



First International Conference **Water Management In Arid Land & Semi-arid Land** New Perspectives And Innovative Approaches



WMAL 2017

Water Management in Arid and Semi-Arid Lands

Program

JUST, Jordan, 7-10 October 2017





Index

	Page
Welcome Message	3
Conference Themes	4
Committees	4
Venue	5
Important information	5
Opening ceremony	6
Keynote sessions	7
Program overview	9
List of Presentations	10
Abstracts	13
Poster session	29
Visits	29
List of participants	30



Welcome message



Under the patronage of HE professor Adel Al Tweissi the minister of Higher Education and Research and on behalf of Professor Omar Al Jarrah, The University President and the Organizing Committee, I am pleased to welcome all of you to the First International Conference of Water Management in Arid and semi-Arid land (WMAL2017) held at the campus of Jordan University of Science and Technology, Irbid, Jordan, on October 7-10, 2017.

The International Conference of Water management in Arid and Semi-Arid land (WMAL2017) is an important event in the country that focuses mainly on arid and semi-arid regions and how to best manage water and agricultural resources in water scarce conditions. New trends and insights on water managements in arid and semi-arid conditions will be introduced by internationally and well-recognized keynote speakers.

WMAL2017 will provide a chance for scientists, researchers, industrialists, policymakers, farmers, members of international organizations to meet and exchange innovative ideas, information, research results, and case studies on several aspects of water and resources management in arid climate. The conference includes 50 peer reviewed presentations, technical papers and posters covers various subjects related to arid lands including soil and water conservation, hydrology of arid lands, wastewater treatment and reuse and agricultural engineering and management. Major findings and new trends on water managements in arid and semi-arid conditions will be introduced through keynote lectures, oral and poster presentations that will be given by internationally and nationally recognized experts. In addition to rich scientific program, the participants will have a chance to discover the beauty of Jordan, the land of rich history and multicultural mosaic.

Special thanks go to conference co-sponsors, including the Scientific Research Support Fund, keynote speakers, and session chairs. The work and dedication of the organizing committee members is highly appreciated. I also thank the University offices and unites that contribute to the successes of this conference, to name a few; president's office, Faculty of Engineering, Public relations unite, Deanship of students Affairs, Operation And Maintenance Unit, Financial Affairs Unit and International Students Office.

We look forward to welcoming you in Jordan.

Prof. Majed Abu-Zreig, Professor and Conference Chair
Professor of water and Environmental Engineering
Email: majed@just.edu.jo



Conference Themes

- Hydrological Processes
- Soil and Water Conservation
- Agricultural Engineering and Management
- Water Treatment and Technology
- Socio-Economic Water Studies

Committees

Organizing Committee

- Prof. Majed Abu-Zreig, Chair, Jordan University of Science and Technology, Jordan
- Prof. Burahn Albiss, Jordan University of Science and Technology, Jordan
- Dr Muna Abu Dalo, Jordan University of Science and Technology, Jordan
- Dr. Zakaria Ajlouni, Jordan University of Science and Technology, Jordan
- Dr. Samer Talozzi, Jordan University of Science and Technology, Jordan
- Prof. Khaled Shawaqfeh, Jordan University of Science and Technology, Jordan
- Dr Jamal Abu Ashour, Jordan University of Science and Technology, Jordan
- Eng. Tasneem Tawalbeh, Jordan University of Science and Technology, Jordan

Scientific Committee

Prof. Majed Abu-Zreig, Chair
Prof. Dr. Andreas Theil
Prof. A Alazba
Prof. Hiroko Isoda
Dr. Jamal Abu Ashour
Prof. Dr. Fayez Abdallah
Prof. Lindsay Stringer
Prof. Wa'il Abu-El- Sha'ar
Prof. Tim D. Davis
Prof. Dr. M. Shatanawi
Prof. Mistsuteru Irie
Prof. Hani Abu-Qdais
Prof. Ramesh Rudra
Prof. Mohammad Ajlouni
Prof. Dr. Ralf Otterpohl
Dr. AdelNabi Fardous
Prof. Haruyuki Fujimaki
Dr. Zaidoon Abu Salem
Prof. Dr. Matt. Barjenbruch
Dr. Bashar Al Smadi

Prof. Dr. Hinkelmann, Rihch
Dr Ziad Al Ghazzawi
Dr. Khaldoon Shatnawi
Dr. Mohammad Abd Elbaset
Dr. Radwan Al Weshah
Prof. Theib Oweis
Dr. Khaldoon Alkudah
Prof. Atsushi Tsunekawa
Dr. Arabi Al Qadi
Prof. José Manuel Vieira
Dr. Moayed Shawaqfeh
Prof. Mahmud Duwayri
Prof. Atef Kharabsheh
Prof. Ali El Naqa
Dr. Qasim Abdelal
Eng. Mohammad Shahbaz



Venue

The conference will take place at the campus of Jordan University of Science and Technology (JUST) located near the city of Irbid.

Arriving to the venue

The university arranges a local transportation for participants from hotels to JUST campus in addition to the trips. Also there is a local transportation that can be used (taxi, and University busses).

Important information

Transport: The transport to the conference venue and events will be provided by the conference also the transport between JUST and hotels.

Registration desk: The registration desk will be located at Salah Al-Dein Hall.

Poster session: Will be held in front of Salah Al-Dein hall, the posters should be hung on arrival of the authors and remain in place until the end of the symposium.

Lunches and coffee breaks: Lunches will be held at JUST cafeteria and the coffee breaks at Salah Al-Dein hall.

Certificates of attendance: Will be available for all participants and will be distributed for presenters at the end of their lectures.



Opening Ceremony:



Patronage by H.E. Prof. Adel Al Tweissi

HE professor Al Tweissi is currently the Minister of Higher Education and Scientific Research as of September, 2016. He is leading the ministry towards knowledge-based economy. He has a PhD in Linguistics from The University of Michigan Ann Arbor, USA. Prof. Al Tweissi held several key positions including the Minister of Culture, Senator, the Senate of Jordan, Chairman of the Board of

Trustees of Mu'tah University, President of the University of Jordan, The Secretary General of the Higher Council for Science and Technology, President of the Founding Committee, El-Hassan Science City, President of Al Al-Bait University, Secretary General (Deputy Minister of the Ministry of Higher Education and Scientific Research, President of Al-Hussein Bin Talal University.



Prof Omar Al Jarrah, President of Jordan University of Science and TEchnology

Prof. Omar Al-Jarrah is currently the President of the Jordan University of Science and Technology. He is a professor and founder of Faculty of Computer Engineering in the department of Computer Engineering. Prof. Al-Jarrah hold Ph.D. in Electrical and Computer Engineering from Ohio State University. He held several academic positions including President of Amman Arab University, Vice president of JUST, Dean of the Faculty of Computer and Information Technology, Director of the

Computer and Information Center and Assistant President for ICT Dr. Professor Omar is currently conducting research in the Intelligent Systems, Robotics, and Computer Networks areas.



Keynote session



Keynote 1: HE DR. HAZIM EL-NASER

HE Dr. Hazim El Naser is currently the Minister of water and Irrigation for the second time since March 2013. HE worked in developing the long term vision of Jordan's Water and Agriculture Sectors and associated policies. He has initiated several strategic regional water projects like the Red-Dead Water Conveyance project, Wadi Arab Water Supply Projects, Shiedieyh-Hasa water conveyance project and witnessed the full operation of the Disi water conveyance project which is supplying the most water stressed governorates of Jordan. HE Dr El Naser earned his Post-Doctorate studies in Environmental

Economics and Policy Analysis from Harvard University-USA in 1996. PhD from the Technical University of Munich and Würzburg-Germany in Groundwater Resources in 1991. MSc in Hydrology from the University of Jordan-Jordan in 1987 and BSc Hydrology from the University of Jordan-Jordan in 1985. HE published more than 55 scientific papers in the field of water, sanitation, irrigated agriculture and environment, and a BOOK on "Management of Scarce Water Resources in the ME (2009), WTI Press, UK. Recently, HE initiated a bundle of fast track projects to absorb the shock of the Syrian refugees which resulted in a sudden rise of water demand in the country. HE played a key role in the sector reform and amendments to the Water Authority laws and legislations for water resource protection and control of illegal violations on water infrastructure which resulted in controlled abstraction of the precious groundwater resources.



Keynote Speaker: Dr. Theib Y. Oweis

Dr. Theib Y. Oweis has been Director of the Integrated Water and Land Management Program of the International Center for Agricultural Research in the Dry Areas (ICARDA) since 1991. As of 1st April 2017, Dr. Theib Oweis returned to ICARDA as the Acting Director. Dr. Oweis had joined ICARDA as an Irrigation and Water Management Scientist in 1991, worked in several capacities as scientist, principal scientist, research team leader, research manager and a Director of IWLMP. After retirement end of 2015, Dr. Oweis continued providing his expertise to

ICARDA while holding a position of Distinguished Guest Professor at the International Platform for Dryland Research and Education (IPDRE) of Tottori University in Japan. He holds an MSc and PhD degrees in Agricultural and Irrigation Engineering from Utah State University, Logan, Utah, USA in 1979-1983, and BSc in Agriculture from Aleppo University in Syria in 1968-1972. He is the author of more than 200 publications in the areas of water use efficiency/productivity, supplemental irrigation, water harvesting, salinity and optimization of water use in agriculture and management of scarce water resources in dry areas.



Keynote Speaker: H.E Prof. Muhammad Shatanawi

Muhammad R. Shatanawi is Professor of Water Resources and Irrigation, UNESCO Chair in Hydrology and Ex-Minister of Water and Irrigation in the Hashemite Kingdom of Jordan. Dr. Shatanawi has had a distinguished career as a minister, professor, scientist, researcher, decision maker and policy advisor in the area of water resources and environment. He has more than thirty years of diverse and wide experience domestically and internationally in hydraulic engineering, water resources management, water and agriculture policy, irrigation systems design, hydrology of arid areas and water desalination. The

results of his research and other work experience have had a measurable impact on policy development, improving water use efficiency, water quality and environmental quality in Jordan.



First International Conference **Water Management In Arid Land & Semi-arid Land** New Perspectives And Innovative Approaches

Program overview

Day / Date	Time	Session
Arrival Day 7/10/2017	19:00 - 21:00	Arrival of participants to the hotels Welcoming reception at Sedrh Hotel
First Day 8/10/2017		
First Day 8/10/2017	Time	Session
	8:00 – 9:00	Registration
	9:00 – 10:15	Opening Session: Welcome speech form - Prof. Majed Abu-Zreig, Conference Chair - Prof. Omar Al-Jarrah, JUST President - HE Prof. Adel AlTweisi, Minister of Higher Education and Scientific Research - HE Prof. Hazim El-Naser, Minister of Water and Irrigation
	10:15 – 10:45	Coffee break
	10:45 - 11:30	Keynote speech Prof. Muhammad Shatanawi, Ex-Minister of Water and Irrigation
	11:30 – 13:30	Session 1 (7 presentations)
	14:00 – 15:00	Lunch
	15:00 – 17:00	Session 2 (6 presentations)
	17:00 – 20:00	Tour and Dinner at the historic city Umm Qais
Second Day 9/10/2017		
Second Day 9/10/2017	9:00 – 10:00	HE Prof. Theib Oweis Director of ICARDA
	10:30 – 11:00	Coffee break
	11:00 - 13:00	Session 3 (7 presentations)
	13:30 – 14:30	Lunch
	14:30 – 16:30	Session 4 (7 presentations)
	17:00	Leave to hotel in Irbid by bus from campus
	18:30	Leave to JUST from hotel by bus
	19:00 – 22:00	Dinner at JUST
Third Day 10/10/2017		
Third day 10/10/2017	9:00 – 11:00	Session 5 (6 presentations)
	11:00 - 11:30	Coffee break
	11:30 – 13:30	Session 6 (6 presentations)
	13:30 – 14:30	Lunch
	14:30 – 15:30	Closing session
	13:00 – 20:00	Dinner and tour at Historic City of Jarash/ Leave from campus
	21:00	Return to hotel in Irbid



LIST OF PRESENTATIONS

Paper Title	Presenter
Session 1	
A Project-Based Approach to IWRM for Small Communities in Developing Countries	Robert Houghtalen
Application of colloid and Nano materials in wastewater treatment	Abeer Al Bawab
Evaluation of phytoremediation potential of callus cultures of Lantana camara LINN. In vitro grown in heavy metals contaminated media	Tamara Al-Qudah
Understanding Water Scarcity in Arid Regions: A Critical Discourse Analysis of Water Scarcity in the Case of Jordan	Hussam Hussein
The Role of Subsurface Water Retention Technology (SWRT) on Water Saving and Increasing Water use Efficiency and Crop Yields Highly Soils Under Arid Climate in Iraq	Mahdi Aoda
Effect of Some Chemical Factors on Production of Pentacyclic Triterpenoids In Callus and Cell Suspension Culture of Lantana Camara L.	Rida Shibli
Spatial Assessment of Hydrogeological Characteristics of Watershed Using Well Records	Salahu Hamza
Water Resources Management Using Modeling Tools in Desert Regions / Jordan	Mo'ayyad Shawagfeh
Examining the Feasibility of Water Harvesting from the Air Humidity in the South of Sistan and Baluchestan Province in Iran	Peyman Mahmoudi
Session 2	
Removal of Heavy Toxic Metals from Wastewater by Adsorption Onto Nano Kaolinite Clay: Equilibrium and Thermodynamic of Adsorption	Akl Awwad
Climate Change Adaptation Efforts in Jordan	Nizzar Al Hammouri
Arid areas and water resources	Khaldoon Al-Qudah
Biochar Produced from Rice Husk and Rice Straw as a Green Technology for Treating Municipal and Industrial Wastewater	Bassim Abbasi
Comparative life Cycle Analysis of Onsite Wastewater Treatment	Bassim Abbasi
Monitoring and Diagnosis of Wastewater Treatment Plants Using a Software Tool: a Case Study of Ain Defla in Algeria	Cherifa Abdelbaki
Spatial temporal analysis of TRMM satellite data to estimate meteorological drought index in Iran	Majid Kazemzadeh
Impact of water harvesting generated under different types of Polyacrylamide Polymer (PAM) on growing of Acacia trees in arid soils	Naji Al-Mefleh
Exploring Stakeholder Decision Practices During Azraq Wastewater Treatment Plant Startup	Heta Kosonen



Paper Title	Presenter
Session 3	
Investigating the Impact of Upgrading AsSamra Wastewater Treatment Plant on Water Quality of King Talal Reservo	Ayat Hazaymeh
Green Wall Treatment	Carsten Riechelmann
The Pollution of the Sea Water by the Waste from the L.N.G. Plant Arzew-Algeria and the Wastewater Purifying System	Menouar Hanafi
Excess Sludge Reduction Using Oxidic Settling Anoxic Process	Reem Hammouri
Climate Change Adaption in Arid Lands	Fayez Abdullah
Modeling Sludge Drying Bed Dewatering Processes in a Temperature Climate	Osvaldo Moiambo
Risk Assessment Approach for Evaluating the Application of Microbiological Criteria Guidelines for Wastewater Reuse in Agriculture in Developing Countries	Helmi Al Zanfaly
Framework for Sanitation Safety Plan for Relaimed Water Use in Agriculture	Maha Halalsheh
Improving the Efficiency of Rain Water Harvesting system for Irrigation using IoT	Arwa Khatatbeh
Session 4	
Determination of Irrigation Depths using a Numerical Model and Weather Forecast	Haruyuk Fujimaki
Parasitic Infection Among Farmers Dealing With Treated Wastewater In Al-Zaitoun Area, Gaza City	Haneen Al-Sbaihi
Variability in Fruits Characters of Moroccan Landraces and Commercial Watermelon (Citrullus lanatus) Cultivars Under Water Stress	Said el Madidi
Marginal Water Resources Use for Resilient Agriculture and Food Security (with reference to center Asia)	Temur Khujanazarov,
Assessment of Wadi Hydrological Processes by Using Modeling Under Semi-Arid Environment in Sudan	Ruaa abdelbasit
Drinking Water (Ground and Surface) and Liver Disorders	Raafat Abdeldayem
Numerical Models of Ancient Terraces, What Can We Learn?	Qasem Abdelal
Growth and Yield parameters of Sunflower under Different Levels of Saline water	Hamzeh Rawashdeh
Application of Remote Sensing in Desertification	Razan Malkawi



Paper Title	Presenter
Session 5	
Parasitic Contamination of Soil Samples in Treated Wastewater Irrigated Plots in Al-Zaitoun Area	Haneen Al-Sbaihi
Effect of Olive Mill Wastewater (OMW) Application on Soil Properties, and Plant Growth Performance Under Rainfed Condition	Osama Mohawesh
Characterization of Organic Matter in Soils Along a North South Transect in Eastern Algeria (Souk Ahras Tebessa)	Zanache Habiba
Water Resources Management in Jordan	Weam Mahdawi
Possibility of the Estimating and Improving Surface Runoff Amount Using the Soil Sorptivity and Soil Water Repellency in Samburu	Fumio Watanabe
Drinking Water (Ground and Surface) and Liver Disorders	Raafat Abdeldayem
Session 6	
A Quality Approach for Managing the Water Distribution Network of the Tlemcen Urban Cluster in Algeria	Cherifa Abdelbaki
The Soil Water Relationship in the Basin of the Tiffech Souk-Ahras Dam Algeria Soil Water Management	Mohamed Benslama
Education for Sustainable Development in Elementary and Secondary Schools: A case Study from Jordan	Rana Ardah
Water Governance and Integrity Risk Assessment for Water Section in Jordan	Manal Al-Shraideh
Statistically Downscaling Precipitation and Temperature for a Semi-Arid Trans-Boundary Basin under SRES and RCPs Scenarios Using SDSM	Alham Al-Shurufat
Water Requirements of the Jordanian Nuclear Power Plants	Tasneem Tawalbeh



ABSTRACTS

Investigating the Impact of Upgrading As Samra Wastewater Treatment Plant on Water Quality of King Talal Reservoir. Authors: Ayat Hazaymeh and Esraa Abdelall

In June 2007, the operation of the upgraded As Samra wastewater plant was started, where the old system that relied on natural treatment was replaced by mechanical treatment. Due to the fact that the As Samra treated water is one of the main source that fed King Talal Reservoir (KTR), this paper aims to understand the effect of upgrading As Samra wastewater treatment plant on water quality of King Talal Reservoir at three sampling points along the reservoir. The water quality data collected over a fifteen-year period, Jan.2001 to Dec.2016, were used. The data were divided into two groups; before As Samara upgrading and after As Samra upgrading. Then, a statistical analysis of water quality data, mainly, Ammonium ($\text{NH}_4\text{-N}$), Nitrate ($\text{NO}_3\text{-N}$), Total Nitrogen (TN), and Total Phosphorus (TP) was implemented. Results showed that As Samra upgrading improved the water quality, where significant reduction $\text{NH}_4\text{-N}$, TP and TN, and a significant increase $\text{NO}_3\text{-N}$, concentration level were noticed. Findings proved the effectiveness of As Samra wastewater treatment plant on enhancing the quality of the water in the KTR, consequently reducing environment deterioration.

Evaluation of phytoremediation potential of callus cultures of *Lantana camara* LINN. *In vitro* grown in heavy metals contaminated media. Authors: Reham Tahtamouni, Rida Shibli, Laila Younes, Saida Abu-Mallouh, and Tamara Al-Qudah

Lantana camara Linn. is a flowering plant that has recently attracted the attention of researchers due to its novel phytoremediation powers against some heavy metals. In this study, phytoremediation potential of *Lantana camara* callus was assessed *in vitro* by measuring the actual accumulation of different levels (0.0, 0.12, 0.2, 0.3 mg/L) of either Chromium (Cr), Lead (Pb), or Cadmium (Cd) in callus. Also, the effect of these heavy metals on growth and survival of the callus cultures was investigated. Callusing was induced successfully from leaf discs grown on MS media plus (2.0 mg/L) of 2,4-dichlorophenoxy acetic acid (2,4-D), while callus multiplication was maximized in MS media supplemented with (2.0 mg/L) 2,4-D plus (1.0 mg/L) Kinetin. In heavy metal experiments, callus growth and quality were found to decrease in response to adding heavy metals to the media at all levels. Meanwhile, all callus cultures recorded full survival rates (100%) by the end of the experiments and resumed growth after being transferred to normal growth conditions. Also, the maximum amounts (0.096, 0.109, 0.0193 ppm) of Cr, Pb, and Cd, respectively were found in callus cultures pregrown on MS media supplemented with (0.3 mg/L) of each heavy metal type. Meanwhile, maximum Biological Absorption Coefficient (BAC) values (0.41, 0.6, 0.30) were recorded in callus cultures pregrown on media with (0.12 mg/L) of either Cr, Pb, or Cd, respectively. More work is still needed to improve BAC values obtained in *Lantana camara* callus cultures to be used as a platform for massive production of hyper accumulator plants against these contaminants.

Understanding Water Scarcity in Arid Regions: A Critical Discourse Analysis of Water Scarcity in the Case of Jordan. Author: Hussam Hussein

Considering Jordan as a case study, this paper is pioneering the social issue of water scarcity, investigating it through a critical discourse analysis. It aims at unpacking the discourse of water scarcity, identifying the actors, interests and ways in which contested framings of the discourse of water scarcity are constructed. Only by understanding the power struggle around and within the discourse, this paper will be capable of investigating the suggested solutions to the issue of water scarcity, showing the



interests behind each solution, who benefits and why. In this way, it will show how different framings of the issue of water scarcity drive towards different solutions to what is framed as a problem of water scarcity. What emerges from this analysis is the presence of the competing narratives of physical water scarcity and of socio-economic water scarcity, blaming, respectively the limited water resources and the mismanagement of the water resources. These framings drive towards mega-projects and engineering solutions versus market oriented or conservation oriented solutions. In so doing, with a social sciences approach, this research contributes with empirical findings to the literature on transboundary water management in the Arab region, pushing the boundaries of the literature in social transboundary water management.

The Role of Subsurface Water Retention Technology (SWRT) on Water Saving and Increasing Water use Efficiency and Crop Yields in Highly Saline Soils Under Arid Climate in Iraq. Authors: Mahdi I Aoda, Alvin Smucker

This work was conducted to evaluate the use of Subsurface Water Retention Technology (SWRT) in sandy soils of Iraq and its effect on water productivity and yield of two vegetable crops. Field experiments were carried out in greenhouses during the spring seasons of 2014 and 2015 at two different locations in Iraq (Diyala and Najaf). Soil texture of both locations was sandy loam. Trials included four treatments arranged according to randomized complete block design "RCBD" with four replications. Treatments included were SWRT, organic fertilizer (OM), no-tillage (NT) and tillage (T) farming applied on tomato and chili pepper crops. Amounts of irrigation water and Irrigation times were determined on basis of 50-55% depletion of available water and hence water was applied up to soil field capacity. Irrigation need was determined by soil moisture content measured by 5TE and GS3 soil moisture sensors at three depths (0.15, 0.30 and 0.45 m). All plant growth and production parameters were measured for both crops. Some nutrient elements in soil and plants were also measured. The results showed that the depths of irrigation water used for tomato were 253.7, 424.7, 439.7 and 439.7; 301, 476.3, 492.5 and 492.5 mm Season⁻¹ for SWRT, OM, NT and T, respectively, at Najaf and Diyala locations, respectively. While for chili pepper depths were 346.2, 445.6, 543.8 and 543.8; 337.9, 582.4, 693.4 and 693.4 mm. Season⁻¹ for SWRT, OM, NT and T treatments at Najaf and Diyala, respectively. Total tomato fruit yields were 8.41, 6.66, 6.57 and 5.68; 9.81, 9.11, 9.04 and 8.51 mt house⁻¹ for SWRT, OM, NT and T treatments, respectively at Najaf and Diyala locations, respectively. For chili pepper fruit yields were 6.21 and 5.78 and 5.17 and 5.49; 13.56, 11.35, 11.82 and 10.42 mt house⁻¹ for SWRT, OM, NT and T treatments respectively at Najaf and Diyala location, respectively. SWRT gave the best field water use efficiency (WUE_f) for tomato at Najaf and Diyala location amounted to 7.87 for SWRT compared to 3.72, 3.55 and 3.07; 7.54 compared to 4.54, 4.36 and 4.09 kg m⁻³ as they were for SWRT, OM, NT and T, respectively. For chili pepper SWRT gave the best value of WUE_f for chili pepper at Diyala location amounted to 16.65 compared to 8.09, 7.08 and 6.24 kg m⁻³ for SWRT, OM, NT and T treatments, respectively. WUE_f for chili pepper at Najaf location were 3.72, 2.69, 1.97, and 2.09 kg m⁻³ for SWRT, OM, NT and T, respectively. SWRT treatment improved plant morphological characteristics even though half amount of water and fertilizer was applied. The results showed that SWRT was superior on other treatments (OM, NT and T) at both Najaf and Diyala locations for all growth and production parameters studied. On another two-season experiment with corn a greater performance of SWRT was obtained in saving irrigation water and increasing WUE and yields.



Effect of Some Chemical Factors on Production of Pentacyclic Triterpenoids In Callus and Cell Suspension Culture of *Lantana Camara* L. Authors: Anfal AL-Ashoush, Rida Shibli, Reham Tahtamouni, Tamara Al-Qudah.

Lantana camara L. is a flowering ornamental plant with high medicinal value due to the presence of several active chemical compounds such as, pentacyclic triterpenes, alkaloids, steroids and flavonoids. The objective of this study was to study the effect of some chemical factors (growth regulators, carbon sources, NaCl, and heavy metals) on fresh weight and production of Betulinic and Oleanolic acids in callus and cell suspension cultures. To study the effect of plant growth regulators on fresh weight and production of Betulinic and Oleanolic acids in callus cultures, plant material was exposed to different concentrations of either Kinetin in combination with 2.0 mg/L (2,4-D) or Thiadiazuron (TDZ). The highest callus fresh (8.78 g) was observed in callus grown in medium containing 1.0 mg/L kinetin in combination with 2.0 mg/L 2,4-D, while maximum amounts of oleanolic and betulinic acids (2.167% , 6.73%) were extracted from callus cultures grown on MS media supplemented with 0.5 mg/L TDZ. Moreover, data obtained from carbon source experiment revealed that, adding elevated levels (0.2 or 0.3 M) of either sucrose, glucose or fructose caused a reduction in callus fresh weight and quality. Meanwhile, 0.3 M glucose enhanced the production of oleanolic and betulinic acids to reach a maximum of (1.618, 15.238%) respectively. In NaCl experiments, elevated concentrations of NaCl resulted in a significant reduction in callus fresh weight, while NaCl at level of (160 mg/L) induced the production of oleanolic (0.823 %) and betulinic acids (2.476%). Meanwhile, data recorded from heavy metals experiments showed that, the maximum production of oleanolic (0.835%) and betulinic acids (8.960 %) was obtained in callus cultures grown on MS medium supplemented with 0.08 mg/L chromium. In cell suspension culture experiments, only treatments that yielded the best fresh weight results in callus experiments were applied in cell suspension culture experimental part. MS media supplemented with 1.0 mg/L kinetin and 2.0 mg/L 2,4-D resulted in the highest cell fresh weight (1.7 g), packed cell volume PCV (8.8 %) in addition to maximum production of oleanolic and betulinic acids (0.499, 0.014 %) respectively. Moreover, the results revealed that the best carbon source and level for cell maximum fresh weight in addition to oleanolic and betulinic acids production was 0.1 M sucrose. In heavy metals experiments, application of 0.08 mg/ L of cobalt to the media resulted in the maximum cell fresh weight (1.97g) and oleanolic acid production (0.705%) compared to the control and the other heavy metals types at similar level. Meanwhile, adding 40 mg/L NaCl to the media reduced cell fresh weight in addition to production of betulinic and oleanolic acids in cell suspension culture compared to the control treatment.

Spatial Assessment of Hydrogeological Characteristics of Watershed Using Well Records. Authors: Salahu Hamza, A Ahsan, A A Musa, S A Salisu, M B Ibrahim.

For proper management of groundwater resources, accurate estimation of groundwater hydrogeological characteristics is exceptionally central. Particularly in arid and semi-arid parts of Africa where the main water source is groundwater, which prospectively makes the region liable to depletion based on the impending climate changes. This study represents an approach for the characterization of a complex aquifer system within a watershed. It entails the use of completion borehole report data from 1000 wells spread across Kano, Nigeria. The report data were digitized and analyzed in ArcGIS. Fractured zones were delineated, and other hydrogeological parameters such as specific capacity, transmissivity, hydraulic conductivity, and recharge were assessed. The aim of this study is to address part of the contemporary problems tormenting the practice of hydrogeology owing to the absence of hydrogeological base maps and poor knowledge of geology in the study area. It was found that the average transmissivity of the wells within the watershed is 36.75m²/day. The mean specific capacity is



8.54m²/day. Hydraulic conductivity (saturated) is characteristically 1.35m/day, and the average recharge within the watershed is 0.14m/year.

Examining the Feasibility of water harvesting from the air humidity in the south of Sistan and

Baluchestan Province in Iran. Authors: Peyman Mahmoudi, Chakavak Khaledi, and Mohammad Fanodi

Providing water for people in arid and semi-arid areas of the world is of great significance. Among the methods that can help provide a small part of the water required by residents of these areas, arid ones in particular, is the technology of water extraction from air humidity. This technology refers to any type of process whereby atmospheric water vapor is condensed and collected. In order to examine the feasibility of water harvesting from air humidity (as a new technology) to provide water for the residents of South-East of Iran, at first the data of Chabahar station about vapor pressure, relative humidity and precipitation was received for a period of 20 years (1991-2010) from Iran Meteorological Organization. These three parameters were used for the theoretical calculation of the amount of water harvesting from air humidity in the South East of Iran. But for the practical calculations of the amount of water harvesting from air humidity, a screen collector with dimensions of 1×1 m was designed and implemented. The amount of water harvesting from this collector was daily monitored for a period of 365 days (from 23 September 2011 to 22 September 2012). The results of this study indicated that due to relatively high average humidity, the southeastern coasts of Iran are suitable for conducting extraction projects in order to harvest water. The average amount of water available in one cubic meter of air in the studied area was 29 grams in the most humid time and 1.8 grams in the driest time. However, given that water extraction depends on different conditions and even at best, all the humidity cannot be collected, field experiments and data analysis were done to determine that approximately 20% of the water available in the air can be extracted in this area. Based on this threshold, therefore, the most amount of extracted water, that is, 8.6 l/m³ a day belongs to May and the least, namely, 1.1 l/m³ a day belongs to January.

Removal of Heavy Toxic Metals From Wastewater By Adsorption Onto Nano Kaolinite Clay: Equilibrium And Thermodynamic of Adsorption. Authors: Nidá Salem, Amany Abdeen, Akl Awwad

In this paper, Nano kaolinite clay used as adsorbent to remove heavy toxic metals [Cr(VI), As(V), Pb(II), Zn(II), Cd(II)] from industrial wastewater. Nano kaolinite clay is prepared from Jordanian raw kaolin clay by a chemical method to be an efficient adsorbent for the removal of toxic metals from industrial wastewater. The effects of solution pH, adsorbent dose, initial metal concentration, contact time, and temperature on adsorption process were studied. Thermodynamic analysis revealed that the negative values of ΔG° and the positive values of ΔH° , the adsorption process was spontaneous and endothermic. The Langmuir isotherm model is the best-fit model to predict the experimental data and adsorption capacity was found 70.42 mg/g, for Cr(VI), 66.5 mg/g for As(V), 64.23 mg/g for Pb(II), 62.22 mg/g for Zn(II) and 58.54 mg/g for Cd(II). Nano kaolinite clay confirmed its ability as an efficient and eco-friendly adsorbent for removal heavy toxic metals from industrial wastewater.

Biochar produced from rice husk and rice straw as a green technology for treating municipal and industrial wastewater. Authors: Faisal Shahin, Ramesh Rudra, Bassim Abbassi, Shiv Prasher.

Biomass is increasingly produced in an amount that poses environmental burdens because of the increasing cost of disposal. Recently, several investigations were dedicated to transfer these wastes into useful products. In this research, rice husk and rice straw were processed to produce biochar. The



purpose of this project is to investigate the effectiveness of both rice husk and rice straw biochar produced under different pyrolysis reaction conditions in treatment of wastewater containing heavy metals (lead, cadmium, copper, chromium, iron and zinc) and endocrine disrupters (estrone, estradiol, progesterone, ibuprofen, oxyvet, and bisphenols). A continuous laminar flow adsorption columns were used to study the performance of biochar adsorption at different flow rates (1, 2, 4, and 10 mL/min). The adsorption columns were fed by synthetic wastewater that was prepared to resemble wastewater quality usually found in urban areas. Samples at different time intervals were analyzed for organics, heavy metals, and endocrine disrupters. The results showed that the adsorption performance was greatly influenced by the type of biochar. It has been found that biochar produced at elevated temperatures resulted in an increase in adsorption capacity of about 35% for each 150 °C temperature increase. Flow rate was found to be a decisive factor in adsorption. Conspicuous decrease in heavy metals, hormones, antibiotic and bisphenols concentrations was achieved at flow rates of 1, 2, and 4 mL/min. However, no significant adsorption was noticed over the entire experimental period at the flow rate of 10 mL/min. This is mainly attributed to the turbulent character of intrinsic pore velocity at higher flow rates. A breakthrough point at $C/C_0 = 0.9$ (ratio of concentration at any period of time to initial concentration) was set as an indicative of adsorption capacity. Rice husk and rice straw biochars showed similar pattern of adsorption, however, with favorable adsorption and increased capacity for rice straw. The first phase of this investigation program inferred that biochars has a considerable potential to be used in wastewater treatment in both primary and post secondary treatment stages.

Comparative life cycle analysis of onsite wastewater treatment. Authors: Kayla Schmidt, **Bassim Abbassi.**

Current methods used in Canada and other developed countries for evaluating the consequences of wastewater treatment systems are based on economic and environmental criteria. This evaluation only takes into account the direct effects of treated effluent on receiving waters or soils; in which the indirect and cumulative environmental effects are often neglected. A life cycle assessment (LCA) evaluates the potential environmental impacts associated with all stages of a product, process or service's life. By compiling an inventory of essential materials, energy, and emission inputs and outputs, a cradle-to-grave assessment (i.e., from raw material extraction to final disposal) allows for cumulative and indirect environmental effects to be accounted for. These impact results can be used for both environmental and socio-economic purposes such as a cleaner production of products, reducing energy costs, and minimizing waste. The focus of this LCA work is to compare and analyze various onsite wastewater management systems, also known as septic systems, using SimaPro, the world's leading LCA software. Under the Ontario Building Code, there are five general septic systems; conventional leaching beds, shallow buried trench, sand filter bed, type A dispersal bed, and type B dispersal bed. Each system is primarily composed of septic tank and a leaching bed. The functional unit for this study was a four bedroom, 240 m² house, with a residential discharge flowrate of 2,000 liters per day for a lifespan of 25 years. The European impact assessment ReCiPe was used to evaluate the environmental effects from cradle-to-grave. Each onsite system was evaluated based on damage to human health, ecosystems, and depletion of resources. Overall, the conventional leaching bed system had the largest environmental impact, with a single score impact (the total environmental load) of 896 Pt. Additionally, the shallow buried trench system had the second largest single score impact of 443 Pt, followed by the type B and type A dispersal, and the filter bed with single score impacts of 439, 364, and 204 Pt, respectively. On the flip side, a life cycle cost analysis favoured conventional septic systems and pushing back the systems with tertiary treatment (i.e. shallow buried trench and type B dispersal bed). Generally, it can



be concluded that LCA is a vital tool in wastewater management decision-making for reducing environmental impacts.

Monitoring and diagnosis of wastewater treatment plants using a software tool: A case study of Ain Defla in Algeria. Authors: Abdelhakim Kellouche and Chérifa Abdelbaki.

A new software platform was assessed for process monitoring and diagnosis of a domestic wastewater treatment plant using Ain Defla in Algeria as a case study. In particular, the effectiveness of the tool was determined for analyzing large amounts of data from the activated sludge purification station as well as for making appropriate recommended operating commands to fix the process resulting from malfunctions. Ten (10) parameters are analyzed by using this tool: Six (06) parameters related to the process and four (04) parameters related to the electrical energy required for waste water treatment. To have a reliable diagnostic tool allows at any time, to check the status of the operation process of WWTP something that was, until now, a very difficult and tedious task. The WWTP of Ain Defla has been selected to illustrate this approach. The results are promising.

Spatial temporal analysis of TRMM satellite data to estimate meteorological drought index in Iran.

Authors: Ali Salajeghe, Majid Kazemzadeh, Javad Akbari.

One of the most important challenges in last century was drought and monitoring and assessing drought severity and duration to combat and mitigate its impacts is very necessary. In recent decades, with developing of remote sensing issues, satellite based-estimating drought indices with high spatial resolution and different time steps were widely used. Hence, the aim of this study is focused on the analyzing drought and error distribution of TRMM satellite data-based estimation with ground data over the period of 1998 to 2014. In this regard, in order to assess the accuracy of meteorological drought index based on the TRMM satellite data, the 41 synoptic stations were used in Iran. In this study, error assessment criteria were included NSE, RMSE, ME, Bias and correlation coefficient and also the IDW interpolation method in software Arc GIS 10.3 was used to spatial analysis. The results of drought index showed that in terms of severity, Kerman, Bushehr, Kashmar, Ghazvin, Bojnurd, Kashan stations have suffered from at least one extreme status for 1998 to 2014 and in terms of frequency, the most frequent drought was in Karaj station among the stations. The results of spatial analysis of error criteria showed that the drought index estimated by TRMM satellite had the lower error in northeast of Iran (around Mashhad and Kashmar stations) and southwest of Iran (around Shahrkord, Esfahan, Yasouj, and Shiraz stations) while the most error were in central region of Iran (around Biarjomand, Tabass stations), respectively. In the most area of the country, drought index estimated by TRMM data had acceptable agreement with ground stations data. And calibrating the TRMM data with ground stations can be used for drought monitoring in areas which without having stations for networks 0.25*0.25 latitude and longitude degrees.

Exploring stakeholder decision practices during Azraq wastewater treatment plant startup. Authors: Heta Kosonen, Heidi Gough, Amy Kim, Muna Abu-Dalo.

Azraq refugee camp in Jordan is among the first in the world to have an advanced wastewater treatment plant (WWTP) on-site. The modular WWTP was first started as a moving bed bioreactor (MBBR) process in January 2016. After four months of, the plant was re-configured and re-started as a denitrificationnitrification process in May 2016, and eventually returned to its original set up during third startup in August 2016. This study followed the Azraq WWTP project from January 2016 to



September 2016 and explored stakeholder decision practices in WWTP management and operation. The mixed method research approach paired water quality data from different process stages with stakeholder interviews to identify and understand factors that contributed to stakeholder decisions during crisis response. The findings of this study showed that while stakeholders use process observations and water quality data in their decision-making, their decisions were also influenced by a number of non-technical concepts, such as prior experience, dedication to succeed and ability to share ideas effectively with others. Furthermore, they suggest that WWTP delivery can be improved when all stakeholders share understanding of the capabilities and limitations of the technology, know how to communicate effectively and inclusively, and are prepared to improvise decisions under uncertainty. The results can be applied to prepare WWTP construction and operation teams for future emergency response situations as well as to any other wastewater treatment projects that take place in harsh environmental conditions and with limited access to resources.

Green Wall Treatment. Author: Carsten Riechelmann

The result of a cooperation between Water Engineering and Energy Engineering Departments of Campus El Gouna is the presented grey-water or wastewater treatment system that contributes to the cooling of buildings while feeding urban agriculture systems in a facade greening structure. It was developed at the Egyptian branch of TU Berlin for the general climatic conditions of arid regions. Since 2016 four systems had been built in Egypt, Germany and Jordan. The one in El Gouna is in operation since March 2017 while being monitored by an S::canTM online sensor set for the sewage parameters and a raspberry PI system for temperature, humidity and flow. A stable temperature difference of 10 - 12 degree between the treatment column and the environment and an effluent quality of BOD₅ <30 mg/L and COD <100 mg/L could be observed. As this complies with Egyptian and Jordanian reuse standards for e.g. fruit trees or dry crops the reuse for urban agriculture is possible.

Modeling sludge drying bed dewatering processes in a temperate climate. Authors: Oswaldo Moiambo, Eleonora Lamprea, Filipa Ferreira, José Matos.

In recent years, the problem of modeling the wastewater sludge dewatering processes in sand drying beds has gained considerable relevance and is considered of particular interest in developing countries. This paper reports the development of a sludge drying bed dewatering processes model. Through mass and heat balance approaches the mathematical model is used to predict the solid content of sludge along time. The efficiency of the proposed model was validated under different weather conditions, using data collected in a pilot installation set in a Portuguese wastewater treatment plant. Field experiments were performed from September 2016 to June 2017. Model predictions were generically consistent with the experimental data. The model, which is still under further development, is considered particularly interesting to design and manage sludge drying beds in arid and semi-arid regions.

Risk Assessment Approach for Evaluating the Application of Microbiological Criteria Guidelines for Wastewater Reuse in Agriculture in Developing Countries. Author: Helmy El Zanfaly

The use of wastewater in agriculture is a possible strategy for addressing problems of water scarcity and nutrient deficiency, beside environmental protection. Municipal wastewater composition varies over time, sites, regions and socio-economic levels of the residential communities. Various municipal wastewater treatment technologies are available and developed. Treatment objectives and properties



as well as the available investment resources have to be considered in the choice of the appropriate treatment technology. The marginal costs of wastewater treatments required to comply with the microbiological guidelines for unrestricted irrigation are very high especially in many low-income developing countries. Decisions taken regarding wastewater management strategies are a process of balancing costs and effectiveness across these two objectives. To reach the decision on which guideline is appropriate, a study aimed to develop risk assessment/cost-effective approach based on mathematical models and experimental data is necessary. The additional health benefit that might result from further risk reduction gained by adhering to the more restrictive regulations should be significant in relation to the major additional costs associated with the expensive technology required to treat effluent to such a rigorous standards.

Framework for sanitation safety plan for reclaimed water use in agriculture. Authors: Maha Halalsheh, Ghada Kassab, Khaldoun Shatanawi, Munjed Al-Shareef.

Although WHO had established guidelines for use of wastewater in irrigation since 2006, such guidelines were not adopted by most countries due to difficulties in implementation. A critical step for rendering such guidelines applicable is the development of a detailed implementation plan, which had been recently recognized as Sanitation Safety Plan (SSP). The plan shall ultimately define roles and responsibilities of different authorities in the whole process. A manual that presents a step-by-step guidance for the development of the SSP was recently published (WHO, 2016). As a pre-step for development of a detailed SSP, a framework might be necessary. The framework may serve presenting general roles and responsibilities associated with implementation process to different authorities for their feedback and approval before investing in a detailed SSP. This paper will introduce what is meant by sanitation safety planning and its framework and will further present example from Jordan where a framework was developed and consulted with different authorities. Jordan has an advanced experience in reclaimed water use in irrigation stemming from the high demand for managing its extremely limited water resources. Accordingly, the country recently had issued guidelines JS 1766: 2014 that adapt the WHO (2006) wastewater management approaches with an attempt for full utilization of resources. The new guidelines would allow use of reclaimed water for unrestricted irrigation. Restrictions were shifted to agricultural practices that are believed to guarantee a produce complying with issued standards. For best adoption of the new standards, a framework for SSP was developed as a pre-step of detailed implementation plan.

Improving the Efficiency of Rain Water Harvesting system for Irrigation using IoT. Authors: Arwa Khatatbeh, Han Mooyoung.

Green Roof is gaining much interest for its social benefits such as creating the aesthetic and green environment as well as its climate change adaptation capabilities such as flood mitigation and heat island reduction. Hence the importance of developing rainwater harvesting system is to cover the requirement of green roof irrigation. This development has employed the internet of things technology (IoT) In this paper, we propose IoT based water monitoring system that measures water level in real-time. Our system is based on the idea that the level of the water can be very important parameter when it comes to increasing the efficiency and stability of a rain water harvesting system especially in arid and semi-arid regions of the world. Using IoT application showed a good result in improving efficiency of rain water harvesting system compare with conventional system usage scenario.



Determination of Irrigation Depths using a Numerical Model and Weather Forecast. Authors: Haruyuk Fujimaki, Iwao Sakaguchi, Vinay Nangia, Theib Oweis.

Effect of a scheme of determining irrigation depth using numerical simulation for crop response to irrigation and weather forecast was tested for wheat cultivation in semi-arid region of Jordan. Drip irrigation system, monitoring system for change in soil water content, and three different treatments (numerically optimized irrigation with this methodology, automated irrigation using solenoid valve, and rainfed) were prepared for the field experiment. Results showed that incomes of the irrigated-treatments predominated over that of the rainfed, while net incomes of the irrigated-treatments were smaller than that of the rainfed. Discrepancy between the numerically simulated soil water content and the measured one appeared, that is, the numerical simulation model overestimated the change in actual soil water content. Both of the decrease in the net income of the numerically optimized irrigation and the overestimated soil water content would result from the underestimated plant properties (drought tolerance, root zone depth) included in the input parameters of the numerical simulation.

Parasitic Infection Among Farmers Dealing With Treated Wastewater In Al-Zaitoun Area, Gaza City. Authors: Haneen Al-Sbaihi, Adnan Al-Hindi, and Khalid Qahman.

Treated wastewater irrigation is associated with several benefits but can also lead to significant health risks. The main objective of this study is to investigate the parasitic infection (PI) among farmers dealing with treated wastewater (TWW) in Al-Zaitoun area- Gaza City. This study included two farmer groups: farmers who dealing with TWW (Mixed water users (MWUs)), and farmers who irrigate by using groundwater (GW) (Ground water users (GWUs)). Each participant was asked to provide stool samples on two phases. The two farmer groups were use GW in the 1st phase while the MWUs were use TWW in the 2nd phase which was after using TWW in irrigation for three months. Prevalence of PI was 30.9% and increased to be 47.3% in the 2nd phase. Negative association not statistically significant (OR= 0.659, CI 0.202-2.153)) was found in the 1st phase, while a positive association not statically significant was found between PI and TWW in the 2nd phase (OR=1.37, CI 0.448-4.21). In this study six parasites species were identified among participants: *Entamoeba "histolytica/dispar and coil"*, *Cryptosporidium*, *Microsporidia*, *Giardia lamblia*, *Strongyloides stercoralis*, and *Ascaris lumbricoides*.

Variability in fruits characters of Moroccan landraces and commercial watermelon (*Citrullus lanatus*) cultivars under Water stress conditions. Authors: Said El Madidi, Fatiha Hakimi.

The aim of this study was to determine the effects of water stress on 9 watermelon cultivars among which five watermelon landraces collected in two localities (rasmouka and zagoura) and four commercial varieties F1. Two irrigation levels were imposed to determine variability on drought tolerance of cultivars. After the true leaves, irrigation treatments were initiated. T1 treatment received full irrigation based on depleted soil moisture in the root zone, T2 treatment received 50 % of T1. The drought tolerance was estimated by the ratio of the value of a trait under the T1 irrigation level and the value of this trait under the T2 irrigation level. For all the characters the mean values recorded in well irrigated conditions were greater than recorded in limited irrigated conditions. The analysis of variance revealed that genotypic differences were highly significant for all characters except TTS. The results show that the modern varieties are more susceptible to the hydric stress than the local landraces and suggest that genotypic variability for tolerance to drought stress exists among Moroccan watermelon cultivars and there is a need to screen a large number of genotypes.



Marginal Water Resources Use for Resilient Agriculture and Food Security (with reference to Central Asia). Authors: Temur Khujanazarov, Kristina Toderich, Dildora Aralova, Shuyskaya, Gismatulina, and Boboev Abdushukurov.

This study is focused on assessment of water and soil quality related to utilization of non-conventional water and plant resources as a part of climate change adaptation measures for the resilient agriculture (rangelands capacity inclusive) in the Central Asian River basins. A combination of field surveys, Lab analysis, GIS-based database and modeling new digital maps of land use, soil-salinity-matrix (SSM), landscape, hydrology and groundwater (including overall water resources and irrigation infrastructure) were generated to understand impacts of non-conventional water use in improving water and food security in the region.

Assessment of wadi hydrological processes by using modelling under semi-arid environment in Sudan. Speaker: Ruaa Abdelbasit.

Khore Abu Fargha is one of the very important seasonal water courses in the Sudan. It brings annually about 10 Mm³. This wadi crosses Gedarif town from Northeast to southwest. The hydrologic evaluation of this Khore is very weak compared with its magnitude and potentialities, in addition to that its flood dangers Gedarif town and its surroundings. Therefore, understanding of the khore flow regime and relationship between rainfall and runoff of the khore become of great importance. The results of the tests and evolutions of the hydrological models show that the IACL rainfall abstraction model and the Snyder's UH runoff transformation model performed well in simulating the rainfall excess and peak discharge by the higher NS values 0.92% for simulation total depth and 0.80% for simulation peak discharge.

Drinking Water (ground and surface) and liver disorders. Authors: Rafat Abdeldayem, Babiker Parsi

Several diseases have been caused by contamination of surface and groundwater. The aim of the present work is to investigate the impact of iron overload in drinking water on liver pathology. Samples of drinking water, blood and true cut liver biopsies were taken from selected inhabitants, who attended in some Dakahlia governorate hospitals. Those inhabitants (16 patients) from Mit-ghamr and Aga districts were suffering from liver disorders (had hepatitis C) and 4 patients had chronic cholecystitis from Mansoura district as control cases. Measurement of iron level in water samples was carried out by the use of an atomic absorption spectrophotometer, analyzed for serum iron level with a micro lab 200 spectrophotometer. The mean value of iron in surface water is lower than the permissible limit of Egyptian ministry of health (EMH) and World health organization (WHO). However, the mean value of iron in groundwater samples is higher than that permissible limit and than those of surface drinking water. Comparison between iron level in drinking water and human blood samples shows positive relationship. The control group depended on drinking surface water and had normal liver function tests, whereas the patient group that depended on drinking groundwater had abnormal values in liver function tests. These data suggest that the polluted iron drinking water is the reason for the liver disorder of the patients. Siderosis was apparent among those patients drinking polluted iron water in comparison to control cases. The siderosis appears to be responsible for resistance to treatment of HCV and progression of fibrosis.



Growth and Yield parameters of Sunflower under Different Levels of Saline water. Author: Hamzeh Rawashdeh

In order to evaluate the effects of using treated wastewater on plant growth, seed, oil yield and yield components of sunflower (*Helianthus annuus* L.) under drip irrigation system, two field experiments were carried out during growing seasons of 2010 and 2011 in land near Ramtha Wastewater Treatment Plant. Both experiments were arranged as randomized complete block design (RCBD) with three replications. for three irrigation treatments i.e., T1= 60% of full irrigation, T2= 80% of full irrigation and T3= 100% full irrigation. Actual crop water requirement (Etc) was calculated based on potential evapotranspiration (ETp) determined from Penman Monteith equation multiply by crop coefficient (kc) of sunflower crop of FAO 56. Between the treatments, two years average showed that 100 full irrigation application of treated wastewater (T3) produced the highest head diameter (226.9 mm), number of seeds head⁻¹ (935), weight of 1000 seeds (92,770 mg), total seed weight head⁻¹ (102,300 mg), plant height (1.56 m), seed yield (3,180 kg ha⁻¹) and oil yield (1,040 kg ha⁻¹). The volume irrigation wastewater was 299.4, 399.2 and 499.0 mm in 2010 and 330.3, 440.4 and 550.5 mm in 2011 for T1, T2 and T3, respectively.

Application of Remote Sensing in Desertification. Authors: Razan Malkawi, Ibrahim Kandah.

Desertification is defined as “land degradation in arid, semiarid and dry sub-humid areas resulting from climatic variations and human activities” (Thomas 1997; Kassas1995; Binns1990). This phenomena started since the second half of the last century. United Nations reports indicate that about 35 millions square kilometers of land are subject to desertification effects. The dry land which is subject to the desertification covers about 90 percent of the Arab world. In these lands concentrate most of the agricultural resources of the Arab world. Hence, desertification is considered one of the most serious environmental problems on a global scale. It affects the dry lands and has strong relations with climatic change and loss of biodiversity. The existing ecosystems in Jordan are fragile and prone to deterioration. The leading causes of land degradation in Jordan are improper farming practices such as over cultivation of the land, over grazing, the conversion of rangelands to crop lands in the marginal areas, where rainfall is not enough to support crops in the long term. Remote sensing technology has been used to help scientists to understand the concepts and to monitor the changes of the earth constituents that take place through time. That is because of the ability of remote sensors to provide a broad and repetitive view of the earth surface.

Parasitic Contamination of Soil Samples in Treated Wastewater Irrigated Plots in Al-Zaitoun Area, Gaza City. Authors: Haneen Al-Sbaihi, Adnan AL-Hindi, Khalid Qahman.

Treated wastewater Reuse (TWW) has potential benefits of meeting water requirements and enrichment soil by organic matter and nutrients, in spite of that soil may also become a reservoir of enteric pathogens and has the potential to transmit many various diseases of enteric origin.

The main objective of this study is to investigate the effect of irrigation with treated wastewater (TWW) on soil parasitic contamination. Soil samples were collected from 55 agricultural plots treated with different irrigation water sources; 36 plot were irrigated by TWW for over a decade, and the other plots (19) were irrigated by groundwater for over a decade (control). The soil samples were taken on two phase; all agricultural plots (55 plot) were irrigated by GW in the 1st phase which was in May, 2016 and (36 plot) were irrigated by TWW in the 2nd phase which was in December, 2016 after using TWW for three months. Prevalence of soil parasitic contamination was 54.5% in the 1st phase and increased statically significant to be 61.5% in the 2nd phase. Negative association not statically significant was



found between irrigation water source and parasitic soil contamination ($OR^{1st} = 0.813$, CI 0.265-2.495) and ($OR^{2nd} = 0.897$, CI 0.28-2.876).

The soil water relationship in the basin of the Tiffech Souk-Ahras dam Algeria Soil water management.

Authors: Mohamed Benslama, Habiba Zanache, Raouf Benslama.

The plain of Tiffech is located to the south west of the city of Souk-Ahras. She constitutes. The starting point of the continental plains. The basin of Wadi Tiffech (Sybouse) is characterized by a severity of natural conditions; A semi-arid climate with torrential rains during autumn and winter periods, dispersed vegetation cover, irregular topography and very steep slopes, low slope, easily accessible terrain, often plowed along the slope, The hydrographic network is quite dense, of which the Wadi Tiffech is the most important. On this Oued a small dam was built with a capacity of 3.90hm³ intended for Irrigation. In terms of agriculture, the geo-morphological configuration of the basin reveals the importance of bovine and fruit crop farming, and a strong dominant role in sheep and cereal production. Intensification of agriculture requires knowledge of soils, as poor cropping practices can influence the structural stability of the soil by promoting Stalinization, soil erosion and soil degradation. Our Contribution to the knowledge of the soils of the Tiffech basin has made it possible to define the fragility of its soils and their aptitude for degradation (physical and chemical). It is imperative to apply sound soil management and adopt good agricultural practices that sustainably protect soil resources.

Effect of olive mill wastewater (OMW) application on soil properties and plant growth performance under rain-fed conditions. Authors: Osama Mohawesh, Husam Al- Hamaiedeh, Samer Qaraleh, Maisaa Haddadin, Doaa Almajali, Abdelraheem Bawalize.

The current study investigated the potential use of olive mill wastewater (OMW) as soil amendments to improve soil and crop productivity as well as to reduce its environmental load. This study also examined the environmental load of OMW application and its relations with other indices of soil quality and productivity of wheat and barley under rain-fed conditions at two sites in Al-Karak District of Jordan. The results showed a significant effect of OMW on most of the measured soil properties compared to the control. The concentration of the measured chemical properties increased with increasing OMW application compared to control. The first season results showed insignificant effect of OMW application on wheat and barley leaf nitrogen and chlorophyll contents at both sites. On contrast, potassium, phosphorus and leaf area increased significantly for wheat and barley plants. The results also showed that wheat and barley growth was better with OMW application. No negative effects were observed for OMW application on plant growth during the season. However, still ongoing research is being conducted for another season.

Characterization of organic matter in soils along a north-south transect in eastern Algeria (Souk-Ahras Tebessa). Authors: Habiba Zanache, Mohamed Benslama, Abdelraouf Benslama.

The north is Algerian one of the most beautiful forests of North Africa thanks to its geographical position and its biotic and abiotic diversity. This zone is located in the north-east of Algeria, where there is a Mediterranean diet climate characterized by a temperature gradient that increases from north to south, while precipitation changes in the opposite direction to the temperature defining a succession of bioclimatic stages ranging from I 'Wet (Seraidi Annaba region) to Semi arid see the arid at Tebessa through the sub-humid of Souk-Ahras. The natural vegetation varies from the suberia in the north to the pine forest and ends with a vegetation dotted with alpha and wormwood. Between vegetation and soil,



humus plays an intermediary role that can influence the pedogenetic process or the distribution of plants in time and space. Soil is the most poorly understood component of the environment while it is the direct support of most human activities. Indeed, by its position of interface between the organic world and the inorganic world, it is the seat of several chemical reactions ensuring the passage from one world to the other. The characterization of the litter (organic matter) and its evolution in the soil have been carried out in this work by analyzing the soil and the litter according to a gradient of aridity of the climate. A close relationship between the quality of the litter and its immediate environment and that the accumulation of litter can have sometimes beneficial or sometimes unfavorable effects. The presence of a very large amount of litter acidifies the reaction of the soil, reduces the stock of the soil into mineral element and increases their unavailability. The absence of litter at the surface of the soil due to a high mineralization activity or low intake results in a naked soil exposed to the influences of climatic agents (water and / or wind erosion). The balance of litter production depends on the forestry group. The majority of the litter falls under the control of the physiology of the plant on the one hand and mainly influenced by environmental conditions in general and climatic conditions in particular. The results obtained at the different stations show the existence of a link between the properties of the soil and the vegetation cover on the one hand and the degree of evolution and the quality of the litter on the other. The results show the importance of the litter in the stabilization of the soil, hence the need to preserve the vegetation cover in order to increase the productive potential of the soil.

Possibility of the estimating and improving surface runoff amount using the soil sorptivity and soil water repellency in Samburu, Kenya. Authors: Fumio Watanabe, Kirui Kipkemoi, Shingi Suzuki, and Takuya Tsurumaki.

Experiments were conducted in the laboratory on soil sorptivity under untreated soil and water repellent peat moss treated soil. This was for estimation of water surface water runoff for water harvesting in Samburu Kenya where undisturbed soil samples were taken and physical properties analyzed. After the experiment, it was confirmed that soil sorptivity reduces with increase in soil moisture for the untreated soil while it increased for the treated soil under a short time. In comparing with Curve number method, it was found that soil sorptivity can be used to estimate water surface runoff while water repellent soil can help increase the amount of surface runoff.

Numerical models of ancient terraces, what can we learn? Author: Qasem Abdelal.

Numerical models have been extensively used in a wide variety of applications. In this research, they were used to help understand the function of the ancient terraces and evaluate their characteristics. These terraces are widely present in Petra and other regions in Jordan. Field investigations to two sites in Petra, backed with numerical modeling verified that these terraces were instrumental in reducing the overall surface runoff. Along with that, these terraces served a function of reducing the overall sediment yield.

A quality approach for managing the water distribution network of the Tlemcen urban cluster in Algeria. Authors: Chérifa Abdelbaki, Sidi Mohamed Smir, Mohamed ALLAL.

In Algeria, the observed weather conditions, combined with a strong urban population have contributed to an inevitable decrease of available resources. The policies adopted in the last twenty years, in terms of dams, sea water desalination, remain insufficient. An unsuitable and poorly planned management was grafted, and created tensions difficult to control in terms of water supply. The observed loss in



water distribution systems are estimated over than 40%. These losses are due to several factors, including the age of the pipes, a non-adapted to the soil characteristics, illegal taps due to uncontrolled construction, a lack of suitable equipment (detection and repair of leaks)... How to remedy? A total quality approach can help us to make a rational solution that overcomes the various deficiencies and shortcomings in the management of the water distribution network by the managing organization, identifying the necessary resources, equipment and manpower to mobilize for a better system management quality of potable water. To better identify failures encountered in the management of water distribution networks, and take the necessary corrective actions, the urban cluster of Tlemcen in Algeria was the case study. A survey was conducted among employees of the water management agency (ADE) and the subscribers of the urban cluster of Tlemcen. Recommendations and suggestions are substantial subsequently to develop a strategy for continuous improvement in the management of water distribution networks.

Education for Sustainable Development in Elementary and Secondary Schools: A case Study from Jordan. Author: Rana Ardah.

This paper presents the experience of the Royal Scientific Society (RSS) and University of Jordan (UJ) in “Promoting Water Use Efficiency in Green Schools” project, a one year project (2015), in terms of providing education for sustainable development. This student-led environmental behavior change (SLEBC) project was designed to get Jordanian youth contribute simultaneously to the development effort and help local communities stand up to the severe water scarcity in their country through fostering environmental sustainable behaviors. It showed how students’ levels of knowledge and attitudes regarding different water related issues had significantly improved throughout the project’s life span. This paper also showed how important the connection is between student motivation and self-determination; motivation is related to whether or not students have opportunities to be autonomous and to make important contributions.

Water Governance and Integrity Risk Assessment For Water Sector In Jordan. Author: Fayez Abdulla, Hani Abu Qdais, Manal Al-Shraideh.

This study concluded that the lack of integrity included an absence of transparency, accountability, participation, responsibilities and lack of justice due to the 37 functions that were discovered in a water company. Three-hundred and twelve questionnaires were distributed in the Water Company which operates in the North of Jordan. Based on the questionnaire distributed in the Company’s Departments which are (Customer Service, Project Management and Procurement, Operation and Maintenance, and Human Resources) there were 37 functions of lack of integrity. The highest probability of risk occurrence was 93% (illegal connections), where the lowest was 13% (One subscriber has more than one water meters). The integrity risk assessment were conducted through a risk matrix through identifying the level of severity and priority of risk management. The results reveal that the highest priority risks were illegal connections, acceptance of lower prices equipment regardless of quality, manipulation of stopcocks by citizens, and absence of transparency in the employment mechanism. On the other hand, the lowest risks were changing a project site to another area due to nepotism, gaining tenders by contractors based on a personal relation with the Company’s staff, and accepting of falsified documents or hiding fake details due to collusion with clients. Finally, The Analytical Hierarchy Process AHP model (Obtained through Expert Choice Software) was used to arrange the four departments according to the priority of management and control. Project Management and Procurement Department were on top of all departments).



Statistically Downscaling Precipitation and Temperature for a Semi-Arid Trans-Boundary Basin under SRES and RCPs Scenarios using SDSM. Authors: Fayez Abdullaah, Alham Al-Shurafat.

In this study, the statistical downscaling model (SDSM) skill have been addressed in downscaling the climate over a semi-arid and trans-boundary basin. In addition, the potential climate change over the basin has been projected. The selected basin is the vital Yarmouk River Basin (YRB) that extends between Jordan and Syria. The scenarios used to drive SDSM are GHGs Representative Concentration Pathways (RCPs) using CanESM3 GCM and Special Report on Emissions Scenarios (SRES) A1B and A2 using CGCM3 GCM. The study findings illustrate that there is a good statistical confidence in the downscaling based on the uncertainty analysis results that have been performed. SDSM showed a good ability to simulate the mean and extreme events for precipitation and temperature. However, SDSM was poor in capturing the daily precipitation pattern and intense precipitation events. During the 21st century, all scenarios have agreed that the mean annual rainfall will continue to decrease while the temperature will continue to increase gradually. Under the worst scenario RCP8.5, precipitation will decrease by 30% and temperature will increase up to 3.5°C difference unless the global warming gets stopped or mitigated. Thus, the projected time series can be adopted with satisfying confidence for any intended climate change impact study within the YRB.

Water Requirements of the Jordanian Nuclear Power Plants. Authors: Tasneem Tawalbeh, Prof. Wa'il Abu-El-Sha'r

The government of Jordan has allocated 30MCM/yr of AsSamra wastewater treatment plant (WWTP) effluent and 15 MCM/yr of groundwater from deep aquifers to cool the Jordanian Nuclear Power Plant (NPP). This research studied the reliability of the allocated quantities and quality of these in-conventional cooling water resources.. For this purpose, nine quality parameters of AsSamra WWTP effluent were identified and explored including: (sulphates, phosphate, nitrates, dissolved oxygen, pH, total dissolved solids, chloride, total hardness and carbonate hardness). Data on these parameters were studied using statistical analysis distributions. Six statistical distributions were tested by Kolmogorov-Smirnov test for each of the parameters by using EasyFit software. Some of these parameters did not meet the cooling water standards and thus necessitates further treatment for AsSamra effluent before it can be used for cooling the NPP. For the groundwater, a three dimensional finite difference flow model (Processing MODFLOW) was developed to study the suggested deep aquifer response and to investigate the resulted drawdown under three different pumpage stresses (scenarios), namely: a withdraw rate of 30 MCM/yr the total amount required annually for cooling the NPP, this scenario caused a very serious drawdown of 319.2 m which exceeded 10% of the total aquifer depth; a 15 MCM/yr pumping rate resulted in 165 m drawdown this also exceeded the established drawdown limits(10% of aquifer thickness); And finally, 9.4 MCM/yr was identified as the maximum allowable pumpage rate with 100 m drawdown.

Impact of water harvesting generated under different types of Polyacrylamide Polymer (PAM) on growing of Acacia trees in arid soils. Authors: Naji Al-Mefleh, Maher Tadrus, Majed Abu-Zreig.

A field experiment was carried out determine the impact of water harvesting generated under different types of Polyacrylamide Polymer (PAM) on growing of Acacia in arid soils. The runoff volume generated under PAM's treatments (PAM A-130, PAM A-836, PAM Aerotil, plastic mulch, and control - no PAM no land cover) over three years (2009 to 2011). The water harvested for different storms was used to irrigate acacia trees. The morphological characteristics (number of leaves, height, number of branches,



and diameter) of acacia trees were monitored during two years (2009 and 2010). The total runoff volume was 511.44, 436.80, 306.92, 1653.01, and 509.50 liter under the treatments PAM A-130, PAM A-836, PAM Aerotil, and control (no PAM and no land cover), respectively. Corresponding to water harvested from PAMs treatments, acacia leaves, height (cm), and diameter were the highest under PAM A-836 and the lowest under PAM A-130. The study found that no linearity relationship between the supplemental irrigation volume and the morphological characteristics of acacia growth.

Application of Colloid and Nanomaterials in Wastewater Treatment. Authors: Abeer Al Bawab, Noor Ghannam, Fida'a Al Shawawreh, Saida Abu-Mallouh, Ayat Bozeya, Rund Abu-Zurayk, Jihad Abd Al Nabi, Natheir Al-Rawashdeh, Fadwa Odeh, Muna Abu-Dalo.

The objective of the current article is to summarize some selected research conducted by our group on the application of colloid and nanomaterials in wastewater treatment. Examples include: surfactant enhanced aquifer remediation technology; modified surfactant; granular activated carbons impregnated with surface active materials; magnetic nanoparticles and nanosized photocatalysts.



Poster session

- **Fate and Impacts of Silver Nanoparticles on the Performance of Wastewater Treatment Process.** Weam Mahdawi, Muna Abu-Dalo, and Hani Abu Qdais.
- **Analysis of Failure Modes of the Wastewater Treatment Plant of Ain el Houtz, Algeri.** Chérifa Abdelbaki, Bessedik Madani, Boukherissi Meriem.
- **Heterogenous Photocatalysis Treatment of Textile Wastewater by Nano-M₂Zr₂O₇ Particles.** Aya Khalaf, Abeer Al-Bawab, Rund Abu-Zurayk, Ayat Bozeyya.
- **Treatment of Olive Mill Wastewater by Sorbent Material(s) Impregnated with Magnetite Nanoparticles.** Jehad Abdelnabi, Abeer Al-Bawab, Borhan Albiss, and Muna Abu-Dalo.
- **Effectiveness of Plants Fiber Impregnated with Green Nanoparticles for Water Disinfection.** Azza Jaradat, Nathir Al-Rawashdeh, Borhan Albiss, Muna AbuDalo.
- **Coupling Magnetite Nanoparticles with Sorbent Materials for Olive Mill Wastewater Remediation.** Abeer Al-Bawab, Noor Ghannam, Rund Abu-Zurayk, Ayat Bozyeh, Muna abu-Dalo.
- **Coupling Activated Carbon with Surface Active Materials for Olive Mill Wastewater Treatment.** Heba Kanaan, Abeer Al Bawab, Nathir Al-Rawashdeh, Muna AbuDalo.
- **A Green Plant-Mediated synthesis of Silver Nanoparticles Using Plant Leaves Extracts of Olive and Rosemary in Conjunction with Tollens Method.** Muna Abu-Dalo, Ismaeel Al-Mheidat, Alham Al-Shurafat, Colleen Grinham and Vinka Oyanedel-Craver.
- **Rooftop Rain Water Harvesting to Alleviate Water Shortages in Jordan.** Majed aAbu Zreig Farah Ababneh.

Visits

- 1st Day Welcoming Dinner: Welcoming dinner will be arranged at the historic site of Umm Qais on Sunday from 6 - 8 pm, 8/10/2017
- 2nd Day Gala Dinner at the University Campus: Included in the registration, Dinner will be provided at the campus of the University from 7-10 pm, outdoor dinner, 9/10/2017
- 3rd Day Dinner and Tours to the Historic Roman City of Jarash, 6-8 pm, 10/10/2017
- Dead Sea – Wadi Rum – Petra (optional): Those who wish to spend extra time in Jordan, the conference committee will arrange a 2 days one night trip in the 11th of October to Dead sea-Wadi Rum-Petra. Departure from Irbid on 11/10/2017 at 8:00 from your Hotel in Irbid, Stop in Amman for Breakfast, Continue to the Dead Sea and stay there for 2 hours, leaving to Wadi RUM and enjoy the sun set with an optional Camel ride. Then have dinner with traditional music and dancing. Leave to Petra at night and check in to Edom Hotel. Spend one day in the historic Rose City of Petra, have an early dinner at Petra. Leave to Irbid through Amman at night. Those who have a flight on 12 October will be dropped in Amman at around 10 PM.



List of participants

Participants	Emails	Affiliation
Hussam Hussein	h.hussein@uea.ac.uk	United Kingdom
Heta Kosonen	hetak@uw.edu	USA
Manal Al-Shraideh	manalsami87@yahoo.com	Jordan
Ayat Hazaymeh	Ayat.Hazaymeh@rss.jo	Jordan
Abdeldayem El-Dosoky	raafat_mandour@hotmail.com	Egypt
Akl Awwad	akl.awwad@rss.jo	Jordan
Carsten Riechelmann	carsten.riechelmann@tu-berlin.de	Germany
Reem Hammouri	reem0929@gmail.com	Jordan
Haneen Al-Sbaihi	hsbaihi@hotmail.com	Palestine
Mahdi Aoda	dr_mahdi70@yahoo.com	Iraq
Ramesh Rudra	rrudra@uoguelph.ca	Canda
Bassim Abbasi	babbassi@uoguelph.ca	Canda
Osvaldo Moiambo	moiambo03@gmail.com	Portugal
Cherifa Abdelbaki	Abdelbakicherifa@gmail.com	Algeria
Robert Houghtalen	rhoughtalen@aus.edu	United Arab Emirates
Peyman Mahmoudi	p_Mahmoudi@gep.usb.ac.ir	Iran
Ruaa abdelbasit	ruaaabdelbasit@gmail.com	Sudan
Alham Al-Shurafat	awalshurafat13@eng.just.edu.jo	Jordan
Fumio Watanabe	f-nabe@nodai.ac.jp	Japan
Osama Mohawesh	osama@mutah.edu.jo	Jordan
Mohamed Benslama	bensamrane@yahoo.fr	Algerie
Zanache Habiba	zanachabiba@yahoo.com	Algerie
Said el Madidi	s.elmadidi@uiz.ac.ma	Agadir
Maha Halalsheh	halalshe@ju.edu.jo	Jordan
Helmi Al Zanfaly	zanfalywater@yahoo.com	Egypt
Timur Khujanazarov	khujanazarov.timur@gmail.com	Uzbekistan
Qasem Abdelal	qasem.abdelal@gju.edu.jo	Jordan
Tasneem Tawalbeh	tmaltawalbeh@just.edu.jo	Jordan
Majid Kazemzadeh	majkazemzadeh@gmail.com	Iran
Menouar Hanafi	hanafi951@yahoo.com	Algerie
Hamzeh Rawashdeh	hamz_rawashdeh@yahoo.com	Jordan
Rana Ardah	Rana.Aarda@rss.jo	Jordan
Rida Shibli	r.shibli@ju.edu.jo	Jordan
Haruyuk Fujimaki	fujimaki@alrc.tottori-u.ac.jp	Japan
Tamara Al-Qudah	T.alqudah@ju.edu.jo	Jordan
Arwa Khatatbeh	arwa.kh@snu.ac.kr	South Korea



First International Conference
Water Management In Arid Land & Semi-arid Land
New Perspectives And Innovative Approaches

Name	Emails	Country
Ibrahim Kandah	ibrahim.qandah@rjgc.gov.jo	Jordan
Salahu Hamza	salahuhamza@gmail.com	Nigeri
Weam Mahdawi	weammahdawi@gmail.com	Jordan
Abeer AL Bawab	abeerbawab@yahoo.com	Jordan
Naji Al-Mefleh	nme fleh@just.edu.jo	Jordan
Khaldoon Al-Qudah	kalqudah@gmail.com	Jordan
Mo'ayyad Shawagfeh	mshawagfah@aabu.edu.jo	Jordan
Nezar Al-Hammouri	nezar@hu.edu.jo	Jordan
Fayez Abdullah	fabdullah@just.edu.jo	Jordan