Fukushima Dai-Ichi nuclear power plant. *Clethra barvinervis* will have separated into leaves, branches and roots. The amount of heavy metals and Cs-137 will be analyzed in the plant materials. Then, the root-endophytes, will be isolated from the roots and the species identified through DNA analysis.

In mine sites and in the area near the Fukusima Dai-Ichi nuclear power plant, soil pollution is very serious problem. This is especially true at the Asio mine where there is a lack of trees on the mountain. Discharged heavy metals and Cs-137 could have polluted the groundwater and river. We hope that *C. barvinervis* can fix Cs-137 as well as heavy metals and inhibit the runoff of soil containing heavy metals and Cs-137.

Keywords: radiocesium, heavy metal, *Clethra barvinervis*, root-endophytes, phytoextraction

10. Arsenic Contamination of Groundwater and the Dynamic State of Groundwater in Tay Island, Dong Thap Province, Viet Nam

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The groundwater has been contaminated with high concentrations of arsenic on Tay Island, Dong Thap province, Viet Nam and it has been investigated by the Mekong Research Group* since 2008. According to the island- wide survey in 2009 by the Mekong Group, all of the locations on western Tay Island have Arsenic concentrations higher than 0.01 mg/L, but eastern Tay Island has showed only the some locations having concentration over 0.01 mg/L. By period investigation in 2010 arsenic concentration ranged from <0.001 to 2 mg/L, with an average concentration of 0.76 mg/L.

Therefore, a hearing survey was conducted between April and Jun 2010. As a result, we have learned that in the Tay Island, most residents are not aware of the problem of arsenic contamination in their groundwater and its effects on their affect health .Many households are using arsenic contaminated groundwater for drinking and the trend seems to be increasing.

The result of groundwater testing clarified that the composition of the groundwater's quality in the first aquifer is similar to that of river water and shallow groundwater. The second aquifer is similar to seawater and contains salt water and fossil. The concentration of arsenic in the first aquifer is higher than in the second aquifer at all times. Comparing the western and eastern Island showed that the west has a higher concentration of arsenic than in the east.

The dynamic state survey showed that seasonal groundwater level fluctuations are similar to the movement of the Mekong River, and its effects are stronger than the effects from precipitation. The 3D simulation groundwater model flow systems showed that the groundwater pumping for agricultural irrigation in the west is greater than in the east, so the groundwater level in the west was lower than that of east. Arsenic is believed to have leached through the groundwater levels which were fluctuated by seasonal groundwater changes and seasonal pumping.

The exchange of river water and groundwater has not been clarified clearly yet. It is necessary to consider the relationship of the source of the arsenic contaminated groundwater recharge and recharge resources.

Keywords: arsenic contamination, drinking groundwater, composition of groundwater, groundwater flow systems, seasonal groundwater fluctuation

*Mekong Research Group is a short name of the Groundwater Arsenic Research Group at Mekong Basin

11. Characterization of Forms and Origins of Nitrogen in the Water of an Agricultural Watershed: The Case of Kamech Watershed (Cap Bon, Tunisia)

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The problem of enrichment of waters by nitrogen has been addressed in several studies. These considered and monitored water quality including that in agricultural watersheds. In this study analyses were undertaken to determine the concentrations of nitrites, nitrates, ammonium and chlorides in streams of an agricultural watershed. The ultimate goal was to assess the dynamics of nitrogen compounds and chlorides during their transport into the water system and identify sources of nitrogen and the origin of the observed concentrations.

A campaign of in-situ measurements and water sampling was conducted during the hydrological year 2009/2010 in order to monitor the spatial-temporal evolution of concentrations of the following: nitrites, nitrates, ammonium and chloride. Following this levies were taken from the water table (piezometers) and the surface water (lakes and rivers) from monthly samples and different measuring points. Initially, our study aimed to validate procedures for monitoring protocols in the field and analytical protocols in the laboratory to ensure reliable results. In a second step the Gum approach was utilized to quantify uncertainty in the absolute and relative analysis. Following this nitrite and ammonium were eliminated from the statistical analysis. A kriged map of the piezometric levels allowed us to follow the direction of groundwater flow in the watershed and Kamech and Piper diagrams facilitated interpretation of the different facies that characterize the chemical area. Subsequently, a Principal Component Analysis (PCA) was performed on nitrates, chlorides and their conductivity using the software Statistica (ver. 8). We then tried to re-project specific functions based on the original elements (major elements, nitrates, chlorides and conductivity). Thus for each of the sites studied, it was possible to determine the distribution of proportions of variances based on original components.

Ⅰ. Introduction

The changes caused by human actions are those that have the greatest influence on the planet and within the context of these changes the quality of water resources are affected by hydro-natural systems. The implementation of research programs is important to monitor, evaluate and find lasting solutions to these effects of anthropogenic actions on hydro-systems. Among the major programs carried out in Tunisia, the MOREW (Mediterranean Observatory of Rural Environment and Water) is managed jointly by the UMR INRA-LISAH SupAgro-IRD, UMR CNRS-IRD-Hydrosciences University of Montpellier II, and the INGREF INAT. Thus in 2002, the retention of the Kamech watershed was incorporated as a case study into the observatory program.

The watershed is located in the Kamech Cap Bon in Tunisia, As part of this study, importance is given to monitoring the quality of surface water and groundwater, primarily the research of different nitrogen forms and chloride. Indeed, nitrite (NO2-), nitrate (NO3-) and ammonium (NH4+) are the nutrients most commonly used in modern agriculture despite the fact that an excess of these salts causes serious environmental problems. One objective of this study was to characterize in space and time the concentrations of nitrogen forms during a hydrological year in the Kamech

watershed. First, the study site, the different experimental devices installed in the Kamech watershed and the field monitoring protocols used in this study are described. The second part describes the development and testing of analytical methods used to perform the analysis of samples from the basin. Finally, the interpretation and discussion of the findings based on PCA (Principal Component Analysis) are considered.

II. Study sites

II.1. Location, morphology

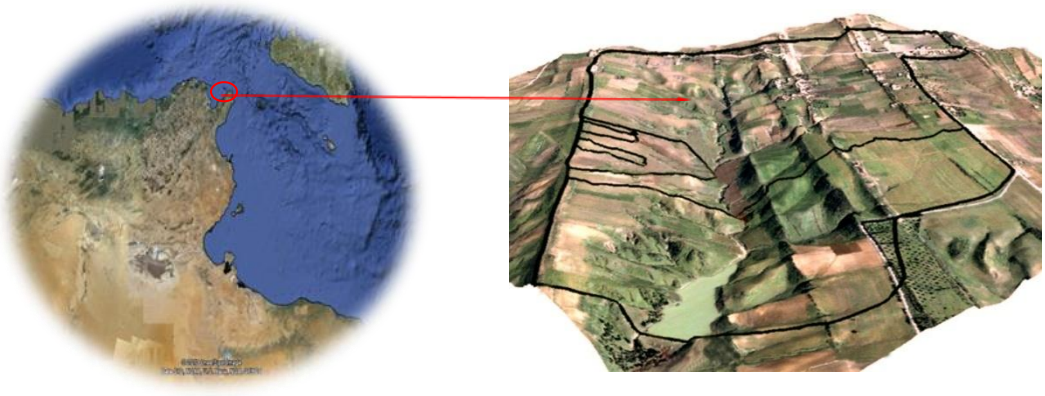

Figure 1 Location of the study area (Google Earth, 2010)

Kamech is a small watershed, rectangular in shape with area of 2.63 km^2, 2.72 km long and 0.9 km wide. It is bounded downstream by a dam built in 1993. This watershed is characterized by an annual temperature range of 24°C. The average inter-annual rainfall is about 670 mm and the average inter annual potential evapotranspiration is about 1430 mm. In the Kamech watershed, natural vegetation is extremely rare due to the proportion of land under cultivation (>60%) either herbaceous or woody path (30%).

The basin is clearly asymmetrical with the larger left bank side, crossed by outcrops of thin beds of ferruginous sandstone arming the marl, and the right slope bank shorter, with a very steep ravine at the expense of marls and clays (Figure 2).

The slope map was digitized at a scale of 1/25000 in ArcView. It shows that the slopes are very marked in all directions reaching a gradient of 30% or more. Therefore the drainage density at around 4.5 km / km ² is strong enough to comprise a small watershed (Figure 3).

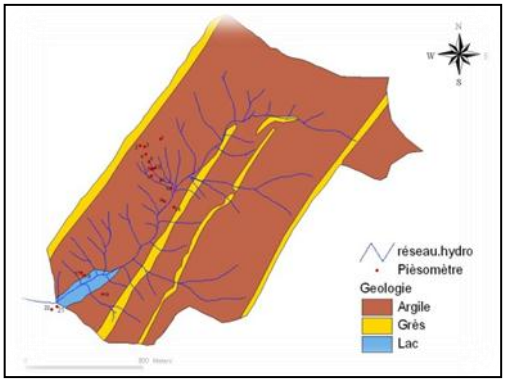

Figure 2 Geological map of Kamech (RD, 2010)

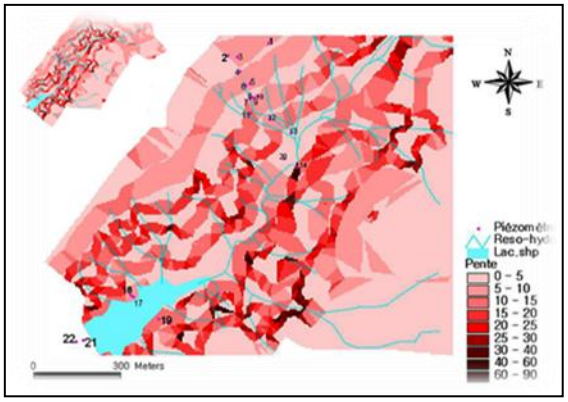

Figure 3 Map slope of Kamech

II.2. The measurement devices

Nineteen (19) piezometers were installed from September 2006 to September 2008 to monitor shallow groundwater near the lake, the river and in the micro-watershed.

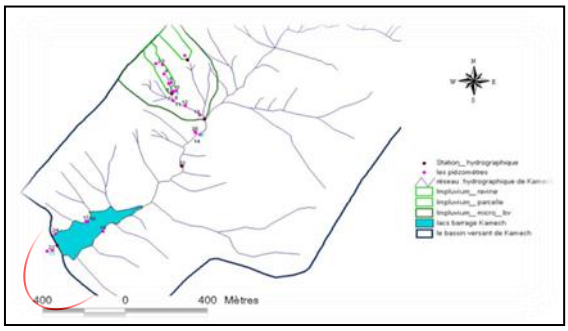

Figure 4 Map of piezometer locations

III. Monitoring protocols on land

Surface water is taken from four gauging stations (plot, ravine, and river basin) hen there is a flow. The lake water is also collected from the dam. These surface waters are collected manually. The groundwater is taken from the piezometers. The sampling is carried out by a plastic vacuum place collector. The electrical conductivity, temperature ad pH are measured for each sample directly in the field. Each sample is then stored I a one liter polyethylene bottle. The bottles are returned to the laboratory on the day of collection. They are then filtered to 0.45µm upon arrival at the laboratory. After this, the filtered samples are stored at 4℃. Analyses are carried out within 48 hours of the bottles arriving at the laboratory.

IV. Adjustment and testing of the used analytical methods

To determine the nitrogen compounds and chlorides, normalized testing protocols were used. Mohr's method was used to identify chlorides and the indophenols blue method was used to determine the ammonium. For nitrates and nitrites, we utilized a molecular absorption spectrophotometer.

V. Results and discussions

V.1.Variation of chloride and nitrogen element chlorides (Cl^-)

V.1.1. Chlorides

Levels recorded during the observation period, show important values are highly variable from one piezometer to another. The majority of the recorded values exceed the recommended standard (according to WHO the chloride content should be between 500 mg/L to 600 mg/L for agriculture). Figure 5 indicates the highest concentrations are from the area of micro watershed level piezometer 1 (1407.6 mg/L), piezometer 2 (1344.6 mg/L) and piezometer 3 (1452.3 mg/L).

V.1.2.Nitrites

The observed variations of nitrites are of the same order of magnitude or lower than the analytical and experimental uncertainties (uncertainties of about 8-67 %). Consequently, they cannot be interpreted in terms of hydrological processes or biogeochemical monitoring them but they can be attributed to the testing protocols or experimental error.

V.1.2. Ammonium

Spatial variations of the mean concentrations of ammonium and those deviations are very low. Hence, they cannot be considered natural variations as the calculation of uncertainty in the experimental protocol used (uncertainty is in the order of 70-77%) is almost equal to the levels calculated in the analysis.

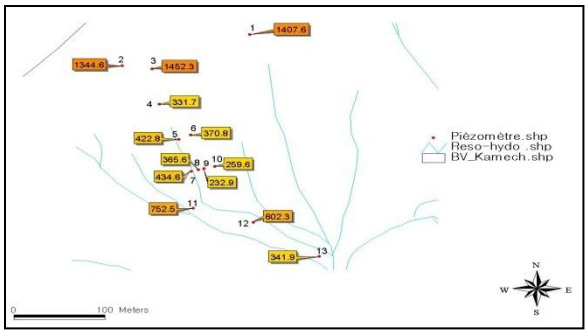

Figure 5 The average concentration of chloride (mg/L) in the micro basin

V.1.2. Ammonium

Nitrates are very soluble and persistent, as most nitrates in excess which remain in the

watershed move gradually into the groundwater. They follow the same percolation route as water. They pass through leaching and the lateral water flow.

The conditions and mechanism which govern the transfer of water regulate the transfer of nitrate (Molénat and al., 2009).

Nitrate levels have significant temporal and spatial variation. The average concentrations ranged from 0.19 mg/L to 43.45 mg/L. Standard deviations are strong which means that the contents are scattered around the mean, hence the temporal variation of nitrate concentrations. The highest concentrations at the micro watershed are recorded at piezometer 12 with an average of 18.30 mg/L (SD9.6) (Figure 6)

At the lake, the nitrate levels are low in the 18 piezometers (5.58 mg/L) (SD 5.40), piezometers 19 (1.25 mg/L) (SD 0.97), piezometers 21 (2.73 mg/L) (SD 0.175) and piezometers 22 (2.06 mg/L) (SD 1.33)). Nitrate levels are very close. This is because these piezometers are powered by a mixture of lake water and after table, except for piezometer 17 here the average nitrate is in the range of 46.45 mg/L (Figure 7).

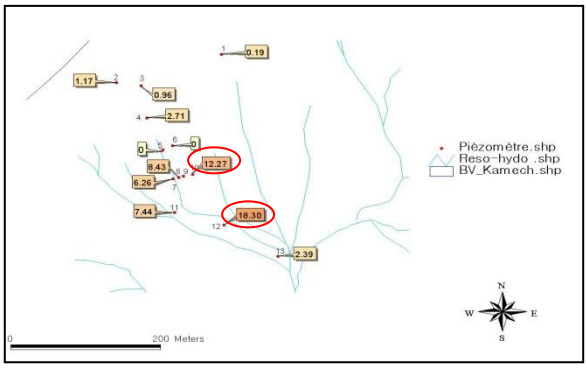

Figure 6 The distribution of the average concentration of nitrates (mg/L) in the micro basin

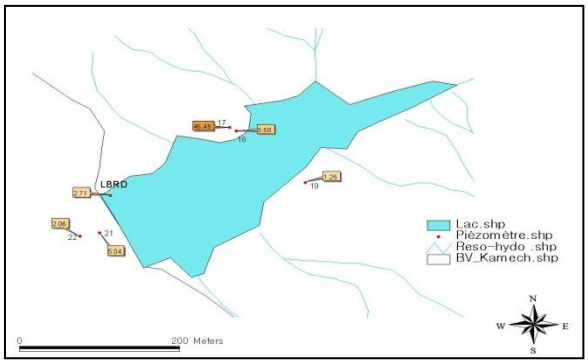

Figure 7 The average concentration of nitrates (mg/L) in the lake

V.2. Interpreting the results of the Principal Component Analysis (PCA)

V.2.1. April Fieldwork (high water)

When considering the outcome of PCA it is necessary to choose the principal components that give a higher percentage of variance. For example during fieldwork in April we considered 5 principal components which make up 96% of the variance (Figure 8).

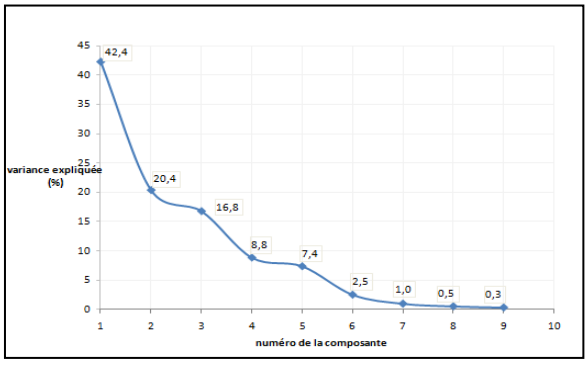

Figure 8 Percentage of variance in principal components

Since the values were determined by the percentages, it is important to continue the work to determine the specific functions weighted by the values that are percentages of the variance. These functions form the basis of Eigen functions orthogonal to each (independent of each other). These functions are called component 1, component 2 … component 5.

In addition, we also determined the relationship between these five major components and major elements and this for each site component 1, component 2 … component 5. Finally, we obtained the results for each site here we have information on the importance of each element studied.

We note that during the period of high water, nitrates, chlorides and conductivity (Figure 9) have strong weights. Indeed, the proportions vary between 0% and 40% for nitrates and between 0%

and 20% for chloride. On the right bank of the watershed Kamech, there are a strong weight proportion of nitrates (20% to 40%). While there is a low weight proportions of chlorides (from 0% to 5%) there were also low weights of nitrate on the left bank of the watershed (from 0% to 10%).While there are strong weights of chloride (10% to 20%). The high weighting of nitrate could be explained by the preponderance of this element on the various sites compared to other elements. Nitrates in the Kamech watershed are due to the use of fertilizers after each rain (Benalaya, 2009). The latter will be leached into groundwater in the form of nitrates.

V.2.1. June Fieldwork (low water)

As the high water season, a PCA was conducted in June during the low water season. Note that for the period of low water, weights were generally unchanged from the period of high water. The proportion of nitrate weights varies from 0 % to 20 % and chlorides vary between 0 % and 10 % throughout the Kamech watershed. This low weight could be explained by the low distribution of these in the Kamech watershed. This phenomenon is due to defitrification (McMahon and Bôholke, 1996) and the lack of fertilizers that are used immediately after rain following the survey undertaken in the field (Figure 10).

The comparison between the nitrate weights during the period of low water with those of high water show that there is a high weighting during the high water mark. This high weighting can be explained by the predominance of nitrate over other elements in the watershed Kamech. This could be explained by the effect of precipitation on nitrate leaching into groundwater immediately after each rain period, following the survey undertaken in the field.

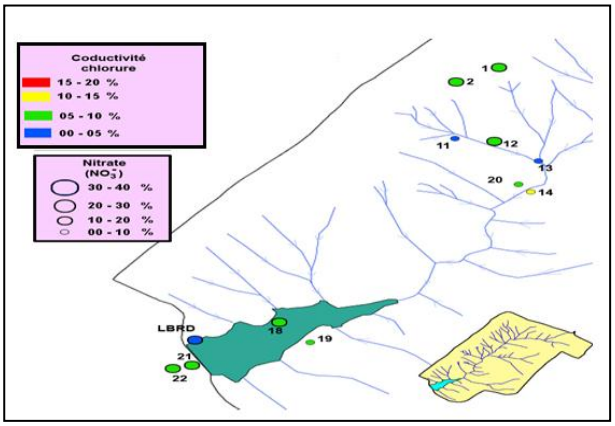

Figure 9 Balancing (%) of nitrate, chloride/conductivity (High Water)

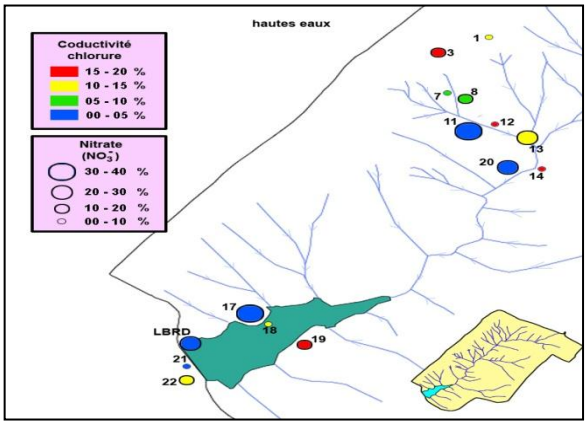

Figure 10 Balancing (%) of nitrate, chloride/conductivity (Low Water)

V.3. Spatial and temporal distribution of nitrate

The variation of the concentration of nitrate in space is related to agricultural activities, the nature of the roof of the water surface and redox conditions (Debieche, 2002). Figure 11 shows that the areas most vulnerable to nitrate pollution are in the downstream portion of the Kamech watershed precisely at piezometer 17 located on the right bank (average of about 43.45 mg/L and a standard deviation of about 17 mg/L). Only at piezometer 17 do recorded levels exceed the acceptable threshold of the WHO.

The other piezometers have low levels of nitrates. This is explained by the nature of the clay that protects the water against the infiltration of nitrate ions.

VI. Conclusion

Monitoring of different forms of nitrates is difficult, since these forms are subject to the influence of several factors such as nutrients concentration, abiotic and biological activity and stream characteristics. A Principal Component Analysis identified the spatial and temporal evolution of nitrate and chloride while taking into account the variation in the major elements of the Kamech watershed. Pollution comes from the use of nitrogen fertilizer in an agricultural watershed. In general, there are no high nitrate levels throughout the Kamech watershed (average nitrate concentrations range from 0.19 mg/L and 18.3 mg/L with the exception of piezometer17 where the nitrate concentration exceeds WHO standards (an average of about 43.45 mg/L (SD 17)).

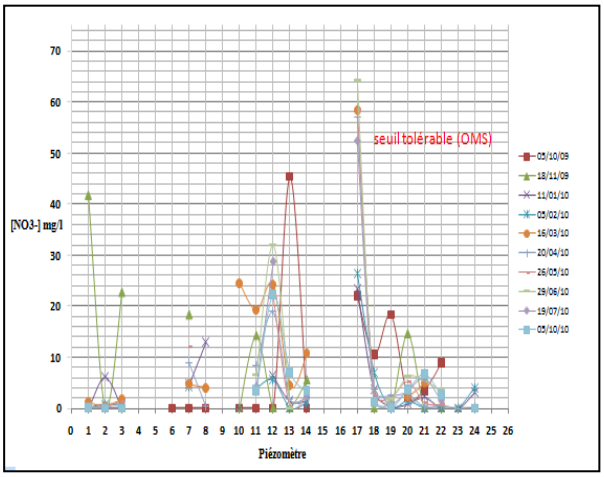

Figure 11 Spatial and temporal distribution of nitrates concentration (mg/L)

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- Google Earth
- Statistica (ver. 8)

12. Groundwater Characterization in Sbiba - Kasserine, Central Tunisia

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The creation of the newly irrigated apple perimeters in the Sbiba area has increased groundwater overdraws. This situation generated an over exploitation of the Sidi Merzoug - Sbiba aquifer system which is confirmed by a significant decrease in the surface water level. A study of the piezometric distribution and the geochemical proprieties of water will facilitate understanding of the groundwater system.

The syncline Sidi - Merzoug - Sbiba is located in the area of central Tunisia. It is situated in the governorate of Kasserine, in the Sbiba region and is limited:

- In the South-West, by the Foussana ditch

- In the North-East, by the Rohia Sbiba plain

- In the South, by Djebels Tioucha and Douleb.

- In the North, by Djbel el Biréno.

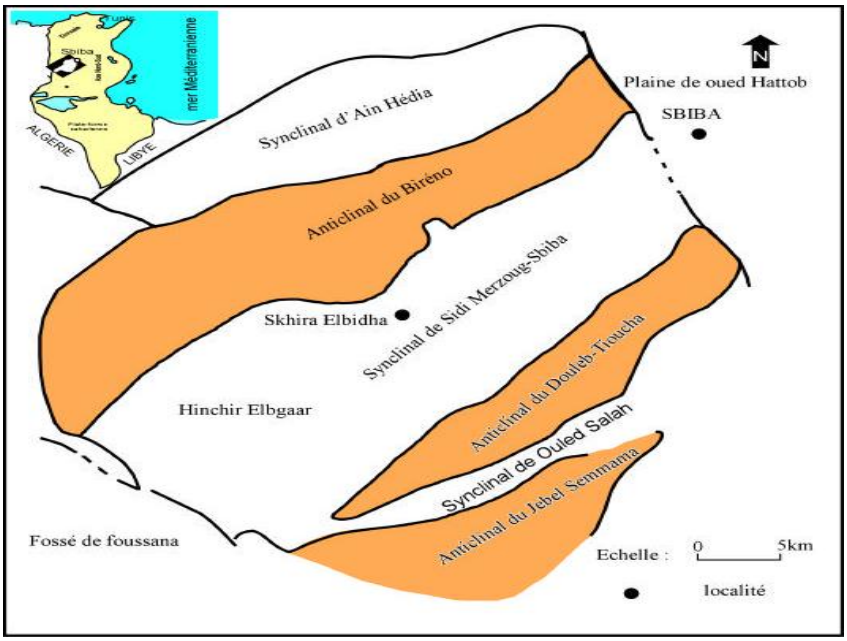

Figure 1 Study area and main components

From a detailed review of the statigraphy, one can distinguish, from the bottom to the top, the following aquifers:

- Campanian limestones.
- The limestones of the Eocene.

- The Marl - limestone alterations of the Middle Eocene.
- The alternating marl - sandstone of the Oligocene.

The groundwater system is composed of:

- **Deep aquifer**
  - Sandstone aquifer (256 km^2)
  - Limestone aquifer (44 km^2)
- **Shallow aquifer**

A study of the geology has shown the importance of the reservoir series of Campanian limestone and Miocene series sandstone. To complete this study and to understand the system better, further subsurface investigation techniques are needed such as recovery of seismic data from oil and hydraulic wells and a geophysical survey.

The ground water monitoring network of the deep syncline Sidi - Merzoug - Sbiba was launched in 1995. It consists of a few piezometers and wells however this number decreases each year due to bad **maintenance** and breaks. This situation is influenced further by inadequate monitoring networks.

The piezometric records reveal a continuous decline of ground water level indicating over pumping. This decrease varies between 5 m and 15 m during the fifteen year recording period and is equivalent to nearly 1 m/year. This significant decrease in the surface water level could be related to the increase in water demand both for drinking and irrigation. This is confirmed by a high increase in the number of wells being sunk.

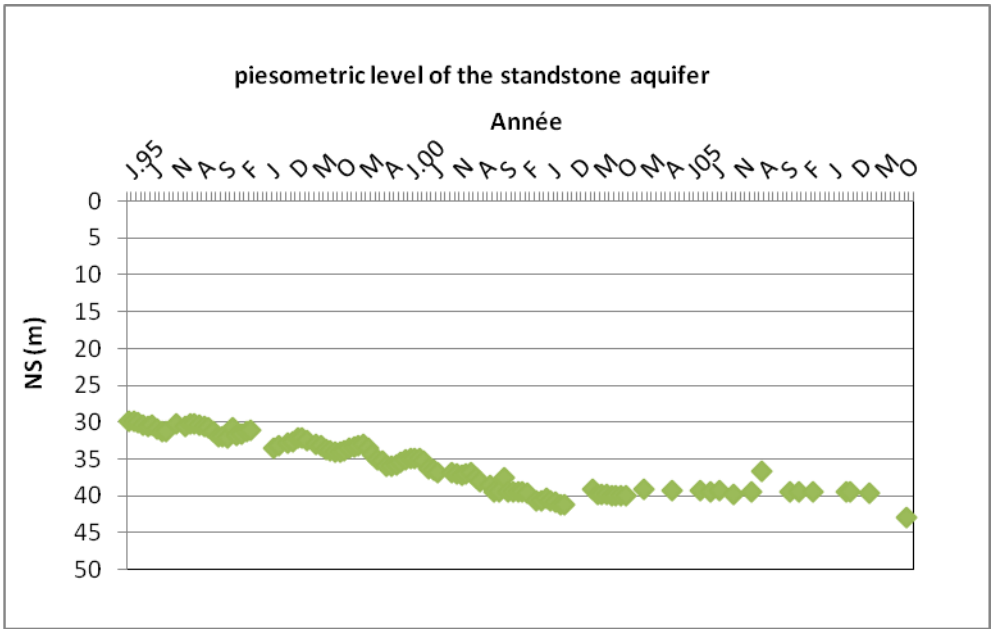

Figure 2 Piezometric level fluctuations at the sandstone aquifer

Figure 1 Visit UNESCO

Figure 2 Visit Pasteur Institutes in Paris

Figure 3 Visit ANGED and sightseeing landfill in Bizerte

Figure 4 Visit Ruspina fish, private fisher crop company in Monastir

Figure 5 Visit Skhira- Taparura project in Sfax

Figure 6 Visit Urban water supply-Desalination plants and irrigation wells at Jerba

Figure 7 Management of oasis system and geothermal production and local water resources management

Figure 8 Tunisia-Japan International Symposium

Figure 9 Other activities in the internship in Tunisia

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