

BOOK OF ABSTRACTS



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



Table of contents

HONORARY COMMITTEE	5
INTERNATIONAL SCIENTIFIC COMMITTEE	8
LOCAL ORGANIZING COMMITTEE	12
OVERVIEW	13
OBJECTIVES	14
KEYNOTE SPEAKERS	15
THEME 1: WATER RESOURCES	23
Contribution to the modeling in Algeria: using the Discharge -Rainfall relationship	24
Impact of climate change on the hydrological regime in the medium valley of Medjera-Tunisia	25
Groundwater flow and salt transport in Zeuss-Koutine and Jeffara Mio-Plio-Quaternary aquifers (Tunisia)	26
Conception and sizing of an industrial waste water treatment station equipped with biogas digester, UV reactor and reverse osmosis unit	27
Smartphone application for vegetable irrigation scheduling	28
Present Scenario of drinking water in India: Review	29
Water and Environmental Sustainability in Langkawi UNESCO Global Geopark, Malaysia: Issues and Challenges towards Sustainable Development	30
Indicators of soil degradation with increasing age of olive tree plantation in south Tunisia	31
Rural wastewater treatment on a filter bed reconstituted by siliceous sand and swelling clay	32
Contribution to characterization of natural diatomite	33
Evolution of a hydro-agricultural system in the chain of Matmata-Dahar: case of the Zammour Wadi between 1967 and 2017	34
Evaluating the best evaporation estimate model for free water surface in arid region	35
Evaluation of irrigation management, yield, and irrigation water productivity of public area of the Nabhana system	36
Potentiality of Drip Irrigation & Buried Diffuser systems in the control of the soil salinity and yield production improvement in sandy soil of southern Tunisia	37
Use of AquaCrop model for estimating crop evapotranspiration and biomass production in hilly topography	38
Evaluating the hydrological behavior of a Mediterranean catchment under climate change: Application in the Siliana upstream catchment	39
Up-scaling of crop productivity estimations using AquaCrop model and GIS-based operations	40
Two-phase flows in porous media in the presence of dissolved salts	41



Social technologies to guarantee access to water for the rural population living in poverty: the Brazilian experience	42
THEME 2. ENVIRONMENT	43
Studying the evolution of gully erosion in southern Tunisia through aerial photography and sedimentological analyses. The case of Matmata region	44
How to preserve groundwater in arid lands? Case study: Analyzing the water management policies implemented in Yazd province to preserve its groundwater resources	45
Long-term effects of soil and water conservation on selected ecosystem services in Minchet catchment Ethiopian Highlands	46
Fluctuations of the piezometric level and wind accumulations during the Quaternary period in the maritime Jeffara (Southern-East of Tunisia)	47
Effect of the major air pollutants on olive pollen performances	48
Effect of Combined application of organic/mineral fertilizer in soil hydraulic properties	49
The artesian mounds, structuring elements of the Nefzaoua (Tunisia), a threatened ancient landscape heritage	50
High contribution of crop rooting to soil carbon in a semi-arid Mediterranean profile: evidence from stable isotopes and modelling	51
Evaluation of pollutants in industrial areas: Assessment of topsoils quality	52
Periodic (cultivation period) and vertical (depth) effects of excessive fertilizer use (chemical and organic) on soil organic components	53
Relationship between the characteristics of the surface of cultivated soils and wind erosion in the Plain of Jeffara	54
Spectroscopic analysis of humic acids derived from different types of exogenous organic matter	55
Impact of drought and salinity on henna (<i>Lawsonia inermis</i> L.) productivity in South-East of Tunisia	56
Analyse de la vulnérabilité des ressources en eaux souterraines en milieu urbain par la méthode DRASTIC modifiée (DRASTICU) : Cas de la nappe phréatique de Sidi Bouzid	57
Physicochemical adsorption properties of heavy metals by different clay combinations in the context of phosphogypsum storage	58
What is the impact of mineral dust on air quality in southern Tunisia? Analysis of 3 years of PM10 concentration	59
Biochar and Compost Effects on Soil and Rain Water Incubated and On Soil Respiration	60
Etude comparative des amendements sableux dans les oasis de la Nefzaoua	61
Evaluation des performances agronomiques et physiologiques de deux variétés d'orge sous la contrainte saline et azotée	62
A mathematical model for rapid hunting of desiccation-tolerant xeroprotectant-producing microorganisms	63



Diversity of arbuscular mycorrhizal fungi associated with rhizosphere of olive tree (<i>Olea europaea</i> L.) in different arid regions of southern Tunisia	64
Vulnerability to drought-induced embolism of six woody species used for reforestation projects in arid regions of southern Tunisia	65
Impact of composting sewage sludge on sanitary quality of tomato	66
Stimulating the Anti-oxidative response and tomato growth improvement through Silicon and Salicylic acid under Salinity	67
Mesocosm scale study on fluoride mitigation measures in cropping systems	68
Optimization of biodiesel obtained from waste frying oil by heterogeneous enzymatic transesterification	69
Nanofiltration polishing membrane process for fluoride removal	70
Agronomic application of Olive Mill Waste Water: Short-term effect on soil chemical properties and Barley performance under semiarid Mediterranean conditions	71
Etude de l'influence des caractéristiques édaphiques sur les teneurs en métabolites secondaires chez deux variétés de <i>Punica granatum</i> L.	72
The effect of no-tillage practice on soil nitrogen dynamic	73
Revival of an indigenous management system in Southern Tunisia: reintroduction of the «Gdel» in private rangelands	74
THEME 3. ENERGY	75
Hybrid membrane processes for better performances of desalination operations	77
The energy valuation of by-products of palm trees date palms	78
Numerical study of heat transfer and entropy generation of magnetoconvection of nanofluids	79
Revisiting a Rapid assessment of the water–energy–food–climate nexus in watersheds undergoing water stress and energy transitions	80
Feasibility of Seawater Desalination in the case of small and medium farms	81
THEME 4. SOCIETIES AND DEVELOPMENT	82
Productivité de l'eau dans les oasis de la région de Tozeur	83
Measurement of Social-Ecological Systems Resilience in Tunisia: Innovative approach using Tri-capital framework	84
Assessing livelihood vulnerability in Tunisian arid zones	85
Multi-criteria analysis of water harvesting techniques in south east of Tunisia	86
Virtual water flows and water value in Tunisia: a case study of wheat and olive productions	87
Gaming simulation for the sustainability of the dairy sector: the role of trust and cooperation	88
Impact of farmers' background on adoption of soil conservation strategy, Ethiopia	89
Impact of water shortage on the competitiveness of agricultural commodities in Tunisia	91



Assessing water stress under climate change in light of SDG 6.4	92
Interaction between climate change, environmental degradation and human migration in the arid area of Tunisia	94
Carbon emissions caused by woodland fires in the African tropical savannas	96
A soil spectral library for soil quality and erosion assessments using landscape approach	97
Monitoring of the state of coastal oases in Tunisia by MOD13Q1 products (Case of the oasis of Gabes)	98
Mapping Land Use and Dynamics of Vegetation Cover in South-eastern Arabia using the Remote Sensing Technology: The Study Case of Wilayat Nizwa (Oman) from 1987 to 2016	99
Evaluation of land degradation using Geo-Spatial modeling approach: A case study in Koutine watershed (Médénine-Tunisia)	100
Cartography of olive trees in the delegation Zarzis (governorate of Medenine) by Landsat 8 OLI: Impact of climate change	101
Contribution of remote sensing and GIS in land use mapping and water erosion modeling in the Nagueb subwatershed - Case of Medenine governorate	102
The use of AHP within GIS in identifying suitable sites for rainwater harvesting technologies in the wadi Oum Zessar watershed, Tunisia	103
Analysis of Vegetation Response to Climate Variability in Southeast Tunisia Using MODIS Time Series Data	104
Actual evapotranspiration estimation over a semi-arid heterogeneous land surface using coupled remote sensing data with surface energy budget and crop water budget models	105



HONORARY COMMITTEE

- **Prof H. Khatteli**, Institut des Régions Arides, Tunisia
- **Prof. Vijay P. Singh**, Texas A & M University, U.S.A.
- **Prof. R. N. Yadava**, AiSECT University, India



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



INTERNATIONAL ORGANIZING COMMITTEE

- **Prof. H. Khatteli**, Institut des Régions Arides, Tunisia
- **Prof. R. N. Yadava**, AiSECT University, India
- **Prof. Vijay P. Singh**, Texas A & M University, U.S.A.
- **Dr. M. Moussa**, Institut des Régions Arides, Tunisia
- **Dr. M. Ouessar**, Institut des Régions Arides, Tunisia



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

INTERNATIONAL SCIENTIFIC COMMITTEE

- Prof. S.Q. YANG, University of Wollongong. Australia
- Dr. D. DAY, The International Centre of Excellence in Water Resources Management. Australia
- Dr. R. HOPKINS, The International Centre of Excellence in Water Resources Management (ICE WaRM). Australia
- Dr. L. CZARAN, UN Office for Outer Space Affairs (UNOOSA). Austria
- Prof. W. CORNELIS, Ghent University. Belgium
- Prof. D. GABRIELS, Ghent University. Belgium
- Dr. T. GUMBO, United Nations Development Program (UNDP). Brazil
- Prof. S. NARAYAN, Seridon College. Canada
- Prof. R. RUDRA, School of Engineering, University of Guelph. Canada
- Dr. R. TOUZI, Natural Resources Canada (NRCan). Canada
- Prof. W. TAO, Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI). China
- Prof. Q. ZHANG, Sun Yat-sen University. China
- Dr. W. WU, East China University of Technology. China
- Dr. A. BRUGGEMAN, Cyprus Institute (CESE). Cyprus
- Dr. A. NEGM, Zagazig University. Egypt
- Prof. Y. CALLOT, Lyon University. France
- Prof. R. MOUSSA, French National Institute for Agricultural Research. France
- Dr. P. PODWOJEWSKI, Institut de Recherche pour le Développement (IRD). France
- Dr. R. ESCADAFAL, Comité Scientifique Français de la Désertification (CSFD). France
- Dr. B. MOUGENOT, Centre d'Etudes Spatiales de la BIOSphère (CESBIO-IRD). France
- Prof. J. HILL, Trier University. Germany
- Dr. D. TSEGAI, United Nations Convention to Combat Desertification (UNCCD). Germany
- Prof. Y. D. CHEN, The Chinese University of Hong Kong. Hong Kong
- Prof. V. K. VERMA, Core Research Group, AISECT. India
- Prof. S. YADAV, AISECT University, Madhya Pradesh. India
- Prof. R. N. YADAVA, AiSECT University, Jharkhand. India



- Prof. A. KOWSAR, Fars Research Center for Natural Resources and Animal Husbandry, Shiraz. Iran
- Prof. G. GHIGLIERI, Cagliari University. Italy
- Prof. P. P. ROGGERO, Nucleo Ricerca Desertificazione (Desertification Research Centre, NRD). Italy
- Dr. S. PALOSCIA, CNR-IFAC – Dept. of Earth Observation. Italy
- Prof. A. TSUNEKAWA, Tottori University. Japan
- Prof. K. UNAMI, Kyoto University. Japan
- Dr. B. Dhhibi, ICARDA-Amman. Jordan
- Dr. T. OWEIS, International Center for Agricultural Research in the Dry Areas (ICARDA). Jordan
- Dr. R. THOMAS, International Center for Agricultural Research in the Dry Areas (ICARDA). Jordan
- Prof. J. KIBIY, Moi University. Kenya
- Eng. W. NDIRANGU, Water Cap – United Nations Development Program (UNDP). Kenya
- Dr. R. ELFITHRI, University Kebangsaan. Malaysia
- Prof. A. HARRADJI, Oujda University. Morocco
- Prof. K. LABBASSI, Chouaib Doukkali University. Morocco
- Dr. M. SEELY, Desert Research Foundation of Namibia. Namibia
- Dr. M. BOUCHAHMA, Ministry of Higher Education. Oman
- Prof. W. G. STRUPCZEWSKI, Institute of Geophysics. Poland
- Prof. L. MOLDOVAN, Petru Maior University of Tirgu Mures. Romania
- Prof. H. KHEMIRA, Jazan Univ. Saudi Arabia
- Prof. K. JA. DU PLESSIS, Stellenbosch University (IWEESU). South Africa
- Prof. Y. CANTON CASTILLA, Almeria University. Spain
- Prof. A. SOLE, Estación Experimental de Zonas Áridas (CSIC-EEZA). Spain
- Dr. G. DEL BARRIO, Estación Experimental de Zonas Áridas (CSIC-EEZA). Spain
- Dr. M. MIRGHANI, Institute of Space Research and Aerospace (ISRA). Sudan
- Dr. H. LINIGER, Bern University. Switzerland



- Dr. T. ABDELKEBIR, The Arab Center for the Studies of Arid zones and Dry lands (ACSAD). Syria
- Dr. R. SALAH, The Arab Center for the Studies of Arid zones and Dry lands (ACSAD). Syria
- Prof. C. RITSEMA, Wageningen University. The Netherlands
- Dr. G. A. CORZO PEREZ, IHE Delft Institute for Water Education. The Netherlands
- Dr. C. MANNAERTS, Faculty of Geo-Information Science and Earth Observation (ITC). The Netherlands
- Prof. F. BEN JEDDI, Institut National Agronomique de Tunisie (INAT). Tunisia
- Prof. N. BEN MECHLIA, Institut National Agronomique de Tunisie (INAT). Tunisia
- Prof. N. GAALOUL, Institut National des Recherches en Génie Rural, Eaux et Forêts (INRGREF). Tunisia
- Prof. B. HAMROUNI, Tunisian Desalination Association / Faculté des Sciences de Tunis (FST). Tunisia
- Prof. E. HAMZA, Institut National Agronomique de Tunisie (INAT). Tunisia
- Prof. A. HANNACHI, Ecole Nationale des Ingénieurs de Gabes (ENIG). Tunisia
- Prof. H. HBAIEB, Institut National des Recherches en Génie Rural, Eaux et Forêts (INRGREF). Tunisia
- Prof. A. HTIRA, Faculté des Sciences de Tunis (FST). Tunisia
- Prof. H. KHATTELI, Institut des Regions Arides (IRA). Tunisia
- Prof. Z. LILI CHABAANE, Institut National Agronomique de Tunisie (INAT). Tunisia
- Prof. M. NEFFATI, Institut des Regions Arides (IRA). Tunisia
- Prof. H. REJEB, Institut Supérieur Agronomique de Chott-Mariem (ISACM). Tunisia
- Prof. M. SGHAIER, Institut des Regions Arides (IRA). Tunisia
- Prof. H. DAGHARI, Institut National Agronomique de Tunisie (INAT). Tunisia
- Dr. R. BOUKCHINA, Institut des Regions Arides (IRA). Tunisia
- Dr. H. BOUSNINA, Institut National Agronomique de Tunisie (INAT). Tunisia
- Dr. H. CHAKROUN, Ecole Nationale des Ingénieurs de Tunis (ENIT). Tunisia
- Dr. M. EL MOURID, International Center for Agricultural Research in the Dry Areas (ICARDA). Tunisia



- Dr.H. GASHOUT, Centre Régional de Télédétection des Etats d’Afrique du Nord (CRTEAN). Tunisia
- Dr. N. HAMDY, Institut Supérieur des Sciences et Techniques des Eaux de Gabès (ISSTEG). Tunisia
- Dr. O. MAHJOUR, Institut National des Recherches en Génie Rural, Eaux et Forêts (INRGREF). Tunisia
- Dr. M. MOUSSA, Institut des Régions Arides (IRA). Tunisia
- Dr. K. NAGAZ, Institut des Régions Arides (IRA). Tunisia
- Dr. M. OUESSAR, Institut des Régions Arides (IRA). Tunisia
- Dr. M. ZAMMOURI, Faculté des Sciences de Tunis (FST). Tunisia
- Dr. A. MTIMET, Independent Expert, Tunisia
- Dr. S. KHLIFI, ESIER. Tunisia
- Prof. S. Sayadi, CBS – Sfax. Tunisia
- Dr. G. ERPUL, Ankara University. Turkey
- Dr. A. OULED BELGACEM, International Center for Agricultural Research in the Dry Areas (ICARDA). UAE
- Prof. F. A. MEMON, University of Exeter. UK
- Dr. C. KING, International Institute of Environment and Development (IIED). UK
- Prof. V. P. SINGH, Texas A & M University. USA
- Dr. X. CHU, North Dakota State University. USA
- Dr. K. DIDAN, Arizona Univ. USA
- Dr. S. EVETT, Agricultural Research Service (ARS-USDA) Texas. USA
- Dr. R. MOHTAR, Texas A&M University. USA
- Dr. M. NEARING, USDA-ARS Arizona. USA



LOCAL ORGANIZING COMMITTEE

- **Houcine KHATTELI**
- **Mohamed MOUSSA**
- **Mohamed OUESSAR**
- **Bouajila ESSIFI**
- **Dalel OUERCHEFANI**
- **Fethi ABDELLI**
- **Hanen DHAOU**
- **Mongi BENZAIED**
- **Ammar ZERRIM**
- **Messaoud GUIED**
- **Hedi KERDI**
- **Saifeddine TURKI**
- **Mohamed LABIADH**
- **Amor JLALI**
- **Najet BELHAJ**
- **Afef MAHJOUBI**



OVERVIEW

The International Conference on Water, Environment, Energy and Society is being organized jointly by the Institut des Regions Arides, Tunisia, AISECT University, India, and Texas A&M University, USA, from 08 to 11 May 2018 in Djerba Island, Tunisia.

The objective of the ICWEES-2018 is to integrate research, technology and practice, in the fields of Water, Environment, Energy, Sustainability, Health, Management and Society; and bring together Scientists, Academicians, Researchers, Practicing Engineers, Consultants, Planners, Policy Makers, Economists and Social Scientists, Managers, and Leaders from around the world to share their knowledge, skills, experience, and expertise through research papers, case studies, and keynote addresses on, but not limited to, water resources, climate change, ecosystems implications for human health, sustainable land use and eco-cities, integrated resources management, green economy, green energy, cleaner production, planning, disaster management, environmental management, etc. The proposed major themes of the conference will be discussed in parallel sessions to provide opportunities for the delegates from around the world to share their knowledge, skills, experiences, and expertise with focus on water, environmental, energy, and societal challenges facing our planet and the future of our generation. Environmental problems, such as desertification processes, land degradation and rehabilitation, land cover and land use change, climate change, droughts, early warning, and more, are of utmost importance in arid environments where natural resources are scarce and vulnerable.

The conference will include paper presentations describing original work on the current state of research and practices in technologies and systems for characterization, mitigation, soil, water resources, and climate change and prevention, preparation, and response and recovery of disasters. The themes include (but not limited to): water resources, land degradation and management, energy resources and use, environmental issues, related social and economic development, geo-information and space technologies, multi-sensor data collection, information dissemination, and early warning and standardization. Studies in all scales are welcome, a special emphasis will be given to large scale, watershed studies.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



OBJECTIVES

- Bring together leading experts, policy makers and organizations, and share latest developments in water, soil and energy resources management under climate change
- Review modern technologies and innovative approaches to be directed in fragile regions for identification, adaptation and mitigation of climate change phenomenon.
- Strengthen exchanges and cooperation in research, development and socio-economic sector for participatory management of soil and water resources and energy



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

KEYNOTE SPEAKERS

PROF. J. A. DU PLESSIS



Prof. J. A. du Plessis has more than 30 years of experience in the field of water engineering, working for 5 years for the Department of Water and Sanitation and the Department of Agricultural with irrigation boards and government water schemes.

He worked for 5 years with the City of Cape Town, dealing with storm water and managing their hydrology database. He then joined the West Coast District Municipality for a period of 7 years as the Director: Water Supply, where he gained experience with all the institutional arrangements and specifically the Water Act and Water Service Act. He joins the University of Stellenbosch in 2003 and is presently a Professor in Hydrology in the Civil Engineering Department. He specialized in water resource evaluations, flood hydrology and he provides institution support to various local authorities.

Kobus serves as a member of the Executive committee in the Board of the Institute of Municipal Engineers for Southern Africa where he is responsible (Director) for training and skills development. He also serves on the Education and Training committee of South African Institute of Civil Engineers (SAICE) and serves on the Editorial Panel of the SAICE Journal. He is a former Head of the Department of Civil Engineering at the University of Stellenbosch and also serves as Technical Advisor for the International conference on Water, Environment and Energy in 2016 and 2018.





PROF. A. HANNACHI

Dr. Ahmed Hannachi is a full Professor at the Chemical-Process Engineering Department, National Engineering School (ENIG), University of Gabes – Tunisia. He obtained a higher engineering degree in chemical engineering from ENIG. He then completed a PhD in chemical engineering at Ottawa University – Canada. Prof. Hannachi has a teaching and research experience of more than 23 years. Throughout his career, he was appointed several assignments including ENIG vice-dine. He is currently leading a research unit within the chemical engineering & industrial processes research laboratory of ENIG. Among his research focuses is process modeling and simulation as a tool for wise management of water and energy resources relying on holistic approaches involving experimental as well as theoretical work. Most of his research activities were conducted within collaborative projects involving national and international partners from industry and academia. He has published more than 150 research contributions in peer reviewed scientific journals and international conference proceedings. He has supervised to successful completion 12 PhDs and over 125 Masters and Final Year Projects.



PROF. C. KING-OKUMU



Caroline King-Okumu provides advice, consultancy, research and writing contributions on dryland development issues to IUCN, WOCAT, UN, CGIAR and other international research and development projects and institutions. She is a Visiting Research Fellow at the Geodata Institute, University of Southampton, and is scoping transboundary resource management issues for a Not-for-Profit Think Tank based in Nairobi called The Borders Institute (TBI).

Her interests include integrated management of water and land in dryland ecosystems, environmental assessment (ecological and economic), groundwater management, sustainable land management, governance, institutional development and capacity building, and supporting efforts by decision-makers to think ahead to develop strategic plans under a changing climate and assessing the returns on investments in adaptation to climate change in water stressed and drought-prone dryland environments.

She has previously worked as a Senior Researcher on Dryland Ecosystems and Economic Assessment for the International Institute for Environment and Development (IIED), and managed large multi-country initiatives on dryland research and development for the International Centre for Agricultural Research in the Dry Areas (ICARDA) and the United Nations University International Institute on Water, Environment and Health (UNU-INWEH). Parts of her Doctoral fieldwork were hosted by the Institut des Régions Arides in Tunisia and by the University of Alexandria in Egypt.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



ATM | **TEXAS A&M**
UNIVERSITY



PROF. G. A. CORZO

Dr. Gerald A. Corzo has extensive experience in modelling for different problems in Integrated water resources management, his high skills in ICT technology have been used to develop different type of scientific application. As researcher and lecturer of different academic institutions have worked and coordinated academic programs. His expertise has been mainly developed around programming mathematical models and statistical models for hydroinformatics problems. Since the last six years he has been working on the use of global hydrological models ensemble and their uncertainty for climate change analysis. This work mainly involves heavy data loads from GCM and GHM models for several scenarios and developed statistical tools for online and parallel processing of such information. This work was presented in the WATCH-EU project report No. 43. As manager of the Hydroinformatics servers during 4 years he developed and implemented data base web systems for different projects at UNESCO-IHE, as well as maintained and managed the institutional basic support collaborative working environment (BSCW). In 2012 he won the Tison award in Hydrology from the IAHS association. Recently he supervised the research projects with ministry of Nigeria to develop a Spatial Data Infrastructure for sharing and analyzing different regions in the country. Aside of this right now he is coordinating the activities of the development of data analysis over large data set in the System Integrado de recursos Hidricos from Colombia. This work and others are being develop under the framework and cooperation with the group CUAHSI and GEOSS, following all OGC standards. He has coordinated the statistics of the Climate change inventory of adaptation and mitigation actions for Latin-America, presented at the WWF in 2012. Is Civil engineer by training with a strong background on computational science and specialized in Teleinformatics. His areas of research cover innovative methods for integrating computational intelligent algorithms and hydrological conceptual models for hydrological forecasting (Flood Early Warning System models integration, Delft-FEWS). He developed scripts for areas of computational intelligence, optimization of water resources, online modeling and in fluid dynamics simulation. One of his recent projects focuses on exploring the use of mobile phone antennas in Colombia for measuring precipitation. He have participated on research projects in different countries like China with the North China University for Water Conservancy and Electric Power in China, Colombia (CINARA), Mexico (Technologico of Monterrey), England (CEH), Norway (University of Oslo) and others. The last five years he served as chair of the session on geo-statistics at the European Geoscience Union. He leaded the LatinAqua network for water research scientist in Latin-America in 2011.

Dr Gerald A. Corzo is a winner of the Tison award 2012 of the IAHS association in hydrology. He has an has extensive experience in modelling for different problems in Integrated water resources management, his high skills in ICT technology have been used to develop various types of scientific application. As researcher and lecturer of different academic institutions have worked and coordinated academic programs. His expertise has been mainly developed around programming mathematical models and statistical models for hydroinformatics problems. Since the last six years, he has been working on online modelling paradigms and how data from global hydrological models and their uncertainty can be integrated and analysed online.





PROF. P. PODWOJEWSKI

Dr Pascal Podwojewski is a director of Research in IRD (Institute of Research for Development) and member of the Mixed Unit of Research (UMR) IEES-Paris – Institute of Ecology and Environmental Sciences of Paris. <http://iees-paris.ufr918.upmc.fr/>. He has over 38 years of experience in Soil science projects at IRD. He is currently posted in the Institute of Arid Regions in Medenine (south Tunisia). Prior to that, he has been posted in 4 different countries and continents (New Caledonia, Ecuador, Vietnam and South Africa) for leading research projects in soil mapping and soil type characterization in relation with major natural changes or degradation by human activities (overgrazing, fire, cultivation, erosion on sloping land). He is specialist of soil biochemical properties, detachment processes and land degradation related with global changes. He is currently in charge in South Tunisia of a programme to improve water retention of degraded sandy soils in arid environment applied for rain fed olive tree plantations. IPBES Land Degradation and Restoration assessment for IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) – Review editor for the Chapter 1 and co-author of chapter 4 Status and trends of land degradation and restoration and associated changes in biodiversity and ecosystem functions.

Main qualifications:

- Soil scientist initiated to soil mapping with the synthetic map of New Caledonia at 1/200 000 with application to specific land use;
- Consulting in soil science for cacao plantation for Commonwealth Development Corporation, Malekula, Vanuatu; and for coconut fertility with CIRAD in New Caledonia and Vanuatu;
- Consulting for nickel mining waste control and management in New Caledonia.
- Consulting for the Francophone Agency (AUF) in Haïti;
- Consulting in soil sciences for natural disasters in Ecuador (El Niño and landslides);
- Consulting in soil sciences for FAO in Bolivia (fertilisuelos, Cochabamba);
- Soil classification for Vertisols and for non-allophanic Andisols and altitudinal soils; soil type characterisation (mineralogy, soil mapping, fertility) with major natural changes, climatic changes, tectonic changes or transformation by human activities (overgrazing, cultivation, compaction, fire, tree encroachment) ;
- Specialist of soil detachment processes and land degradation related with Land use changes in tropical environment (erosion on sloping land, long term cultivated land, impact on soil properties of tree encroachment in rangeland); consultancy for ipbes: land degradation, erosion.
- Modification of physical characteristics of soils with soil engineers, Application to tropical soils and technosols in Ile de France province;
- Study of the variations in organic carbon stocks in soils (Andisols of Ecuador, Mountain soils in Vietnam, long-term trial with sugar cane crop in South Africa, sandy soils of South Tunisia). Implication in the Circasa project.





PROF. R. N. YADAVA

Prof. R N Yadava holds position of Vice Chancellor of the AISECT University, Hazaribag, Jharkhand, India His research interests include Solid Mechanics, Environmental Quality and Water Resources, Hydrologic Modeling, Environmental Sciences and R&D Planning and Management. Yadava has executed a variety of research/consultancy projects in the area of Water Resources Planning and Management, Environment, Remote Sensing, Mathematical Modeling, Technology Forecasting, etc.

He has got adequate experience in Establishing Institutes/Organizations, Planning, Formulating, Organizing, Executing and Management of R&D Programs, Organizing Seminars/Symposia/Conferences at National and International level. He has got to his credit guiding a number of M.Tech. and Ph.D. students in the area of Mathematical Sciences and Earth Sciences. Dr. Yadava has visited and delivered invited lectures at different Institutes/Universities in India as well as in abroad in the various countries such as USA, Canada, United Kingdom, Thailand, Germany, South Korea, Malaysia, Singapore, South Africa, Costa Rica, and Australia, etc.

He earned an M.Sc. degree in Mathematics with specialization in Special Functions and Relativity from Banaras Hindu University, India in 1970 and a Ph.D. degree in Mathematics with specialization in Solid Mechanics from Indian Institute of Technology, Bombay, India in 1975. Also, he is recipient of Raman Research Fellowship and other awards. Dr. Yadava has been recognized for three and half decades of leadership in research and service to the hydrologic and water resources profession. Dr. Yadava's contribution to the state of the art has been significant in many different specialty areas, including water resources management, environmental sciences, irrigation science, soil and water conservation engineering, and mathematical modeling. He has published more than 90 journal articles; four text books; fourteen edited reference books.

Leadership in research and service to the hydrologic and water resources profession. Dr. Yadava's contribution to the state of the art has been significant in many different specialty areas, including water resources management, environmental sciences, irrigation science, soil and water conservation engineering, and mathematical modeling. He has published more than 90 journal articles; four textbooks; seven edited reference books.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018





PROF. V. P. SINGH

Professor Vijay P. Singh is a University Distinguished Professor, a Regents Professor, and the inaugural holder of the Caroline and William N. Lehrer Distinguished Chair in Water Engineering in the Department of Biological and Agricultural Engineering and Zachry Department of Civil Engineering at Texas A&M University. He received his B.S., M.S., Ph.D. and D.Sc. degrees in engineering. He is a registered professional engineer, a registered professional hydrologist, and an Honorary Diplomate of American Academy of Water Resources Engineers, ASCE.

Professor Singh has extensively published the results of an extraordinary range of his scientific pursuits. He has published more than 1025 journal articles; 28 textbooks; 67 edited reference books, including the massive Encyclopedia of Snow, Ice and Glaciers and Handbook of Applied Hydrology; 113 book chapters; 314 conference papers; and 72 technical reports in the areas of hydrology, ground water, hydraulics, irrigation engineering, environmental engineering, and water resources.

For his scientific contributions to the development and management of water resources and promoting the cause of their conservation and sustainable use, he has received more than 90 national and international awards and numerous honors, including the Arid Lands Hydraulic Engineering Award, Ven Te Chow Award, Richard R. Torrens Award, Norman Medal, and EWRI Lifetime Achievement Award, all given by American Society of Civil Engineers; Ray K. Linsley Award and Founder's Award, given by American Institute of Hydrology; Crystal Drop Award and Ven Te Chow Award, given by International Water Resources Association; Hancor Soil and Water Conservation Engineering Award given by American Society of Agricultural and Biological Engineers; and Outstanding Distinguished Scientist Award, given by Sigma Xi, among others. He has received three honorary doctorates. He is a Distinguished Member of ASCE, and a fellow of EWRI, AWRA, IWRS, ISAE, IASWC, and IE and holds membership in 16 additional professional associations. He is a fellow/member of 10 international science/engineering academies. He has served as President and Senior Vice President of the American Institute of Hydrology (AIH). Currently he is editor-in-chief of two book series and three journals and serves on editorial boards of 20 other journals.

Professor Singh has visited and delivered invited lectures in all most all parts of the world but just a sample: Switzerland, the Czech Republic, Hungary, Austria, India, Italy, France, England, China, Singapore, Brazil, and Australia.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018





PROF. V. K. VERMA

Chancellor Dr. CV Raman University and Head Core Research Group AISECT

He is an Electronics and Communication Engineer. Alumni of National Institute of Technology Raipur and Indian Institute of Technology Chennai. Started career in Bhilai Steel Plant and switched to Indian Air Force. In a rich career of Indian Air Force handled several projects of national and international importance. As the Deputy Director in Ministry of Defence, GoI, looked after Radar and Communication projects in whole India. Deputed at France as a team leader to participate in designing and manufacturing of Mirage aircraft simulator. Was founder member for setting up Indian Air Base for Mirage Operations.

In last 18 years planned, established and managed many institutions and group of institutions of higher learning. In 2011 became the founder Vice Chancellor of AISECT University Bhopal (MP) India, now known as Rabindranath Tagore University (RNTU). He has formed a Core Research Group (CRG), of five Universities being run by AISECT, which is handling more than 15 research projects including 3 international research projects. He is currently the Chancellor Dr. CV Raman University, heads the CRG and also works as the senior consultant to AISECT group. He is editor in chief of two research journals approved by the Indian University Grant Commission, available in print and e-versions. He has set up 7 skill Academies and 7 centers of Research Excellence in RNTU. His area of interest is Renewable Energy, Radar & Communication and Environment. Under his leadership RNTU has received many national and international awards in education skill and research. He was felicitated by Govt of India for skill initiatives taken by the AISECT in 2014.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



THEME 1: WATER RESOURCES

KEYNOTE SPEAKER: Prof. J.A. Du Plessis, University of Stellenbosch, South Africa



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



Contribution to the modeling in Algeria: using the Discharge -Rainfall relationship

Asma Dahak* and Boutaghane Hamouda

Algeria

*Corresponding author email: asma16061991@gmail.com

Abstract

The expansion of urbanization affects mainly: rural areas by the increasing runoff after a heavy rain. Water presents in rivers results two processes: surface flow and groundwater flow, with different approaches, as function of velocity and time. Hydrological models are created for modeling these two processes, primary to forecast floods then, to manage its effects on watersheds. there are several flooding sources affecting a river 's catchment, and flood risk from these sources is predicted to increase as a result of climate change: from overflow: after having a rain, or after accumulation of water in all layers of ground, or causes by buildings and impermeable surfaces such a concrete. Our study focuses on contribution to the modeling in Algeria: using simulation in continuous method. we choose the Madjez Ressoul watershed with an area of 103 km² as a study surface, because there are enough data to analyze the hydrological processes. For most cases the difference between the original rainfall and the direct runoff can be considered as infiltrated water. our model uses the traditional Horton equation as function of storage, includes production and transfer relationship to show how water occurs in tree reservoir of ground (surface flow, sub-surface flow and groundwater flow). The parameters used to simulate this model are: the initial and final infiltration rate, the recession coefficients for the three reservoirs, the delay time, and a coefficient of decrease in infiltration curve then the initial losses. this model is a new simplification of the original model, created by (Boutaghane 2014), helps to understand flooding risk by the processes of flow. Results of calibration and simulation show that this model is very satisfactory with a Nash coefficient equals more than 0,7.



Impact of climate change on the hydrological regime in the medium valley of Medjera-Tunisia

Khouloud GADER *, Ahlem Gara, Marnik Vanclooster, and Mohamed Slimani

National Agronomic Institute of Tunisia (INAT) & Laboratory of Research, Sciences and Technologies of the Waters, University of Carthage, Tunisia

**Corresponding author email: khouloud.gader@yahoo.fr*

Abstract

Tunisia, as a Mediterranean region, is characterized by rainfall regimes and hydrometeorological phenomena variable in space and time. Climate change will increase this variability: extreme events such as droughts and floods can often a catastrophic situation. In this context and concerning the impact of climate change on water resources in Tunisia, this study consists on performing a climate modeling by the method of the Statistical Downscaling to obtain projections of the precipitation and the temperature at the Siliana climate station according to RCP4.5 scenario with the Global Climate Model MIROC5 by 2100. The data used in this study for a period of 30 years from 1981 to 2010 are obtained from the national climate data center NCDC and the National Institute of Meteorology database. Then, to evaluate the impact of climate change, we used the empirical Rainfall runoff model at monthly scale GR2M to simulate the current hydrological behavior of the basin as well as the projected flow. The GR2M model was therefore applied to the upstream Siliana catchment area of 1040 square kilometers, which is part of the medium valley of Medjera- Tunisia. The values of the monthly potential evapotranspiration are calculated from the mean monthly temperature series by application of the Thornthwaite formula and the mean monthly flow is calculated from the contribution of the Siliana dam. We have taken a hydrological start-up year from September 1990 and calibration is done from September 1991 to August 2008. The Results indicate that GR2M performs well in the upstream Siliana basin since the Nash criterion is good. The model was finally used for estimating streamflow by 2100.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Groundwater flow and salt transport in Zeuss-Koutine and Jeffara Mio-Plio-Quaternary aquifers (Tunisia)

Hanen Jarray, Mounira Zammouri, Mohamed Ouessar, and Samir Sahal

Ecole Nationale des Ingénieurs Sfax (ENIS), Université de Sfax, Tunisia

Laboratoire d'Eremologie et Lutte contre la Désertification, Institut des Régions Arides Médenine (IRA), 4119-Médenine, Tunisia

*Corresponding author email: jarray_hanen@yahoo.fr

Abstract

The development of the hydrodynamic model of Zeuss-Koutine and Mio-Plio-Quaternary (MPQ) aquifers is useful to better understand the flow and hydrodynamic system. The calibration of the mathematical model in steady state is based on the reconstitution of the reference piezometric maps of the modeled aquifers in 1980. Model calibration is performed using manual and automatic calibration to adjust the transmissivities values of the modeled aquifers. The model calibration in transient state enables to adjust the storage coefficient distribution and determine the water budget and the piezometric maps in 2015. We notice a continuous decrease of the piezometric level especially for Zeuss-Koutine aquifer, since the rainwater recharge is very small while withdrawals highly increased. For MPQ aquifers, the considerable recharge through rainwater infiltration maintains the piezometric level more or less stable. The predictive simulations highlighted the effect of the rate of exploitation on the piezometric level which will be subjected to a continuous lowering. Since the area is characterized by high salinity contents, MT3DMS is used to evaluate the transport of salts in the studied aquifers. The salt transport model was calibrated through field observations. Sensitivity analysis was performed whereby model parameters: porosity, recharge water salinity, dispersivity etc. The results of the developed salt transport model showed that the salinization process affects the areas close to the Mediterranean Sea and the sebka of Oum Zessar. The recharged areas by precipitation and infiltration have the low salinity values ranging from 1 to 2.5 g/l. The inflow from the Triassic aquifer through Tajra fault results high salinity values reaching 3.5 g/l in the southeast of the Zeuss-Koutine aquifer.



Conception and sizing of an industrial waste water treatment station equipped with biogas digester, UV reactor and reverse osmosis unit

Missaoui Samia, Sellami Mohamed Habib, and Tahar Othmen

*Laboratory of soft material and electromagnetic modelling, Physics Department, FST, University Tunis
El Manar, Tunisia*

**Corresponding author email: mh.sellami@planet.tn*

Abstract

The reuse of the industrial treated wastewater in all fields (agricultural industrial domestic) is an orientation asked by all intervening in the water sector in the purpose to protect the environment and combat the scarcity of water resources. This valorization can't be done without making the appropriate treatment in order to respect the norms. In this work, we are developing a general method to conceptualize a treatment station equipped with biogas digester, UV reactor and reverse osmosis unit. A case study to size this category of station and to calculate its efficiency for the waste water issued from a paper industry installed in the Sahel of Tunisia will be detailed. The main basic equations used are those for mass transfer, radiate transfer and energetic transfer. We have calculated the optimal sizes of every device for a total elimination of particles, the amount of methane to produce from the sludge recapitulated and the efficient intensity of the UV lamp for a complete microbe deactivation. We have also estimated the total energy to consume for the functioning of treatment station. We have deduced that if the methane produced from the biogas digester is valorized we can ensure the total energy requirement of the station.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Smartphone application for vegetable irrigation scheduling

Boutheina Douh M'Hamdi*, Gaarraoui Afraa, Mejri Abbas, Hammami Amal, Mguidich Amel,
Boujelben Abdelhamid

Higher Institute of Agronomy of Chott Meriem, University of Sousse, Tunisia

**Corresponding author email: boutheina_douh@yahoo.fr*

Abstract

As part of the improvement of the agronomic aspect on the one hand and the technological evolution using ICT on the other hand, the idea behind this end-of-study project is to develop a Smartphone application for monitoring plant water requirements. The application was developed with UML: Undefined Modeling Language, "Microsoft Visual Studio 2012". A data collection was undertaken from FAO 56 to prepare the database to activate this application based on the relationship between soil-plant-atmosphere. The considered parameters are the duration of each vegetative stage, the cultural coefficient, the depth of rooting, and the fraction of exhaustion. For calculating the reference evapotranspiration, three models were used: Turk, Blaney Criddle and Hargreaves-Samani. Thus, a soil file was implanted with texture, permeability, water content at the field capacity and permanent wilting point. To verify found values quality, this innovative application was applied to the carrot culture by comparing the results of the three models mentioned above. There is no significantly difference between the results of the three models for the following parameters: Evapotranspiration (6 to 7 mm/day), gross requirements (4 to 5 mm/day), net requirement (5 to 6 mm/day), irrigation duration (4 to 5 hours) et irrigation frequency (3 to 5 days).



Present Scenario of drinking water in India: Review

Manish Upadhyay

Raman University, Kota, Bilaspur Chhattisgarh. (AISECT group of Institutions)

Corresponding author email: man_bsp@rediffmail.com

Abstract

Water scarcity in India: India's huge population makes it very vulnerable when it comes to water shortage and scarcity. About 330 million people in the country now suffer from regular water shortage issues. A dry spell causes the number of people suffering to rise sharply. Last year some 300 districts spread across 13 states including Uttar Pradesh, Maharashtra, Odisha, Bihar, Jharkhand, Andhra Pradesh, Telangana, and Madhya Pradesh suffered from an acute shortage in the supply of drinking water. Trains carrying drinking water had to be sent to Latur in Maharashtra. India's economy is largely dependent on its agriculture. Water shortage and drought not only affect the rural districts but also have a disastrous effect on inflation and economic progress. With alarming issues like farmer suicides surfacing, it is time we Indians introspect and take a harder look at water wastage in the county. A recent study suggests that by 2040 there will be no drinking water in almost all of India. By far the greatest waste occurs in electricity producing power plants, which require great amounts of water to cool them down. Between 2030 and 2040, many parts of the world will face fresh water scarcity and India is likely to be one of the worst affected countries. Alarming Signs: Per capita availability of water in India has gone down from 6,042 cubic metre in 1947 to about 1,545 cubic metre in 2011. By 2050, India's burgeoning population and water scarcity will reach alarming proportions. Over 90 percent of the waste water discharged into rivers, lakes, and ponds is untreated and leads to further contamination of fresh water sources. The greatest waste of fresh water comes from lack of adequate storage and utilisation facilities of river waters. India has no desalination facilities to use the abundant seawater resources.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Water and Environmental Sustainability in Langkawi UNESCO Global Geopark, Malaysia: Issues and Challenges towards Sustainable Development

Rahmah Elfithri*, Mazlin Bin Mokhtar and Md Pauzi Abdullah

Institute for Environment and Development (LESTARI),

Universiti Kebangsaan Malaysia (UKM)

Corresponding author author: elfith_ukm@yahoo.com

Abstract

Langkawi is an island which is characterised by its exceptional geological and biological landscape, ecological diversity and wildlife, cultural and heritage values, recreational and tourism attraction and uniqueness of its own local community. Langkawi has been selected as UNESCO Global Geopark since 2007 (the first in Southeast Asia) and recently has been selected as one of the UNESCO Sustainability Science Demonstration Site since 2015 to apply sustainability science concepts for resolving water and environmental related issues in the area through education and ecotourism, linking with local stakeholders. Identification of issues and challenges related to water and environmental sustainability towards sustainable development in Langkawi Geopark has been done through local stakeholder consultation workshop, field data collection and survey on water and environmental quality state condition in Langkawi via site observation, identification and verification, water sampling and questionnaires distribution to local stakeholders and community, as well as detailed discussion/interview sessions with some selected local government agencies, local authorities, private entities, NGOs and local community in Langkawi Geopark. Six key issues related to water and environmental sustainability in Langkawi has been identified out of 21 issues occurred in Langkawi Geopark. Strategic recommendation and way forward towards sustainable development in Langkawi Geopark has been formulated for implementation, including promoting sustainability science as a platform to responds to the future needs in dealing with water and environmental sustainability related issues in Langkawi Malaysia.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Indicators of soil degradation with increasing age of olive tree plantation in south Tunisia

Mariem Hazoug^{1*}, Pascal Podwojewski^{1,2}, Mounir Abichou³, and Mohamed Moussa¹

¹ *Laboratory of Eremology and Combat Desertification Arid Areas Institute Medenine, Tunisia.*

² *Research Institute for Development, Paris, France*

³ *Olive Institute Medenine, Tunisia.*

*Corresponding author email: mariem.hazoug@gmail.com

Abstract

In olive orchards of south Tunisia, intensive tillage (from 4 to over 8 per year) is processed to eradicate weeds and to limit the soil evaporation by stopping the capillary rise. Soils are generally low differentiated Arenosols, 50cm thick, overlaying a calcareous fragipan. The tillage practice has considerably altered these fragile soils, which are particularly depleted in organic carbon. They have a very weak soil structure leading to crusting especially in the low part of the furrows and are compacted with a ploughpan limiting the fast infiltration of scares rains.

In the office of federal land plantation in Chammakh, we will compare the soil organic matter status of different plots, from grazing open areas and plantation of 1, 7, 15, 35 and over 110 years of age respectively. We expect to find indicators of the soil degradation rate by evaluating the soil carbon decrease in complete soil profiles and we will characterize the hydric properties of the surface soil crust on the top (structural crust) and bottom (sedimentary crust) of furrows. We will also characterize the infiltration rate in the ploughpan that has formed after increasing time of compaction.

Keywords: Olive tree, soil degradation, Arenosols."



Rural wastewater treatment on a filter bed reconstituted by siliceous sand and swelling clay

Saifeddine Eturki*, Naceur Jedidi and Hamed Ben Dhia

Institute of Arid Land, Regional direction of Gabes, Tunisia

**Corresponding author email: turkisaifeddine@yahoo.fr*

Abstract

The rural wastewater treatment by infiltration percolation is an important issue for the low cost of the process, but this issue is becoming major by reconstruction of a sand filter formed by mixture of sand and clay fortified by pebbles. The natural clay, especially the smectite is the traditional material used as adsorbent of pollutants, but the percentage to be added in the filter must meet two important criteria: increased purification performance and proper permeability that helps preserve the system.

To validate the results obtained by batch and incubation tests, a column of rural wastewater treatment by infiltration percolation on massive siliceous sand mixed with 10% of clay and a coarse fraction of pebbles representing 1/3 by weight of the mixture was installed in the laboratory and receive 20l of rural wastewater regularly every three days for a period of three consecutive months. After five weeks of operation, period required for the installation of the biofilm, the purification efficiency of the column for the organic pollution or nitrogen is important. Stability of low levels of these pollutants in the filtrate is observed. The adsorption of ammonium on the clay is very fast and this affinity is allowing the attachment of small organic molecules on ammoniated clay to result in the formation of the biofilm. The clay swelling and subsequently its contraction will inhibit the early clogging of the filter bed. The column is also efficient for bacterial purification as it tends to stability bacterial load less than 10³CFU/100 ml. Indeed, around the 10th week of functioning, indicator bacteria of fecal contamination and *Pseudomonas aeruginosa* loads are lower than those non-restrictive reuse standards of World Health Organization

Keywords: Reconstituted filter; infiltration percolation; column; swelling clay; adsorption.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



Contribution to characterization of natural diatomite

Hazem MERADI*, L'Hadi ATOUI, and Kotbia LABIOD

URMA/CRTI, Algeria

**Corresponding author email: meradi213@yahoo.com*

Abstract

With the complex examination of raw material from a Sig deposit in Algeria in the region of Mascara area, physical, chemical and mineralogical properties of diatomite have been defined. It has been found that it is a dominantly amorphous material, sedimentary rock of the type silica-diatomite. The raw material consists of approximately 75% SiO₂. Of the physical properties, more significant is porosity, which is higher than 60%. The raw material has a wide spectrum of possibilities for practical application: intensive absorbent for several types of liquids and chemical properties of the soil, natural insecticide, and filter water etc. For determination of the chemical contents, properties and origin of the raw material the following methods have been used, such as, chemical analysis, XRD analysis, optical microscopy and thermal analysis.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Evolution of a hydro-agricultural system in the chain of Matmata-Dahar: case of the Zammour Wadi between 1967 and 2017

Mohamed Abbassi*, Mohamed Moussa, Hédi Ben Oueddou, Tarek Ben Fraj, Emmanuel
Reynard

*Institute of Arid Regions (IRA), Medenine, Tunisia
Geomorphologic laboratory of Cartography of the Mediums, the Environments and Dynamic (CGME),
University of Tunis, Tunisia*

Institute of Geography and Durability, University of Lausanne, Switzerland

**Corresponding author email: abassi.med84@gmail.com*

Abstract

During the Five last decades, hydro-agricultural installations in the chains of Matmata-Dahar knew a remarkable space extension. This extension, generated by the intervention of the mechanical machines, appears either by the side widening of the old surfaces arranged or by the invasion of the new neighboring surfaces. In this paper, we study the distribution of these installations (in particular Jessour) in the upstream part of the catchment area of the Zammour Wadi. To border this question, we based on the related previous studies, the air photographs, the Google Earth images and the fieldworks. Firstly, we studied the distribution of Jessour in this zone in 1967 and in 2017. Then, we developed a comparative approach which show the various special changes in Jessour (appearance, disappearance or persistence) during this last half-century.



Evaluating the best evaporation estimate model for free water surface in arid region

Elhamdi Jihen* and Chkir Najiba

Tunisia

*Corresponding author email: hamdijihen@gmail.com

Abstract

Estimating evaporation from standard meteorological data continues to be an active area of research and practical application. Studying it allows a better knowledge and understanding of the mechanisms and regularities that guides the water circulation in nature and also its associated processes. However, the applicability of evaporation models to the calculation of free water surface evaporation in arid regions is still uncertain.

The general aim of this study is to analyze and determine a free water surface evaporation model suitable for arid regions by comparing pan evaporation data with a set of different empirical methods after recalibrating constants values of each equation. The comparison carried out for the Sidi Bouzid station (Central Tunisia) allowed proposing a new empirical formula for free water surface evaporation.

The survey has been performed on climate data recorded during the period 1985 to 2015, including air temperature (°C), relative humidity (%), wind speed (m/s) and rainfall (mm) in order to highlight annual and seasonal variability, as well as the evaporation increase under global warming.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Evaluation of irrigation management, yield, and irrigation water productivity of public area of the Nabhana system

Ben Abdelmalek Maroua* and Nouiri Issam

National Agronomic Institute of Tunisia (INAT)/BGR, Tunisia

*Corresponding author email: maroua.benabdelmalek@hotmail.com

Abstract

The management of agricultural irrigation in public areas of Nabhana watershed, was studied according to the production of different crops and arboriculture. Therefore, a socio-economic survey was applied to 140 farmers and 10% of agricultural fields, which were selected by stratified method. Then, the collected data was used to calculate the irrigation water productivity (IWP) for the 2015/2016 campaign. The, representing 100% of the percentage of agricultural households using mineral fertilizers performance indicator (PMAI) was 100% for the most popular vegetable crops in this area (peppers, peas, tomatoes and cereals), while, it was at 75% for the arboriculture (olive trees, apricots and citrus fruit). Drip irrigation was the most used technique for crops and arboriculture, excepting some olive trees.

Pepper and tomatoes consumed the biggest part of irrigation water, with an average dose of 12.2 and 8 thousand m³/ha respectively. However, tomatoes had higher irrigation water productivities and higher production level, representing 5 times that of pepper. The lowest IWP was recorded for olive tree, ranging between 0.7 and 1.1 kg/m³ as per irrigation technique. Nevertheless, apricots had 3 times higher IWP compared to olive, with an irrigation dose of 9 thousand m³/ha.

Keywords: Irrigation management, Nabhana, IWP, yield.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Potentiality of Drip Irrigation & Buried Diffuser systems in the control of the soil salinity and yield production improvement in sandy soil of southern Tunisia

Ines Gasmi*, Said Chibani, Ibtissem Lassoued, Mohamed Mechergui and Mohamed Moussa

IRA, Tunisia

*Corresponding author email: gasmi-ines@hotmail.fr

Abstract

The potential of localized surface irrigation system (Drip irrigation) used to irrigate pepper in greenhouse with two irrigation treatments 50% ETP and 100% ETP in the southeast of Tunisia to reduce subsurface drainage, control soil salinity and increase the yield production in the regions affected by soil and water salinity. Compared with the Buried diffuser which is a new irrigation technique for localized subsurface irrigation, patented at the Institute of Arid Regions, Medenine-Tunisia; this technique allows the optimization of use and water resources protection in arid regions.

The crops were affected by the water salinity, which ranges between 4-6 g/l and exceed pepper salinity tolerance (3 g/l). Yield increases for water treatment 100% ETP from 590 kg in the greenhouses irrigated by drip irrigation system to 613 kg in the greenhouse irrigated by buried diffuser system, and for water treatment 50% ETP from 337 kg in the greenhouse of drip irrigation system to 402 kg in the greenhouse irrigated by buried diffuser system.

As a result, the buried diffuser helps to eliminate the salinity in the root zone for the treatment 100% ETP while, it has the same effect as the drip irrigation system for the irrigation treatment 50% ETP, but always there is an improvement in the scale of yield production."



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Use of AquaCrop model for estimating crop evapotranspiration and biomass production in hilly topography

Boudhina N*, M.M. Masmoudi, and N. Ben Mechlia

Institut National Agronomique de Tunisie (INAT), University of Carthage, Tunisia

**Corresponding author email: masmoudi.med@inat.agrinet.tn*

Abstract

Many operational crop models are frequently used for the simulation of biomass and yield production using rainfall, temperature and reference evapotranspiration data. The use of such models in sloping areas is questionable, since crop evapotranspiration (ET) in hilly topography is influenced by slope and aspect of cultivated fields as relief affects both radiation and aerodynamic processes. The objective of this work is to evaluate the impact of relief on ET, water balance and crop production at field and watershed scales using AquaCrop and field measurements, in terms of biomass, soil water content and evapotranspiration. Measurements, including climatic factors, crop evapotranspiration, soil moisture and biomass production, were conducted on wheat in three fields with different slopes and aspects during the growing season of 2013. Results show a good agreement between observed and AquaCrop simulation values for biomass and soil water content in terms of root mean square errors (RMSE) and significance coefficient (R^2). However, crop evapotranspiration is underestimated by the model in sloping fields (4%-12%). Adaptation of AquaCrop to take into account the effect of relief on ET and on production in hilly watersheds is discussed on the basis of the obtained results.



Evaluating the hydrological behavior of a Mediterranean catchment under climate change: Application in the Siliana upstream catchment

Ahlem GARA*, Khoulood Gader, Yves Trambly, Donia Jendoubi, Slaheddine Khelifi, Marnik Vanclooster, and Christophe Bouvier

*National Agronomic Institute of Tunisia (INAT), University of Carthage
High School of Engineering of Medjez el Bab (ESIM), Tunisia,
Unité de Recherche en Gestion Durable des Ressources en Eau et en Sol (GDRES), High School of
Engineering of Medjez el Bab, Tunisia*

*Corresponding author email: ahlem_gara@yahoo.fr

Abstract

In Mediterranean semi-arid catchments, climate change projections are expected to noticeably affect flow regimes. We scrutinize, in this paper, the probable climate change impacts on the discharge behavior of the Siliana Upstream catchment, which is located in the central of Tunisia and being one of the main catchments on the medium Medjerda Valley: The only permanent waterway in the country.

We used the spatially distributed conceptual SCS-LR model available in the ATHYS platform for both past and future climate conditions.

In the first hand, we simulated the model based on past climate conditions. The database considered is long-term measurement of discharge estimated by the daily water balance of the Siliana dam. A 27-year period (1988_2015) of daily rainfall, Potential Evapotranspiration (PE) and discharge was used to capture a wide range of past hydro-climatic conditions. The model performance was inspected using a cross-validation test and based on several accuracy criteria such as Nash-Sutcliffe, the Root Mean Square Error (RMSE), the Ratio of the RMSE to the standard deviation of the observed Q and the Percent BIAS.

Subsequently, we forced the model, applying the parameters established for the past climate conditions, with the projected daily precipitation and Temperature (2070-2100) driven from an ensemble of high-resolution EURO-CORDEX dynamical climate simulations using the regional climate model RCA4 with five global climate models, under two emission scenarios (RCP 4.5 and RCP 8.5), in intention to assess significant changes and uncertainty in hydrological behavior.

These models show a potential decrease in precipitation and increase in temperature towards the future compared to the historical period. Therefore, flow regime in the Siliana Upstream catchment is expected to present a decrease in runoff however PE is projected to increase.



Up-scaling of crop productivity estimations using AquaCrop model and GIS-based operations

Alaya I, M.M. Masmoudi and N. Ben Mechlia

Institut National Agronomique de Tunisie, University of Carthage, Tunisia

*Corresponding author email: masmoudi.med@inat.agrinet.tn

Abstract

Many models are used to assess the impact of climate and CO₂ concentration changes on production and evaluate adaptation strategies (Anwar et al., 2007; Bocchiola et al., 2013; Lorite et al., 2013; Mitter et al., 2015; Stockle et al., 2010; Voloudakis, 2015; Vanuytrecht et al., 2014). However, the use of biophysical crop models in hilly semi-arid and arid areas is constrained by the great variability of soil, slope and land use. On the other hand, geo-spatial models, including the most popular ones like SWAT, are using simplified crop modules which do not reflect the complexity of the simulated processes (Dinar et Mendelsohn, 2011; Teshager et al., 2016). At the field level, biophysical models show good performance when applied to accurate input data and calibration parameters. However, uncertainty increases when scaling up site-based results to watershed level (Huffman et al., 2014). In this work, an attempt is made to estimate total crop production, over ten seasons (2004-2013), in a watershed characterized by a strong fragmentation and significant soil and slope variability, from a small sample of sites, using the AquaCrop model. Three categories of texture, depths and slopes were considered to classify the 220 fields of the watershed into 27 soil classes. Production estimations were derived from the representative fields of each soil class by extrapolation to the watershed and compared to production summation of all fields in the watershed. Results show good correlation between the watershed productions, in terms of biomass and yield, obtained by both methods. The relative root mean squared difference "RRMSD" was in the range of 3-5% for biomass and 2-3% for grain yield.



Two-phase flows in porous media in the presence of dissolved salts

Lazhar Ramzi* and Najjari Mustapha

National School of Engineering, University of Gabes, Tunisia

*Corresponding author email: najjari98@gmail.com

Abstract

The deterioration of porous materials is largely attributed to the salts present in solution in the pore space. This phenomenon of alteration is classically associated with the crystallization of dissolved salts via the notion of crystallization pressure. The phenomenon of crystallization is itself often very directly related to the flows or saturation variations due to the evaporation to which the porous medium is subjected. A better understanding of alteration phenomena therefore requires an understanding of the ion transport during evaporation and in particular the evolution of their local concentration. In this context, this work consists in studying experimentally and numerically the transfer of ions in solution in a heterogeneous porous medium. The concrete problems that require a precise description of the phenomenon of crystallization and desalination are not lacking: we can cite for example, in the field of buildings, conservation of monuments, soil, We therefore understand the practical interest of the construction of a rigorous modeling of porous media. Among these modelizations, one can quote, on the historical scale, the first so-called macroscopic modeling based on the notion of average on a volume of control. More recently, microscopic modeling has just been developed: modeling on pore networks.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Social technologies to guarantee access to water for the rural population living in poverty: the Brazilian experience

Vitor Leal Santana* and Francisco Fujita de Castro Mello

Ministry of Social Development, Brazil

*Corresponding author email: vitor.santana@mds.gov.br

Abstract

The supply of quality drinking water is essential for life, but even today, millions of people around the world still do not have access to this basic need. In general, the lack of sufficient resources to implement and maintain conventional and technically more complex systems of water supply is the main barrier to the care of certain populations, especially those located more dispersed. In this context, in a movement started on a large scale in 2003, the Brazilian government has been betting on social technologies as a solution for the water supply of families living in poverty in rural areas, especially in a context of increasing water scarcity from surface and underground sources. Most of these technologies are used to capture and store rainwater, with ample potential for meeting the demand for water in regions with high water scarcity. There are already more than 1 million families directly benefited, being very probably one of the largest climate coexistence/adaptation programs in the world, which has made possible the supply of both water for human consumption and the development of small production systems. The activity has been concentrated mainly in the semi-arid region, an area of 1 million km², equivalent to almost twice the territory of Spain, with a population of 22.5 million people, 8.5 million residents in the rural area. Several studies have demonstrated the efficacy and effectiveness of this action, be it a substantial reduction in the incidence of waterborne diseases, reduction in time spent fetching water, and reducing social vulnerability. In this context, the objective of the paper is to present the context from which this action has been developed, discussing the strategies, the legal framework and the political and administrative processes that have made possible the effective implantation of these technologies in such a wide and complex territory.



THEME 2. ENVIRONMENT

KEYNOTE SPEAKER : Prof. P. Podwojewski, Institut de Recherche pour le Développement (IRD), France



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Studying the evolution of gully erosion in southern Tunisia through aerial photography and sedimentological analyses. The case of Matmata region

Ninon Blond*, Nicolas Jacob-Rousseau, Dalel Ouerchefani and Yann Callot

UMR 5133 Archéorient, Université Lumière Lyon 2, France

**Corresponding author email: ninon.blond@univ-lyon2.fr*

Abstract

In the last decades, South Tunisian landscapes have been drastically modified by agriculture and its evolutions. In the studied region, from Chemlali to the North to Toujane and Zmertem to the South, different situations occur. In the Matmata mountains, covered by thick and erodible loess deposits, farmers have built dams – jessour – in the gullies, and used them for soil and water conservation, as well as for agriculture. With the progressive rural depopulation and the shift of the population towards regions with more profitable agriculture (like “New” Matmata or the Jeffara plain), abandoned jessour were progressively destroyed, leading to the resumption of gully erosion and the loss of important amounts of soil. On the other hand, the installation of population and culture in flatter zones progressively resulted in the filling of previous gullies in these areas, thanks to tabias and fields. Comparison of ancient aerial photographs (1954 and 1972) with contemporary satellite imagery enables the proposition of a first scheme of the evolution of the landscape over the past fifty years. Field survey and sedimentological analyses of some jessour fillings in the northern part of the study area allow precise description of sedimentary deposits and a first estimation of soil losses.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

How to preserve groundwater in arid lands? Case study: Analyzing the water management policies implemented in Yazd province to preserve its groundwater resources

Ali Asghar Semsar Yazdi* and Mohammad Saleh Semsar Yazdi

UNESCO-ICQHS, Iran

**Corresponding author email: saleh@tkce.ir*

Abstract

Over the past decades, population growth, improvements in living standards, developmental plans and other related human activities have put extra pressure on water resources of arid and semi-arid lands. Some of the aquifers of these regions have been subjected to undermining. Yazd province, ranked among the dry lands of the world, situated in the central plateau of Iran, with average annual rainfall of 98 mm has experienced this situation. Over the past 42 years (from 1975 to 2017) this region has lost 4 billion cubic meters of its groundwater reserves due to over pumping. In order to mitigate the overexploitation crisis and their long-term environmental and ecological consequences, some measures have been taken by the national and local authorities.

This paper will first review the situation of Yazd aquifer in the past decades, then will describe and analyze the water management policies to mitigate the groundwater crisis and the measures taken to preserve the groundwater of this area. As a result, it will suggest implementation of these practices to other similar regions of the world.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Long-term effects of soil and water conservation on selected ecosystem services in Minchet catchment Ethiopian Highlands

Alemtsehay Subhatu*

Centre for Development and Environment, Hallerstrasse 12, 3012 Bern, Switzerland, Institute of Geography, University of Bern, Hallerstrasse 10, 3012 Bern, Switzerland.

**Corresponding author email: alemtsehay.teklay.subhatu@cde.unibe.ch*

Abstract

The extensive human pressure on the land coupled with strong precipitation events that concentrated from June to September led to high land degradation. Land degradation in the Ethiopian Highlands negatively affects the provisioning (crop production) and regulating (soil erosion) ecosystem services. Therefore, since 1980s soil and water conservation technologies have been implemented in Minchet catchment Ethiopian Highlands. The study assesses the long-term effects of soil and water conservation on selected ecosystem services in Minchet of Ethiopian Highlands. Data has been collected through field measurements and social survey. The study result shows that after the implementation of soil and water conservation the biomass and grain yield of teff and wheat shows an increasing trend. The terraces, which developed over 30 years following construction of fanya juu bunds on cropland results significant amount of grass biomass, which uses for feed. The social survey shows, farmers benefited by maintaining soil and water conservation technologies including plantation plots were essential livelihood and for spiritual values. However, with increasing of population this land management practices may not be enough to feed the population and at the same time maintain the ecosystem services. We thus highlight further improvement of land management practices and expanding to other similar places.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Fluctuations of the piezometric level and wind accumulations during the Quaternary period in the maritime Jeffara (Southern-East of Tunisia)

Amira Essid*, Mohamed Ouaja, Mohamed Taieb Labiadh and Kamel Regaya

University of Gabes, Tunisia

*Corresponding author email: amira1essid@gmail.com

Abstract

In southeastern Tunisia, Quaternary lands begin with a thick series of silty-clayey and conglomeratic deposits. Attributed to the lower to medium Pleistocene, this series represents a fluvio-lacustrine sedimentation deposited in a warm and relatively humid climate with contrasting seasons as evidenced by the abundance of carbonate concretions. Largely distributed in maritime Jeffara, these fluvio-lacustrine deposits are incised by numerous wide valleys in which the Upper Pleistocene and Holocene deposits are accumulated. Marked by their desertic facies, these deposits mainly correspond to fine aeolian sands and silty-gypse clays of coastal plains and associated sebkhah. These characteristic facies of hot and arid climates are interspersed with fluvio-lacustrine deposits reflecting brief wet periods.

At least three climatic sedimentary sequences, corresponding to orbital cycles, consist of the superposition of heterogeneous sediments of fluvio-lacustrine origin and homogeneous fine sands deposited by marine winds. The degradation and preservation of these sequences are tightly controlled by tectonic uplifts and piezometric fluctuations of the water table. In the lower coastal plains, the latter depends much more on variations in the base level than on precipitation.

In agreement with Swezey's work (2001 and 2002) which reveals an overall trend towards widespread wind mobilization of sediments during the late Pleistocene, stabilization of early Holocene aeolian sediments and a return to mobilization generalized wind sediments towards the end of the Holocene and the orbital scale cycles identified, also in the Sahara, from fluvio-lacustrine data (Kocurek, 1998 in Swezey, 2001), the deposit emplacement model Upper Pleistocene and Holocene in maritime Jeffara shows the same climatic sedimentary sequences and allows, thanks to the possibilities of correlation with the equivalent marine formations, to give them eustatic significance. It thus makes it possible to integrate quaternary desert deposits within the overall framework of changes in climate and fluctuations of the relative sea level.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Effect of the major air pollutants on olive pollen performances

Sahar Hadj Hamda*, Helena Ribeiro, Ali Ben Dhiab, Monji Msallem, Juan de Dios Alché and Ilda Abreu

National Institute of Agronomy of Tunisia

**Corresponding author email: riahisahar@hotmail.fr*

Abstract

Olive trees produce and release large quantities of pollen into the atmosphere due to the pollination process. While airborne, the pollen is highly influenced by the environmental conditions, such as climate and air pollution which are being a serious limiting factor for a good fertilization. These conditions can alter the plant metabolism inducing the modification of the chemical structure of proteins present in pollen leading to the pollen sterility with impact on the pollination and crop size but also the health of workers and citizens sensitive to Olea pollen allergens. The present work aims to study the effect of some gaseous pollutants (O₃, NO₂ and SO₂) on the fertility, the protein profile of olive pollen (*Olea europaea*) collected separately from two Tunisian cultivars (Chetoui and Chemlali). The experiment tests were carried out using an environmental chamber system for in vitro exposure of pollen to different levels of pollutant gases during continuously 6 hours. The results of fumigated samples comparatively to non- exposed pollen revealed a significant decrease of pollen fertility in term of viability and germination. The polypeptide profiles were determined using sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) showed bands ranging from 15 to 100 kDa with changes of blotting intensities and different behavior of the cultivars. All of these results suggest that increasing levels of air pollutants may have a negative impact on the *Olea europaea* pollen and hence influence on the fruit production. Pollen exposure to air pollutants may lead to pollen sterility by damaging some cellular structure and modifying the protein profile. Such damages affect necessary olive production and annual production. However, some effects are confused thus further studies are needed using more

Keywords: Air pollutants, olea europaea, pollen fertility, protein profile



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Effect of Combined application of organic/mineral fertilizer in soil hydraulic properties

Nissaf Karbout*, Mohamed Moussa, and Habib Bousnina

Soil Science, Tunisia

*Corresponding author email: nissaf.karbout@yahoo.fr

Abstract

The effects of compost, manure, soil amendments and bentonite (aluminium phyllosilicate clay) as on soil hydraulic properties and improving water availability from saturation to oven dryness were investigated. The soil amendments were mixed with sand of dune soil and compared with untreated soil and reference soil from Chott Djerid. Two methods: Hydraulic properties: Hyprop and WP4 dew point potentiometer methods were used to measure the whole range of soil hydraulic properties from saturation to oven dryness. The hyprop and WP4 results also exhibited that soil amendments increased the soil water content of the amended soils at low matric potentials. The results of soil water retention curves revealed that control retained less water at any matric potential compared to the amended soils. The soil water retention increased with the increasing of soil amendments amount to attend the maximum in SBC treatment with $\delta S=0.477\text{cm}^3.\text{cm}^3$. The particle size distribution change significantly ($p<0.05$) with the addition of bentonite. These results suggested that the soil amendments improved the soil water retentively which confirmed the appropriateness of these soil amendments for potential use in sandy soils improvements.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

The artesian mounds, structuring elements of the Nefzaoua (Tunisia), a threatened ancient landscape heritage

Afef Raddadi*, Dalel Ouerchefani⁽²⁾, Maël Crépy, and Yann Callot⁽¹⁾

⁽¹⁾UMR 5133 Archéorient, Université Lumière Lyon 2, ⁽²⁾ Institut des Régions Arides de Médenine (IRA), Tunisia

*Corresponding author email: Yann.Callot@univ-lyon2.fr

Abstract

The oasis landscapes of the Nefzaoua (South Tunisia) have been structured - at least since antiquity- around artesian springs forming mounds made up of a mixture of artesian ejecta and wind deposits. The populations have developed an agriculture based upon plots radiating around these springs. Some of these were built during the Roman period and were still in use in the 1980s; on the contrary, others dried up earlier, making it possible to identify a shift towards the Chotts with the lowering of the water table. With the recent development of deep drilling and the multiplication of individual boreholes, the landscape is now completely destructured: the oases are reorganized and the mounds suffer destruction. In this study, the transition of the old to the new landscape system, as well as intermediate transformations, are analysed through the sedimentological study of remaining mounds, old topographic maps and satellite imagery at several dates. The data collected and validated by several field missions are included in a GIS for spatial analysis purposes. This work also has operational aims: one of the aims is to design a preservation strategy for heritage and tourism purposes of some of these remains, as they are essential but fragile witnesses to the history of the hydro-agricultural landscapes of the oases of the Nefzaoua.

Keywords: Nefzaoua, oasis, artesianism, mounds of springs, landscape history. Protection of the natural and human heritage."



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



High contribution of crop rooting to soil carbon in a semi-arid Mediterranean profile: evidence from stable isotopes and modelling

Jamel Jaouadi*, Abdessatar Hatiraa, Jérôme Balesdent, Hamouda Aichi, and Habib Ben Hassine

FST Tunis, Aix Marseille Univ, CNRS, IRD, Coll France, INRA, CEREGE, Europole de l'Arbois, BP80, 13534 Aix-en-Provence, France

**Corresponding author email: jamelbadis1@gmail.com*

Abstract

Organic carbon storage in soils is a key process for agriculture sustainability and future climate control. Nevertheless, this issue has been insufficiently studied in the semi-arid context of northern Africa. We selected a Tunisian site, where the natural ^{13}C labelling offered by the C4 crop forage sorghum allowed tracing the turnover of carbon at a decadal scale (12 years). In these soils with a high carbon stock (166 t ha^{-1} in the first meter), one third of the new crop-derived carbon was found below the upper 30 cm. Rooting is a major source of deep SOM and should not be neglected in C balance of such semi-arid soils. Subsoil C age (ca. 400 yrs) indicates that C turnover is four times slower than in topsoil C age (ca. 100 yrs). The soil C model RothC using default parameters has accurately predicted topsoil C turnover with no particular adaptation to the specific environment. Besides, particulate organic matter (POM) can act as an estimate of the resistant plant material model compartment. We provide a simple model prediction of subsoil C dynamics. Under semi-arid climates, irrigation is a key driver of C dynamics and its role in carbon management requires specific studies.



Evaluation of pollutants in industrial areas: Assessment of topsoils quality

Ines Terwayet Bayouli*, Housseem Terwayet Bayouli, Emna Ammar, and Ali Ferchichi

Arid Regions Institute, Tunisia

*Corresponding author email: bayouli_ines@yahoo.fr

Abstract

During last decades industrial encroachment of southeastern Tunisia have emerged pollution problem. Assessing heavy metal soil contamination in mining soil of Gafsa situated in the South west of Tunisia was carried out in four sites at different distances towards the mining source (1000 m, 6 Km). Rhizospheric soil samples were removed at two depths 0-10, 10-15cm. Concentrations of Cu Zn Fe Cd Ni were analyzed using atomic spectrophotometry, physicochemical parameters (CEC, conductivity, pH, CaCO₃, TOM) were measured. A significant variation of all metals concentration was detected between close sites to reference site. High significant variation between depths was stated showing an increasing concentration of heavy metals on top soils except for the reference site.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Periodic (cultivation period) and vertical (depth) effects of excessive fertilizer use (chemical and organic) on soil organic components

Souidi Yousra*, Ines Gasmi, Mariem Hazoug, Said Chibani, Ibtissem Lassoued, Habib Lamourou, Hafedh Rigane, and Mohamed Moussa

Tunisia

*Corresponding author email: yosrasuidi@yahoo.fr

Abstract

Sub-tunnels cucurbit cultivation, in the region of Skhira, located in the southeast of Tunisia, is characterized by a high dependency on excessive use of chemical and organic fertilizers, in this way, land use for this speculation decreases from a year to another.

In order to study the organic effects of fertilizers on the soil, in terms of short periods (before, during and after cultivation) and long periods (after 2 and 10 years of cultivation) and in terms of depth for a witness plot. We noted that there is a richness in organic matter for some fertilizing elements, such as calcium, magnesium and nitrogen as well as for the soil salinity in all plots, even for the witness one, with maximum values during cultivation and post-crop periods and a minimum at 10-year-old plot level, that due to an horizontal propagation of organic components. The same parameters were performed according to the depths and we noted that there are no remarkable differences between the surface and the soil depth due to the vertical propagation of organic components. This propagation was facilitated by the sandy loam texture of the soil, which can eventually reach the water table and causes two types of pollution: organic and inorganic.

Keywords: Fertiliser; soil; organic components; periodic effects; vertical effects.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Relationship between the characteristics of the surface of cultivated soils and wind erosion in the Plain of Jeffara

Houda Oueriemmi*, Jean Louis Rajot, Abdelhakim Bouajila, and Mohamed Labiadh

Institute of Arid Regions, Médenine, Tunisia

*Corresponding author email: houdaoueriemmi@hotmail.com

Abstract

The plain of Jeffara is part of arid Southeast Tunisia characterized by high temperatures, low and erratic rainfall, and sandy and shallow soils, that is to say easily erodible by the wind. The purpose of this work is to study the characteristics of the soil surface that promote wind erosion in olive fields located in the plain of Jeffara including crusting. Special attention in the field has been paid to the description of the surface state and measuring the resistance to penetration crusts. The physico-chemical characteristics of the soil were measured in the laboratory.

The results of this work show that the majority of soils in the plain of Jeffara are vulnerable to wind erosion, given the systematic presence of a nearby erodible fraction of 100 μm . Soils that seem least erodible are characterized by a higher rate of fine particles (silt + clay) and a higher organic matter content, both favoring aggregation, or a higher rate of limestone which could correspond to a coarse sand fraction.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



Spectroscopic analysis of humic acids derived from different types of exogenous organic matter

Fatma Baraket*, Imen Ben Mahmoud, Hadda Ben Mbarek, Rayda Chaker, Hafedh Rigane, Sameh Maktouf, Nabil Soua, Mouna Khelifi, kamel Gargouri, Imen Ben Mahmoud, Hadda Ben Mbarek, Rayda Chaker, Hafedh Rigane, Sameh Maktouf, Nabil Soua, Mouna Khelifi, and Kamel Gargouri

Tunisia

*Corresponding author email: baraketfatouma@gmail.com

Abstract

The supply of exogenous organic matter to soil can be a solution that improves the stock of soil organic matter. Moreover, it may represent an adequate solution to minimize the amount of organic wastes. Organic amendments are often in order to increase the amount of humic compounds in soils. However, not all the organic amendments bring equally the same amount of stable organic carbon or humic compounds. Thus, the research for efficient sources of organic matter becomes a necessity. A comparative study of three types of organic amendments (Olive-pomace compost, peat and manure sheep) was performed using advanced spectroscopic techniques such as (infrared spectroscopic, visible uv and rock-eval pyrolysis). The results of analysis of humic acids derived from these different types of organic matter showed that the compost has the highest levels of TOC, and the high content of Oxygen Index. This proved the maturity of the compost. It was also noted that high levels of hydrogen index were correlated with low levels of Oxygen Index for humic acids from manure sheep. These results were confirmed by rock-eval pyrolysis, infrared spectroscopic techniques.

Keywords: exogenous organic matter, humic acids, spectroscopic studies.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Impact of drought and salinity on henna (*Lawsonia inermis* L.) productivity in South-East of Tunisia

Hanen Enneb*, Mohammad Ayaz Ahmad and Ali Ferchichi

Laboratory of Dryland and Oasis Cropping, Institute of Arid Zone of Médeninre, 4119, Tunisia.

*Corresponding author email: hanenenneb@yahoo.fr

Abstract

Climate change constitutes a real environmental problem, which is of concern for all the countries in the world. Rapid changes in the climate are already happening and multiple consequences are expected. It is predicted that environmental stresses will increase due to climate change. Drought and salinity, frequently co-occurring in both natural and agricultural ecosystems, are the most important abiotic stresses limiting agricultural production worldwide. Rising salinity and prolonged drought both limit plant growth and biomass production, alter the allocation pattern of biomass, and even causes plant death. Consequently, an improvement in drought and salinity tolerance in crops is a prerequisite for achieving economic gains. Tunisian flora is well known for its richness and diversity of medicinal plants such as henna (*Lawsonia inermis* L.); a flowering plant which belongs to the family of Lyteraceae, and which is distributed in dry tropical and subtropical zones including North Africa. This plant pertains to continental oases where water shortage and saline soil constitutes the essential limiting factors of agricultural production. The pot experiment was carried out in the Institute of Arid Regions in Medenine-Tunisia to investigate the effects of drought and salt stresses on growth characteristics of *Lawsonia inermis*. Results showed that drought caused a significant reduction ($P < 0.05$) in the shoot dry weight of the T2-stressed henna (25% FC), compared to the optimal irrigation (T0: 100% FC). Indeed, in response to severe stress (T2), *L. inermis* reduced the shoot dry weight by 49.2%, as compared to T0-plants. Under salt stress, the shoot fresh biomass decreased significantly with increasing NaCl concentration. In contrast root fresh biomass only decreased significantly when 150 mM NaCl.

Keywords: *Lawsonia inermis* L, Climate changes, Abiotic stresses, Oases, Shoot dry weight, Root dry weight.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Analyse de la vulnérabilité des ressources en eaux souterraines en milieu urbain par la méthode DRASTIC modifiée (DRASTICU) : Cas de la nappe phréatique de Sidi Bouzid

Gammoudi Safa*, CHKIR Najiba, BOUGHATTAS Nour El Houda, Arraouadi Soumaya, HAMDJ Monji, and ZOUARI Kamel

Ecole Nationale d'Ingénieurs de Sfax, Tunisia

*Corresponding author email: safa_gammoudi@outlook.fr

Abstract

L'urbanisation rapide pose de nombreux problèmes, car elle impose de grandes exigences en ressources naturelles telles que les eaux et les terres afin d'assurer un niveau de vie satisfaisant pour les populations. Ce travail analyse l'impact de l'urbanisation sur le régime des eaux souterraines dans une ville en développement, la ville de Sidi Bouzid. Malgré que cette ville située au centre de la Tunisie soit soumise à un climat semi-aride ; elle est fortement ancrée dans son environnement agricole. La vulnérabilité des eaux souterraines a été évaluée dans la zone d'étude sur la base du modèle DRASTIC, reconnu comme l'un des modèles les plus largement utilisés pour l'étude de la vulnérabilité des aquifères. Cependant, ce modèle est peu adapté à l'environnement urbain. Nous avons donc modifié la version standard de ce modèle pour mieux représenter la vulnérabilité de l'aquifère en milieu urbain. En plus de ses 7 paramètres environnementaux (profondeur de l'eau, recharge nette, nature de l'aquifère, nature du sol, topographie, impact de la zone va dose et conductivité hydraulique), le modèle DRASTIC modifié intègre un huitième paramètre « U : utilisation des terres urbaines » qui permet de tenir compte de l'imperméabilisation des sols par l'urbanisation. De plus, une analyse de sensibilité a été utilisée pour valider et évaluer l'effet de chaque paramètre individuel sur les résultats. La validation du modèle DRASTICU a été réalisée à travers la relation entre la vulnérabilité des eaux souterraines et la concentration en nitrate. La carte finale montre que le centre de la ville est très vulnérable alors que les zones limitrophes sont moins touchées par la pollution.



Physicochemical adsorption properties of heavy metals by different clay combinations in the context of phosphogypsum storage

Kawther ben Moussa*, Eturki Saifeddine, Bouajila Ahmed, and Ouessar Mohamed

*Eremology and Combating Desertification Laboratory, Institute of Arid Land Medenine,
Tunisia*

*Corresponding author email: kawtherbenmoussa44@gmail.com

Abstract

This work deals with current problematic issues of environment-health interactions in the context of phosphogypsum storage. Our Tunisia suffers from pollution problem mainly from the Tunisian Chemical Group. Phosphogypsum is the by-product of the manufacture of phosphoric acid, resulting from the sulfuric attack of a natural calcium phosphate ore. On the environmental front, crude phosphogypsum is likely to release heavy metals and radio-elements into the water and into the atmosphere, which poses serious problems. Several researchers have shown that a variety of materials of natural or biological origin are characterized by their ability to fix significant amounts of heavy metals. Taking the example of clays that have been the subject of various studies for various applications such as adsorption. Clays are known by their adsorption capacities, their important specific surface area and their abundance in nature. The objective of our work is to experiment with new sorption conditions of heavy metals present in the rejection of solid phosphogypsum on Tunisian clay mixtures.

Keywords: phosphogypsum, storage, clay mixtures, adsorption, heavy metals.



What is the impact of mineral dust on air quality in southern Tunisia? Analysis of 3 years of PM10 concentration

Christel Bouet*, Mohamed Taieb Labiadh, Jean Louis Rajot, Gilles Bergametti, Béatrice Marticorena, Saâd Sekrafi, Mohsen Ltifi, Anaïs Feron, Thierry Henry des Tureaux, and Houcine Khatteli

Institut d'Ecologie et des Sciences de l'Environnement de Paris (iEES Paris), UMR IRD 242, Bondy, France et Laboratoire Interuniversitaire des Systèmes Atmosphériques (LISA), UMR CNRS 7583, Créteil, France

*Corresponding author email: christel.bouet@ird.fr

Abstract

The south of Tunisia is a region very prone to wind erosion. During last decades, changes in soil management have led to an increase in wind erosion. In February 2013, a ground-based station dedicated to the monitoring of mineral dust (that can be seen in this region as a proxy of the erosion of soils by wind) was installed at the Institut des Régions Arides (IRA) of Médenine (Tunisia) to document the temporal variability of mineral dust concentrations. This station allows continuous measurements of surface PM10 concentration (TEOM™), aerosol optical depth (CIMEL sunphotometer), and total atmospheric deposition of insoluble dust (CARAGA automatic sampler). The simultaneous monitoring of meteorological parameters (wind speed and direction, relative humidity, air temperature, atmospheric pressure, and rainfall) allows to analyse the factors controlling the variations of mineral dust concentration from the sub-daily to the annual scale. The results from the three first years of measurements of PM10 concentration will be presented and discussed, especially according to the Tunisian air quality standards. The origin of the episodes of high PM10 concentration (when daily average PM10 concentration is higher than 120 µg m⁻³) will be determined by combining local meteorological data, air-masses trajectories, sunphotometer measurements, and satellite imagery.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Biochar and Compost Effects on Soil and Rain Water Incubated and On Soil Respiration

Kaouther Ardhaoui^{1*} and Mohamed Moussa²

¹*ISBAM, Gabes University, Tunisia.*

²*Laboratoire d'Érémologie et Lutte contre la Désertification, IRA Medenine, Tunisia*

**Corresponding author email: ardhaouikaouther@gmail.com*

Abstract

An arid zone is characterized as an area of low precipitation, high temperature, and high rate of evaporation. The soil in this zone is characterized by neutral, high salt content, and low organic matter. Therefore, its agronomic potential can be easily deteriorated by erosion or overcultivation and consequently amendments are added to enhance physico-chemical properties of soil. These amendments have beneficial outcome on agricultural productivity, but their effect on soil (microbiological and physico-chemical aspects), water table and global environment are to be investigated seriously. Organic amendments are known to ameliorate the quality of soil, but their effect is not simultaneous, several weeks are required and even months to notice this effect. In this preliminary research, we studied rain water, incubated with soil and also with a (soil, compost), a (soil, biochar) and a (soil, biochar, composte) mixtures. In fact, some physicochemical properties of the incubated water were collected during a period of about five weeks (37 days). In addition, the effect of adding compost and biochar on soil respiration, was followed during 34 days. The kinetic properties of this process were deduced.



Etude comparative des amendements sableux dans les oasis de la Nefzaoua

Zied Zriba* and Moussa M.

Laboratoire d'Éremologie et Lutte Contre la Désertification, Tunisia

**Corresponding author email: ziedzriba87@gmail.com*

Abstract

Dans ce travail nous avons étudié l'impact de la topographie et l'amendement sableux pratiqués dans les oasis de la Nefzaoua au sud de la Tunisie, sur les paramètres physicochimiques de sol.

L'étude de la caractérisation de l'opération d'amendement sableux menée à travers une prospection de 54 agriculteurs a permis de révéler que 70% des agriculteurs prospectés pratiquent l'amendement sableux dans leur oasis. L'évaluation de cette pratique a montré des différences significatives selon la variation de la topographie des oasis.

L'étude des effets des amendements pratiqués sur les caractéristiques physicochimiques du sol a été menée dans 9 oasis situant dans trois délégations (Souk Lahad, Kébili, Douz) de la région sur des parcelles amendées et des parcelles non amendées. Les résultats obtenus ont montré que l'amendement sableux des sols oasiens fait augmenter leurs perméabilités et diminuer leurs réserves d'eau utilisable. En termes d'irrigation, les doses à apporter sont moins importantes dans les sols amendés et les périodes d'irrigation sont plus courtes que pour les sols non amendés. Concernant les caractéristiques physicochimiques, l'amendement sableux avec l'amendement organique, font augmenter la teneur en matière organique, phosphore et azote dans les horizons superficiels du sol.

Par ailleurs, il faut signaler que les doses d'irrigation, les périodes d'irrigation et les fractions de lessivage calculées pour des sols amendés et des sols non amendés sont nettement inférieures et celles appliquées réellement par les agriculteurs. Ce qui se traduit par des pertes d'eau excessives au moment de l'irrigation conduisant à la remontée continue de la nappe phréatique qui pose aujourd'hui un problème réel pour les oasis de la région. Aussi, le tour d'eau pratiqué dans ces oasis et qui dépasse les 20 jours conduit à la mise au stress hydrique des cultures pratiquées notamment les cultures herbacées. C'est pour cette raison que les agriculteurs ne disposant pas d'une autre source d'eau pour irriguer ont abandonné ces cultures fourragères et maraîchères.



Evaluation des performances agronomiques et physiologiques de deux variétés d'orge sous la contrainte saline et azotée

Ben Azaiez Fatma Ezzahra*

INAT, Tunisia

*Corresponding author email: zahra.azaiez@gmail.com

Abstract

En Tunisie, la production en orge occupe la deuxième place après le blé dur, toutefois, sa productivité est limitée par le problème de salinité. Dans ce cadre s'intègre ce travail qui vise à évaluer les performances agronomiques et physiologiques de deux variétés d'orge (100/1B) et (Barley Médenine) sous la contrainte saline (0, 150 Mm NaCl) et azotée (1 et 10 Mm KNO₃) et sous des conditions contrôlées.

Les résultats montrent une grande variabilité entre les deux variétés. La variété «100/1B» enregistre la teneur en azote la plus élevée pour les parties aérienne et racinaire, la hauteur du maître brin la plus importante. Le traitement azoté a amélioré significativement l'absorption de l'azote pour les deux parties aérienne et racinaire. Cette amélioration est plus importante chez la variété « 100/1B » que la variété « barley mednin », elle atteint 70% en absence de NaCl et 52% en présence de NaCl pour la partie aérienne de la variété « 100/1B », alors qu'elle est de l'ordre de 47% et 28% pour la variété « barley mednin ». Les résultats ont permis de mettre en évidence un effet hautement significatif de l'apport azoté sur l'ensemble de paramètres mesurés, en effet malgré la diminution de la biomasse racinaire suite à l'application de stress salin, l'azote a augmenté le poids sec de la partie aérienne. L'application de NaCl a causé une diminution de la hauteur, nombre de tiges et nombre de feuilles par plante surtout pour la variété sensible au stress salin « Barley mednin» contrairement à l'application azotée qui améliore ces paramètres. Le traitement salin a retardé le cycle de la plante ce qui cause l'augmentation de la valeur SPAD. On peut conclure que le traitement azoté pourrait atténuer l'effet de stress salin sur l'ensemble des paramètres morphologiques et physiologiques chez les deux variétés d'orge.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

A mathematical model for rapid hunting of desiccation-tolerant xeroprotectant-producing microorganisms

GUESMI Sihem*, A. Dkhili, C. Benhamda, K. Ghedira, A. Cherif and H. Sghaier

Institut National Agronomique de Tunisie, Tunisia

*Corresponding author email: quesmisihem152@gmail.com

Abstract

The desiccation period (H10, hours (h)), necessary to cause a 90% reduction in Colony Forming Units (CFU), is an important factor related to various applications of desiccation-tolerant xeroprotectant-producing microorganisms. However, for extremophiles, a relatively long period is required to determine this value in vitro. For example, the H10 is equal to 1008 h for *Deinococcus radiodurans*, one of the most desiccation-tolerant prokaryotes. The radiation period (D10, gray (Gy)), necessary to cause a 90% reduction in CFU, of *D. radiodurans* can be determined in less than H10/10. In this study, based on the positive correlation between xerotolerance and ionizing-radiation resistance, we present the best mathematical model relating H10 and D10 and thus allowing a fast screening of desiccation-tolerant xeroprotectant-producing microorganisms.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Diversity of arbuscular mycorrhizal fungi associated with rhizosphere of olive tree (*Olea europaea* L.) in different arid regions of southern Tunisia

Sarra Ouledali*, Mustapha Ennajeh, Erica Lumini, Valeria Bianciotto, Paola Bonfante, and Habib Khemira

Research Unit of Biodiversity and Valorization of Bioresources in Arid Zones, Faculty of Sciences of Gabes, City Erriadh, Zrig, Gabes 6072, Tunisia

*Corresponding author email: sarraouledali@yahoo.fr

Abstract

The abundance, the distribution and the diversity of indigenous strains of arbuscular mycorrhizal fungi (AMF) in Tunisian arid and semi-arid regions were little investigated. The overall objective of our work was to improve olive cultivation under arid climate by using mycorrhizae. So, as first step we aimed to identify autochthones AMF-species associated with olive tree rhizosphere in different arid regions of southern Tunisia. The soil samples were collected from the rhizosphere of two indigenous olive cultivars (Chemlali and Zarrazi) growing in three sites (Matmata, Zarzis, Tataouine) along an aridity gradient. Spores were extracted and their abundance was determined. First, the AMF spores were characterized morphologically. After that, the strains were genetically characterized by PCR amplification and sequence analysis of a portion of their 18S rDNA. Our results show that Zarzis-site has the highest spore density while Tataouine-site has the lowest one. The morpho-molecular characterization allows to the identification of 10 fungus species. Acquired results indicate the dominance of Glomeraceae family represented by *Glomus*, *Rhizophagus* and *Funneliformis* genres, followed by *Diversisporaceae* family. Matmata-site exhibits the highest AMF strain diversity; while Tataouine-site shows the lowest one. For the same site, AMF species in Zarrazi-rhizosphere were more diversity than those in Chemlali-rhizosphere.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Vulnerability to drought-induced embolism of six woody species used for reforestation projects in arid regions of southern Tunisia

Samira SOUDEN*, Mustapha ENNAJEH, Noomen MASSOUDI, and Habib KHEMIRA

Research Unit of Biodiversity and Valorization of Bioresources in Arid Zones (BVBZA)
Faculty of Sciences of Gabes, University of Gabes, Tunisia

*Corresponding author email: souden_samira@yahoo.fr

Abstract

The accentuation of drought intensity caused by climatic changes requires the adjustment of the reforestation species package used in the rehabilitation projects in arid regions of Tunisia. The resistance to xylem cavitation could be a promising criteria for the selection of the drought-tolerant species. The objective of this study is to determine the degree of vulnerability to xylem cavitation in six woody species (*Eucalyptus camaldulensis*, *Casuarina glauca*, *Acacia cyclops*, *Eucalyptus troquata*, *Acacia salicina*, *Cupressus sempervirens*). Six-month old seedling of each species transplanted in 17 L pots were subjected to severe water deficit by watering-off during 60 days. The percent loss of xylem hydraulic conductivity (PLC) caused by cavitation was determined at regular intervals of xylem water potential (Ψ_{xyl}). The vulnerability curves to embolism were constructed for all species. The xylem water potential provoking 50% of PLC ($\Psi_{50\%}$) was determined for each species. Results show that an inter- and intra-specific variability in vulnerability to xylem cavitation exists between studied species. Referring to $\Psi_{50\%}$, the rank of the six species according to increasing degree of vulnerability to embolism is: *E. camaldulensis* -7MPa, *C. glauca* -6.8MPa, *A. cyclops* -6.7 MPa, *E. troquata* -5.7MPa, *A. salicina* -5.5 MPa, and then *C. sempervirens* -4.5MPa.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Impact of composting sewage sludge on sanitary quality of tomato

Salma Meddeb*, Dhouha Tangour, Hamouda Aichi, and Habib Ben Hassin

INAT, Tunisia

*Corresponding author email: salma.meddeb@hotmail.com

Abstract

Since 2007, Tunisia has a legislative framework about using sewage sludge in agriculture (NT 106-20). This regulation required chemical analyses, technical practices, surveys and prohibited its use for vegetable crops. By the way, the amount of sludge produced by waste water treatment station is constantly increasing, while ways for the disposal and recovery are not progressing. The most of treatment waste is landfilled (50% of waste were landfilled) and only 5% were composted. However, published standards and work books relative to the use of sewage sludge in agriculture and its valorization constraint agriculture and consumer social and psychological reluctance.

Despite of reducing sewage volume, eliminating odor nuisance and increasing fertilizing properties of the soil, one of the purposes of composting sewage sludge is to eliminate pathogenic microorganisms by hygeinising it, reducing its harmful effect and avoiding its later recontamination. Therefore, the high temperature during the composting process which can exceed 65°C.

In this study, a comparative study of the impact of two types of compost: compost of Acacia and a compost of sewage sludge on the bacterial and sanitary quality on seasonal tomato variety has been done in order to see if composting sewage sludge can eliminate pathogenic microorganisms which has harmful effect in men and animal health.



Stimulating the Anti-oxidative response and tomato growth improvement through Silicon and Salicylic acid under Salinity

Salma Wasti*, Hajer MIMOUNI, Doriane BANCEL, Anissa NSAÏRI, Ibtissem MEDYOUNI, Marwa HAMMAMI, Najwa ABDI, H  l  ne GAUTIER, and Hela BEN AHMED
Faculty of Sciences

*Corresponding author: Salma.wasti1@gmail.com

Abstract

In arid and semi-arid Mediterranean, soil salinity is a major abiotic factor that reduced productivity of many crops such as tomato (*Solanum lycopersicum*) which plays an important role in the human diet. So, overcome salt stress and its effects on crops is important to ensure the stability of agricultural production. Plant salt tolerance could be improved through several programs breeding as exogenous application of salicylic acid (SA) and silicon (Si). Treatment with 100 mM NaCl depressed plant growth and reduced SOD and CAT activities and lowered regeneration of reduced ascorbate and reduced glutathione. In addition, salinity increased the production of MDA in leaves and roots. An exogenous application of Si (4 mM) or SA (0.01 mM) reduced the depressive effect of NaCl on growth and affected antioxidative metabolism by increasing the levels of antioxidants and stimulating ascorbate-glutathione cycle enzymes activity (APX, GR, MDHAR, DHAR) in roots. However, both molecules did not act in a similar way: only Si was able to reduce H₂O₂ accumulation in leaves whereas SA stimulates SOD activity. Conclusively, Si and SA had a positive effect on plant growth especially under stressed environment and were found effective in the enhancement of salinity tolerance of tomato plants.



Mesocosm scale study on fluoride mitigation measures in cropping systems

Rizzu Margherita*, Ara Angelo, Cappai Chiara, Demurtas Clara, Melito Sara, Mshanga John, Patteri Giacomo, Pinna Maurizio, Piredda Agostino, Roggero Pier Paolo, and Seddaiu Giovanna

Department of Agricultural Sciences, NRD - Desertification Research Centre. University of Sassari

*Corresponding author email: mrizzu@uniss.it

Abstract

High fluoride (F) contamination of water and along the food chain in the African Rift Valley is at the base of severe diseases, such as dental and skeletal fluorosis. However, knowledge on the F effects on crops cultivated in contaminated environments and on effective F mitigation strategies for cropping systems are still limited.

The aims of this study were to assess: (i) the impact of F-rich irrigation water and F enriched soil on productivity, product quality and nutritional value (e.g., functional secondary metabolites) of some target crops; (ii) the soil amendment efficiency in mitigating F plant uptake and accumulation, (iii) the fluoride partitioning into plant components (edibles and not edibles parts) for the tested crops.

A pot experiment on the most representative local crops (maize, bean, tomato) was carried out in the greenhouse at the experimental farm of the University of Sassari. Different F concentrations in the irrigation water and two soil amendments (lime, kaolinite) using enriched soil (1000 ppm F-) or not enriched soil were compared.

The obtained results will provide the basis for the implementation of field-level experiments in the African study areas in order to evaluate the effectiveness of the identified strategies in the specific local context.

This research is part of the Flowered project (a Horizon 2020 European funded project: Grant Agreement - N. 690378) (www.floweredproject.org).



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Optimization of biodiesel obtained from waste frying oil by heterogeneous enzymatic transesterification

Mariem Harabi, Zied Zarai and Mohamed Bouaziz*

Faculty of Science of Sfax

*Corresponding author email: mohamed.bouaziz@fsg.rnu.tn

Abstract

Energy needs are rapidly increasing in countries. 80% of the world's primary energy is of fossil origin. Unfortunately, the world's oil reserves are permanently diminishing and there is no real alternative today. In this context, biofuels are particularly taken into consideration. The objective of this work is to find a source of sustainable production for the production of biodiesel and to determine the most appropriate treatment method and the best-operating conditions. The enzymatic transesterification of Waste Frying Oil (WFO) with methanol for the purpose of biodiesel synthesis has been found to be very effective. The transesterification step was catalyzed by commercialized lipase and the reaction conditions were optimized using the fractional factorial then the Box Behnken "BBD" plane coupled with the response surface methodology (RSM). Experimental values showed good similarity, implying that the empirical models used in this work can be used to describe the relationship between factors and response. The optimal reaction conditions were determined using a regression model: temperature 30°C, molar ratio methanol/oil (3:1), amount of lipase 3.1%, water content 14%, amount of hexane 10% and incubation rate of 250 rpm with an incubation period of 24.33 hours. Under these conditions, the yield of Methyl esters of WFO was 99.7%.



Nanofiltration polishing membrane process for fluoride removal

Nouha Meftah, Assil Mejdi, Abdessalem Ezzeddine, Ahmed Bedoui, and Ahmed Hannachi*

GPSI, ENIG/Faculté des Sciences de Gabès

*Corresponding author email: ahmed.hannachi@enig.rnu.tn

Abstract

Despite their harmful effects, several industrial wastewater effluents are still rejected to the marine environment. It is necessary to treat this effluent in order to respect the environmental standards before discharge into the sea. Several techniques have been developed for fluoride treatment in effluents. A neutralization associated to a membrane process can achieve this goal when the concentration of fluorides is very high such as for some industrial effluents. Each step requires an optimization to get the best overall result.

The objective of this study is to investigate the removal efficiency of nanofiltration (NF) membranes to reduce fluorides from a real industrial wastewater adequately neutralized with lime.

This study demonstrated that the neutralization with hydrated lime using excess of about 36% at pH 6-7 led to fluoride removal rates higher than 98.7 %. The effect of several operating parameters on the permeate quality was determined. The best removal conditions of fluorides were identified.

Keywords: Industrial wastewater; Fluoride; Treatment; Neutralization; Nanofiltration; Optimization.



Agronomic application of Olive Mill Waste Water: Short-term effect on soil chemical properties and Barley performance under semiarid Mediterranean conditions

Raja Dakhli*, Houcine Khatteli, Houcine Taamallah, Ridha Lamouri, Mohamed Ouessar, and Elhem Mallek Maalej

*Corresponding author email: rajaedakhli@yahoo.fr

Abstract

The extraction of oil produces olive mill wastewater "OMWW" which has a very strong polluting power resulting in high levels of COD (chemical oxygen demand), high salinity and a strong phenolic compounds causing environmental pollution. Thus, the exploitation of this waste without preliminary treatment is very limited considering the toxic effect on soil and plants. The search for new technologies or processes for recovery of the effluent is necessary. The spreading of OMWW in the sandy soil in arid conditions of Southern Tunisia is a potential alternative for this purpose. The identification of a recovery method of "OMWW" as a fertilizer in agriculture is an initiative with both agronomic and environmental interest.

In this study, the spreading of 15, 30 and 45 m³/ha for three consecutive years were tested in the presence of irrigated barley crop in order to assess the impact of the incorporation of these effluent on soil chemical and biological characteristics and plant behaviour.

The results of the study showed that spreading amounts from 15 to 45 m³/ha for three consecutive years induced a considerable improvement of soil fertility.

The pH and soil phosphorus content remain stable during the three years of study while the soil salinity was increasing for the 45 m³/ha treatment where it exceeded 6 dS /m.

In addition, all the components of barley yield, except 1000 grain weight, were negatively affected by "OMWW", in particular yield plots that received higher doses as 30 m³/ha and 45 m³/ ha.

Obviously, the straw, spikels and grain yield, are catastrophically affected with relatively different degrees depending on the dose applied but also on the cumulative effect of successive applications during the three years of study.

Keywords: OMWW, soil, Barley crop, yield.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Etude de l'influence des caractéristiques édaphiques sur les teneurs en métabolites secondaires chez deux variétés de *Punica granatum* L.

Bouteina Fella^{*}, Marwa bannour, Nissaf Karbout, Tarek Zammouri, Mariano Oton Alcaraz, Francisco Artes Calero, and Ali Ferchichi

Institut des Régions Arides, laboratoire d'Aridoculture et Cultures Oasiennes. Tunisia

**Corresponding author email: boutheinafellah@gmail.com*

Abstract

Punica granatum L. est considéré comme un fruit substantiel. Ces plantes sont généralement décrites comme étant des arbustes ou des petits arbres. En effet, la variété « Gabsi » est l'un des cultivars de grenade les mieux reconnus en Tunisie pour sa qualité sensorielle très appréciable, et pour sa valeur nutritionnelle importante. Dans cette étude, les espèces étudiées de grenadiers ont montrés des teneurs élevés en polyphénols totaux, anthocyanes et par des activités antioxydantes importantes. En effet, les résultats montrent que la teneur la plus élevée en polyphénol est enregistrée dans l'écorce de la variété « Gabsi » et que la teneur la plus élevée en anthocyane est obtenus dans les feuilles de la même variété ($648,70 \pm 47,58$ mg AGE/ 100g MS et $0,13 \pm 0,00$ mg ECG/100g MS, respectivement).

Néanmoins, afin de mieux connaître les propriétés du sol qui peuvent influencer la production et/ou la qualité de grenadier dans le milieu oasien. Nous avons déterminé les caractéristiques physico-chimiques du sol de la région Zerkine II. Les résultats obtenus montrent que l'oasis de Gabes est caractérisé par un sol moins fertile à cause de l'aridité du milieu. Nous avons constaté que

En définitive, nous avons confirmé que *Punica granatum* L. nécessite un milieu édaphique bien déterminé. L'ensemble des résultats obtenus montrent que les caractéristiques édaphiques constituent un facteur majeur pour la détermination de la qualité des fruits de *Punica granatum* L.

Mots-clés : Activité antioxydante, anthocyane, caractéristique édaphique, polyphénols, *Punica granatum* L.



The effect of no-tillage practice on soil nitrogen dynamic

Mohamed Annabi*, Haithem Bahri, Roukaya Chibani, Hatem Cheikh M'hamed, and Amir Soussi

INRAT, Tunisia

*Corresponding author email: mannabi@gmail.com

Abstract

Soil nitrogen statute is of great importance in determining soil fertility. Soil tillage and crop residue management can affect soil microbial activity and therefore nitrogen dynamic. In Tunisia, the implementation of no-till (NT) practice is increasing during the last decade. The aim of this work was to follow the mineralization of nitrogen in soils converted to no-till compared to conventional tillage system, under northern conditions.

The surface layer of the soil was sampled in 6 farmers in Northern Tunisia. Conventional tillage (CT), no-tillage adopted for less than 5 years (NT<5 years) and no-tillage adopted for more than 5 years (NT>5years) have been compared in each studied farmer. Total soil organic carbon content (SOC) was determined using the Walkley-Black procedure. Total soil nitrogen content (TSN) was measured using Kjeldal method. Soil nitrogen mineralization was followed under laboratory conditions at 28°C during three months according the French XPU 44 163 standard. Concentration of TSN is 0.06 % higher in NT>5years than in CT. SOC content is greater under NT than under CT. Concerning C:N ratio, it is about 6.8 under CT. However, this ratio is higher under NT (9.9 and 8.4 for NT<5years and NT>5years, respectively). After three-month, soil N mineralization is 38 % higher in NT<5years than in CT.

In conclusion, NT system improves STN by an important restitution of crop residues under NT than under CT. This result confirms the contribution of NT system to improve chemical soil fertility. The increase of N mineralization under NT must be taken into account in the fertilization program. This result signifies a better mineral nutrition of plants and an economy of fertilizers.



Revival of an indigenous management system in Southern Tunisia: reintroduction of the «Gdel» in private rangelands

Ouled Belgacem Azaiez, Farah Ben Salem, Mouldi Gamoun, Fethi Gouhis, Mohamed Neffati,
Roukaya Chibani, Ezzeddine Belfekih, and Mounir Louhaichi*

International Center for Agricultural Research in the Dry Areas (ICARDA)

*Corresponding author email: M.Louhaichi@cqiar.org

Abstract

To face the negative effects of human pressure and environmental changes, developing grazing management strategies is an important tool for rangeland sustainability in the dry areas. This study aimed at assessing the reintroduction under enhanced arrangements of the indigenous deferred grazing locally named as “Gdel” for the management of private rangelands in southern Tunisia. Under the framework of the IFAD funded project “PRODESUD” and in collaboration with the Office of Pasture and Livestock, 6 rangeland sites subjected respectively to 1 year, 2 years, 3 years rest, 2 sites under light grazing after rest and free grazing (control) were selected in a representative pastoral community of Southern Tunisia. Total plant cover, range production and carrying capacity were determined inside and outside the rested sites. Preliminary findings indicate that two years rest have recorded the highest values for all scored parameters. This was followed by the first-year grazing. The freely grazed site (control) had the lowest values as compared to all other management modes. Perennials are the most dominant in all treatments including the control, but they have the highest cover in the 2nd year rested rangelands. Two years rest constitutes an entirely positive influence and provides three times more forage than three-year rest. Under the three years protection, rest is unlikely to achieve any notable benefits. Two years rest followed by one year grazing is an efficient tool to maintain sustainability of rangelands. Based on these findings, rest-rotation grazing or alternation of short periods of grazing with periods of vegetative rest seems to be more favorable than strict or long-term protection. Such grazing management would be recommended for restoring the degraded rangelands



THEME 3. ENERGY

**Keynote speaker: Prof. A. Hannachi, National Engineering School (ENIG),
Tunisia**



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Hybrid membrane processes for better performances of desalination operations

Ahmed Hannachi* and Khaoula Minyaoui

National Engineering School of Gabes, University of Gabes, Tunisia

**Corresponding author email: ahmed.hannachi@enig.rnu.tn*

Abstract

Water is a precious, fragile and very limited resource, which should be coherently and rationally managed. Perhaps on the top of challenging facing humanity is how to design and operate desalination processes respecting sustainability criteria. Such critical challenge could be won by implementing integral approaches for desalination processes considering water assets wise management, energy savings, and adequate technical practices with limited negative impacts. Currently Reverse Osmosis (RO) desalination is the leading technology for providing fresh water out of a multitude of raw water sources. However, the energy demand of this membrane technology is still relatively important compared to other membrane separation processes such as Nano filtration (NF). The latter is able to produce a good fresh water quality in brackish water desalination market, at a low operational pressure with an equal high retention of multivalent anion salts. In a previous work we have showed that NF compared to RO performs much better when considering water and energy savings along with some technical and environmental considerations for brackish water desalination process within arid region where permeate is blended with raw water and delivered to the consumer. In fact, adopting an integral approach showed that switching from RO to NF allows reducing energy consumption by 40% along with water saving of more than 4%. In the current work we will show that hybrid NF-RO processes will allow performing even better than solely RO or even NF processes for several scenarios of water desalination and distribution.



The energy valuation of by-products of palm trees date palms

Saad Karim, Intissar Zarrouk, Hela El Ferchichi Ouarda, and Mlaouhi Amor

Tunisia

**Corresponding author email: saadkarim2010@gmail.com*

Abstract

Aim of the study: In the world as well as in the Mediterranean Basin, the impacts of climate change and promote increased energy demand. The activation of the carbon from mineral or biological source increases the porosity and the surface of contact with any liquid. It is used largely in industrial domain and pollution removal in sanitary process. The biological raw material is originated from agricultural waste or forest biomass after pyrolysis. Tunisia counts more than 5 million palms which are concentrated in the south. The petiole of the palm leaves is considered as waste, mainly used for dune fixation and local source of energy. The objective of this work is to evaluate the properties of the activated carbon of date palm wastes specifically the leaves. Different species were compared. Their calorific power of the palms and the charcoal yield were evaluated. Material and methods: This work is studied five palm varieties most dominant date palm Tunisia. The activation was done using two different methods; physical and chemical. In the physical method; the samples were treated at high temperature (800°C) and humid environment while in the chemical method the samples were treated with Na₂CO₃. Main results: The specific area of the activated samples was measured using the iodine method. The average value was more than 1000 m²/g. Conclusion: Finally, the economic feasibility of the process was evaluated and showed that the cost of the processing is much cheaper than the activated carbon which is totally imported.

Keywords: Date palm, Valuation, Pyrolysis, Activated carbon, Activation physical, Activation chemical.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Numerical study of heat transfer and entropy generation of magnetoconvection of nanofluids

Soufien Belhaj* and Brahim Ben-Beya

Faculté des sciences de Tunis, Tunisia

*Corresponding author email: soufien.belhaj.fst@gmail.com

Abstract

The present investigation deals with the numerical study of the magnetoconvection flow of nanofluids especially the study of the heat transfer and the entropy generation. The numerical simulations were conducted using a numerical approach based on the finite volume method implemented in the code "NASIM". Effects of various parameters (thermal boundary conditions, nanoparticles volume fraction and Hartmann number) on heat transfer rate as well as entropy production are predicted and discussed. Results show that increasing the amplitude "A" increases the heat transfer and decreases the entropy generation. Also, a negative role of the magnetic field in ameliorating the heat transfer rate was deduced. In addition, augmenting the nanoparticles volume fraction ameliorates slightly the heat transfer rate and reduces the entropy generation. Finally, the best thermal system's performance was obtained at high values of amplitude, Hartmann number, and nanoparticle volume fraction.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



Revisiting a Rapid assessment of the water–energy–food–climate nexus in watersheds undergoing water stress and energy transitions

Caroline King-Okumu* and Hadi Jaafar

IIED, United Kingdom

*Corresponding author email: caroking@yahoo.com

Abstract

Strategies for management of water scarcity in the Middle East and North Africa negotiate a complex system of trade-offs between water, energy, and food production. We have previously observed the effects of rural households' green water management practices on basin-level water, energy, food and carbon stocks and flows in six basin agro-ecosystems and reported these to the international readership of the International Journal of Water Resources Development.

This study highlighted critical choices concerning energy technologies, costs and implications for carbon emissions that are associated with water management in water stressed basins. We observed that the case for increased strategic support for green agricultural water management practices appears stronger when weighed from the nexus perspective, rather than purely from the point of view of water balance and food production. However, we were only able to sketch our assessment qualitatively.

We will revisit this previously completed study and reflect on scope for further exploration of the critical choices concerning energy technologies, costs and implications for carbon emissions that are associated with water management in our selected water stressed basins. We will also consider the relevance of our approach and insights for other water stressed basins in the dryland regions of sub-Saharan Africa.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Feasibility of Seawater Desalination in the case of small and medium farms

Issam Daghari^{(1)*}, Ali Gharbi⁽²⁾ and Hédi Daghari⁽¹⁾

(1) *Tunisian National Institute of Agronomy, Tunisia*

(2) *High School of Engineers, Medjez-El-Bab, Tunisia*

*Corresponding author email: issam.daghari@gmail.com

Abstract

Desalination of seawater and brackish water can be an alternative as it can provide additional water volumes but also good quality water resources especially since Tunisia has 1256 km of coastal areas. On the other hand, the direct normal irradiance of Tunisia is high. It is 2000 KWh/m²/year compared to the world average of 1300 KWh/m²/year.

The feasibility of desalination of water by solar energy in Tunisia has been studied for:

- *Small scale (farms between 1 ha, 5ha, 10 ha, 50 ha and 100 ha)*
- *Medium scale (farms between 500ha and 1000ha)*

On a small scale, desalination through the Photovoltaic+Reverse Osmosis (PV+RO) configuration for irrigation water supply was found to be profitable only for high-yielding crops for desalinated water salinity not exceeding 6 g/l.

On a medium scale, desalination through the Concentrating Solar Power + Multi-Effect Distillation (CSP+MED) configuration for irrigation water supply was considered to be cost-effective only for crops with high added value, low water requirements and locations with high solar irradiance.



THEME 4. SOCIETIES AND DEVELOPMENT

Keynote speaker: Dr. Caroline King-Okumu, the International Institute of Environment and Development (UK)



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

Productivité de l'eau dans les oasis de la région de Tozeur

Rached Zouhair* and Selmi Saleh

Institut National de la Recherche Agronomique de Tunisie

**Corresponding author email: rached_zouhair@yahoo.fr*

Abstract

La ressource en eau constitue, d'une part, le facteur déterminant de la production dans les oasis et la ressource rare et vulnérable dans la zone de production, d'autre part. L'objectif de ce travail est d'estimer la productivité de l'eau dans les oasis du Djérid et d'identifier les facteurs socioéconomiques qui agissent sur la productivité de cette ressource. Pour ce faire l'approche des coûts reconstitués a été mobilisée afin de déterminer le coût de production des dattes et d'estimer la marge brute par mètre cube d'eau. Un échantillon de 100 exploitations phoenicoles dans la région de Tozeur ont été interviewées. Les déterminants de la productivité ont été identifiés par le modèle Tobit. Les résultats obtenus montrent que le coût de production des dattes varie d'une exploitation à une autre et la marge brute par unité d'eau est faible. Parallèlement, la productivité de l'eau varie en fonction de la taille de l'exploitation et les investissements réalisés dans la parcelle.

Mots-clés : Productivité de l'eau, coût de production, Datte, Tunisie.



Measurement of Social-Ecological Systems Resilience in Tunisia: Innovative approach using Tri-capital framework

Maroua Afi*, Boubaker Dhehibi, and Aymen Frija

*International Center for Agricultural Research in the Dry Areas, Joint Msc Program: University College
Cork, Ireland & Polytechnic University of Madrid, Spain*

**Corresponding author email: marwaafi_1990@hotmail.fr*

Abstract

Dryland systems are under pressure to meet the increasing food demand of its population and decrease the environmental impacts of production. Sustainable intensification of food production requires that interventions related to agricultural practices and management strategies must be interconnected with social and ecological contexts as well as production systems vulnerability. This paper contributes to the existing literature by providing an innovative integrated systems research framework that assesses farmers' adaptive capacity to cope with risks and production systems vulnerabilities in a context of climate change.

The objective is to develop a typology of socio-ecological systems' resilience profiles, using an explanatory set of variables defining rural livelihoods and agricultural systems on one hand, and resilience determinants which are: buffer capacity, self-organization and capacity for learning, on the other hand. Furthermore, the purpose of this research aims to measure precariousness indicator (Pr), which represents the distance of the identified systems to the "collapse point", or breakdown situation. In this regard, we refer to tri-capital framework method and by tri-capital, we relate to economic capital (EC), social capital (SC) and natural capital (NC) calculated based on a set of composite indicators allowing the determination of the Pr indicator.

The typology resulted on 4 clusters representing each a different resilience profile of socio-ecological systems. The Pr resilience indicator for the different farm types is ranging between zero (not resilient) to 5.32 (strongly resilient). The first Cluster, characterized with large rain-fed crops and low integration of livestock, includes the highest share of weakly resilient farm types. While, almost 33% of the population cluster 4, characterized by positive economic and social attributes, are strongly resilient. Moderately resilient farm types were more present in the population of Cluster 2 and 3; 48% and 49%, respectively. Both clusters have relatively high natural capital and positive social or economic attributes.



Assessing livelihood vulnerability in Tunisian arid zones

Mondher Fetoui*, Mongi Sghaier, and Fatma Aribi

Institut des régions arides Médenine 4119 Tunisia

*Corresponding author email: mondher_ga@yahoo.fr

Abstract

The Tunisian arid zones have known social and economic dynamics for nearly a century. These dynamics have seriously affected the traditional lifestyles and the forms of adaptation of the local population and their increasing needs in a context of resources scarcity and climate aridity.

This work aims to assess the vulnerability of livelihoods, as well as their level of exposure, sensitivity and adaptation to constraining socio-economic and biophysical conditions. We surveyed 60 households in the Jeffara region, which is a part of Tunisian arid zones, on socio-demographics, livelihoods, social networks, food security and climate variability. Vulnerability assessment of livelihoods was estimated by calculating a livelihood vulnerability index (LVI) (Hahn et al., 2009), after adapting components and subcomponents to the local context.

The analysis shows that the study area is more vulnerable in terms of social networks, food security and climate variability but it is characterized by a good “adaptability” which improves its resilience.

The results are very useful for decision makers to monitor vulnerability, better manage, organize and adapt actions and interventions in order to improve the capacity of adaptation, reduce exposure, sensitivity and risks generated by climatic changes scenarios.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Multi-criteria analysis of water harvesting techniques in south east of Tunisia

Naceur MAHDHI* and Nesrine KADRI

Institut des Régions Arides de Médenine, Tunisia

*Corresponding author email: naceur.mahdhi@ira.rnrt.tn

Abstract

The medium-term planning of Water harvesting techniques (WHT) poses a problem of prioritization and selection of the appropriate techniques in arid zones. This prioritization is influenced by the physical effectiveness, financial efficiency, and social acceptability of these practices. The objective of this study is to evaluate different SWC practices in Oum Zessar Watershed in southeast of Tunisia using qualitative criteria and weightings by different stakeholders (farmers and experts) based on ecological, economic and social impacts using Multi-Criteria Analysis (MCA). The study reveals that MCA is a useful evaluation tool that takes into account non-monetary and less quantifiable effects of WHT practices. Farmers employ a range of criteria to evaluate the performance of SWC practices. The relative importance of each criterion in their selection of SWC alternatives depends mostly on slope categories. In steeply sloping areas, jessours and tabias are the most viable WHT alternative in all watershed areas, followed by cisterns. For moderate sloping areas, jessours and tabias are the best alternative for farmers (and experts) followed by stone ridges. Gabion units were the most preferred alternative on plots with gentle slopes followed by jessours and tabias. Policy makers and development practitioners are encouraged to pay greater attention to both farmer preferences and slope specific circumstances when designing WHT strategies and programmes.

Keywords: Water harvesting techniques, slope, multi-criteria analysis, impacts, watershed, Southeast Tunisia"



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Virtual water flows and water value in Tunisia: a case study of wheat and olive productions

Asma Souissi*, Ali Chebil, Nadhem Mtimet and Chokri Thabet

Institut Supérieur Agronomique (ISA) Chott-Mériem, Tunisia

*Corresponding author email: asma.s@hotmail.com

Abstract

This paper aims to assess virtual water content and the economic indicators of water use in wheat and olive productions for the different bioclimatic stages and at national level in Tunisia. Virtual water (VW) is referring to the used freshwater in an exchanged commodity producing process. VW trade could be considered as a potential solution for water scarcity in countries facing risks of water shortage like in Tunisia. Data was collected from a selected sample of 113 wheat producers and 123 olive producers during 2012-1013 cropping seasons, through the use of a survey including technical and economic information. Olive was chosen as it represents the most strategic exported product and wheat because it is the main imported one. Besides, wheat and olive trees are widely cultivated in Tunisia. Collected data was used to estimate water productivity and VW flows using the Water Footprint Network methodology. Results indicated that by importing wheat, Tunisia is saving up to 1.39 Km³ of water. While, olive oil exports, implies the export of 2.44 Km³ of virtual water. From an economic perspective, olives have a better gross margin than wheat in the arid and inferior semi-arid (ISA) bioclimatic stages. The highest irrigation water value is estimated around 1 Tunisian Dinar (TND)/m³ for olive trees in the ISA where it does not exceed 0.29 TND/m³ for wheat. At the national level, if we consider the economic water productivity (EWP), for rain-fed agriculture, olives have a higher EWP. Moreover, irrigation water value is estimated at 0.51 TND/m³ for olives and it is about 0.40 TND/m³ for wheat. According to our findings, wheat production must be encouraged in the Humid and sub-humid regions while olives could be encouraged in arid and semi-arid areas in order to valorise water in these regions and increase the export revenue of foreign currency.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Gaming simulation for the sustainability of the dairy sector: the role of trust and cooperation

Meriem Msaddak*, Jamel Nasr, and Lokman Zaibet

National Agronomic Institute of Tunisia, Tunisia

*Corresponding author email: msaddakmeriem@hotmail.fr

Abstract

The dairy value chain in Tunisia is facing several problems. The large number of stakeholders for the flow of milk produced on the farm (Farmers, collection centers, large private producers, service unions, intermediaries, etc.) has led to a malfunction of the activity in the sector. The narrow policy focus on biophysical technology generation and dissemination, without considering the underlying problems related to institutional conditions and socio-economic processes, has also contributed to low technology adoption and limited broader development in the dairy value chain. This coordination problem is strongly linked to the absence of organization among the different agents in the value chain.

In our research, we used the gaming simulation as a tool to study the effect of trust on the performance of the value chain. The game was designed according to the specificity of the dairy value chain in the region of Bizerte in Tunisia and to show the role of building trust in the dairy value chain between farmers. We investigated groups of farmers in 5 regions in Bizerte. The data was collected from the game sessions, the pre-questionnaire, the post-questionnaire and the debriefing. During the game, we studied the different strategies of the actors facing different scenarios and situations.

We identified parameters that affect trust and cooperation. Results show that satisfaction, reputation, honesty and shared values improve trust. We noticed also that there is a positive relationship between cooperation and trust.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Impact of farmers' background on adoption of soil conservation strategy, Ethiopia

Anissa Gara*, Hiromichi Toyoda, Edwin P. Mhede, and Hiroyuki Iwamoto

Institut National Agronomique de Tunisie, Tunisia

*Corresponding author email: anissa.gara@gmail.com

Abstract

Landscape degradation by soil erosion has increased considerably in Ethiopian lands due to deforestation of natural mountain forests and the cultivation of large areas resulting in a serious environmental problem threatening the sustainability of agriculture and population food security.

In Boset Wareda (in Ethiopia), farmers are producing for subsistence and exerting an increasing erosion of the land. Nevertheless, soil and water resources degradation addicted by natural and anthropogenic activities are usually controlled by soil conservation techniques and water harvesting constructions.

This study has contributed knowledge on social, economical and technical factors affecting adoption of CTs among household farmers in Ethiopia. CT development in the rural sector is not possible without addressing the current challenges identified in this study such as household heads farming experience, household size, and access to extension services, high costs of adoption, labour costs, and size of land owned by a household head.

To reach this goal, econometrics analysis was derived from cross-sectional data for a single time period of production. Probit and Tobit models were econometrically estimated to evaluate rate of adoption (i.e., participation in conservation techniques) and intensity of adoption (i.e., allocation of land for conservation techniques) by the interviewee farmers.



Quantification of environmental and socio-economic impacts of hill lakes and of soil and water conservations techniques in Bizerte Governorate

SELLAMI M. H*., Ben NOUNA B., Jebari S., Aichi H., Chemak F, Romdhani C.,and Msolli S.

High Institute of Engineering Medjez El Bab, Tunisia

**Corresponding author email: mh.sellami@planet.tn*

Abstract

The purpose of this work is to quantify the environmental and the socio-economic impacts of hill lakes and of hydro-agricultural schemes for water and soil conservation realized in Bizerte Governorate. Also, we will analyze their influences on the evolution of local agricultural production systems. In this context, case studies were carried out for the Souidia /Oued El Bagrate watersheds and the Souidiya/Moghra hill lakes. These sites were chosen as experimental pilot sites within the "PAPS-EAU-Valorisation" project.

We have used thematic maps, geographic information system tools, hydrological formulations and the revised universal soil loss equation to calculate water storage capacity and transported sediments. Also, we have evaluated the production systems and socio-economic situations before and after the installation of devices.

For both Souidiya and El Bagrat watersheds, the results showed an increase of the cultivated areas and of the livestock size. Also, we have recorded an excess of water resources compared to the demand for irrigation water. The rate of erosion was decreased of about 54 % in Souidya watershed and passed from 33.23 t / ha / year to 28.23 t / ha / year in ElBagrat watershed. The total cost of the managed areas of the watershed is estimated at about 3400 DT / ha and the total financial gain, if we apply the adequate agricultural practice in the studied area, can reach 3042 645 Dt.

Keywords: Soil loss, hill lake, Bizerte, hydroagricultural devices, water and soil conservation impact, agricultural production system, RUSLE /GIS approach.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Impact of water shortage on the competitiveness of agricultural commodities in Tunisia

Ali Chebil*, Aymen Frija and Bechir Bennouna

National Institute for Research in Rural Engineering, Water & Forestry (INRGREF), Tunis, Tunisia

**Corresponding author email: chebila@yahoo.es*

Abstract

In this paper, we assess the effects of water shortage on the competitiveness of major traded commodities in Tunisia. Based on a sample of 170 wheat farms and 51 orange farms, located in the main producing regions of the country, stochastic production frontier functions were used to estimate changes in marginal water value under different levels of water availability. These values are then used as opportunity costs and utilized in the calculation of Domestic Resource Cost (DRC) coefficients. Empirical results show that Tunisia has a comparative advantage ($DRC < 1$) in the production of orange. However, Tunisia exhibited a DRC greater than one for wheat. Results of sensitivity analysis demonstrate the degree of deterioration of competitiveness in wheat and orange production due to decrease in water availability. At 50% decreases in water availability, DRC ratio increases from 1.24 to 8.27 for wheat, and from 0.91 to 1.13 for orange. However, improvement of irrigation water efficiency leads to a relative increase in the DRC for both commodities. Therefore, further efforts to optimize management practices of irrigation water at field and farm levels are needed. This could be achieved through better irrigation scheduling and deficit irrigation strategy.

Keywords: Water shortage, water value, competitiveness, agricultural commodities, Tunisia



Assessing water stress under climate change in light of SDG 6.4

Caroline King-Okumu*

IIED, United Kingdom

*Corresponding author email: caroking@yahoo.com

Abstract

SDG 6.4 requires a substantial increase in water-use efficiency across all sectors and to ensure sustainable withdrawals and supply of freshwater by 2030. The level of water stress will be tracked by all countries in terms of freshwater withdrawal as a percentage of available freshwater resources.

We examine the challenges and opportunities that attention to this SDG could create for the scientific community to better inform national strategies for adaptation to climate change and climate extremes – e.g. drought and floods. We draw insights from water resource assessments available in large watersheds located in 3 climate-stressed regions in East Africa (Western Asia (Upper Orontes), East Africa (Ewaso Ng'iro North Catchment Area), and West Africa (the sub-basins of the arid territory of the Senegalese Ferlo).

We will consider technical challenges and progress made in assessing the volumes of water resources available and extracted on an annual basis, including consideration of the effects of erratic and extreme events. We will also reflect on institutional arrangements determining water resource management, monitoring and assessment. Our final recommendations will focus on common priorities to overcome disciplinary boundaries, institutional boundaries and ongoing capacity development challenges.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Horticulture in the region of Beja

HERMI SAYARI Monia*, REJEB Hichem, and MOUSSA Mohamed

*Laboratory Eremology and Combating Desertification, Institute of Arid Region (IRA)
Medenine, Tunisia*

*Corresponding author email: sayarim76@gmail.com

Abstract

Knowledge gained on the long-term effects of horticulture management practices in outskirts of Tunisia. It includes fruit growing, vegetable crops, floriculture and landscaping. Traditionally, the role of horticulture was epitomized in food function. Actually, this sector is one of the smart carts of territorial development. It is considered as a viable and sustainable solution to enhance food security, employment and combined environmental degradation. In Tunisia, this sector participates with 40% of agricultural production value, 27% of agricultural employment, 90% of vegetable needs and 20% of agricultural exports.

However, this horticulture is faced with many challenges related to the urbanization and climate change that characterize the world of the twenty-first century.

The aim of this study is to describe the potentialities of peri-urban horticulture in the region of Beja and to specify the constraints limit the expansion of these production systems. Also, this study precise the role of urban and peri-urban horticulture in the organization of the north western Tunisian territory (case of the region of Testour).

Keywords: Horticulture, Territory, Development, Potentialities, Constraints, Environment



Interaction between climate change, environmental degradation and human migration in the arid area of Tunisia

Taoufik Gammoudi*

Institute of Arid Regions, Tunisia

*Corresponding author email: taoufik.gammoudi@ira.rnrt.tn

Abstract

The climate change which affects a fragile rural environment can accentuate the degradation of natural resources and socio-economic well-being. This phenomenon menaces the human to live in security whose effects are particularly vulnerable on the equilibrium between man and area.

Faced with the environmental perturbations in particular those related to climate change the rural populations sometimes find in migration a strategic means to avoid socio-economic constraints and to improve financial and food needs. Today, what is the degree of the environmental migration?

The object of this paper is to identify if the migratory movements really result from the degradation caused by climate change. We will use survey data from 355 households in the arid area of Tunisia.

This work has finally revealed that migration is the result not only of socio-economic factors but also of other environmental factors. Abandonment of agricultural land due to drought and lack of water is admitted by the local population as one of the main causes of migration. Faced with the increase of environmental stresses and the progressive degradation of ecosystems, the most serious effects of climate change concern probably human migration.

Keywords: climate change, degradation of natural resources, migration, arid area of Tunisia



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

***THEME 5. GEO-INFORMATION AND REMOTE
SENSING TECHNOLOGIES***

Keynote speaker: Prof. G.A. Corzo, IHE-Delft for Water Education, Netherlands



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



Carbon emissions caused by woodland fires in the African tropical savannas

Weicheng Wu*, Eddy De Pauw, Claudio Zucca, and Minqiang Zhu

East China University of Technology, China

*Corresponding author email: wuwc123@gmail.com

Abstract

This study presents a remote sensing-based assessment of carbon emission resulted from woodland fires in tropical savannas from 2000 to 2010 taking Sudan and South Sudan as an example. We used 996 pre-dry and dry season MODIS products (500 m resolution, 16-day interval) from Oct to Mar, and 96 Landsat images acquired in Dec-Feb of the mentioned period for this purpose. The MODIS products contained NDVI, EVI and four spectral bands namely blue (B), red (R), near infrared (NIR) and middle infrared (MIR), and were employed to produce the reversed Normalized Burn Ratio (RevNBR). Those acquired Oct regarded as pre-burn state were stacked together to extract the cloud-free RevNBR by a maximization algorithm, and the same was done for those from Dec to Mar as burning and post-burn state. A differencing was applied, i.e., $RevNBR = RevNBR_{POST} - RevNBR_{PRE}$. A new combined-landscape indicator (CLI) was proposed using the annual mean rainfall and digital elevation model and classified into 20 equal interval units. An innovative conditional thresholding approach was developed and applied to the RevNBR, under which a specific threshold was set for each CLI unit to identify accurately the burnt areas. Landsat data were used for defining the regions of interest (ROIs) of the burnt areas as ground-truth data for assessing the accuracy of the burnt area detection on the MODIS data. In the identified burnt areas NDVI-based woody biomass models were applied to the differenced NDVI ($NDVI = NDVI_{PRE} - NDVI_{POST}$) to estimate the burnt woody biomass and the related carbon emissions in each dry season. Results revealed that about 118,800 to 212,000 km² of savanna woodlands were annually burnt, leading to an annual emission of about 7.5-13.3 million tons of carbon. These LM-related fires, extending often to other woodlands and even to National Parks and Reserves, constitute a severe environmental problem.



A soil spectral library for soil quality and erosion assessments using landscape approach

Donia Jendoubi*, Hamouda Aichi, Nissaf Karbout, Hanspeter Liniger, and Mohamed Moussa

Centre for Development and Environment (CDE). University of Bern, Switzerland

**Corresponding author email: hamoudazaq@yahoo.fr*

Abstract

Efficient planning of soil conservation measures requires, first, to understand the impact of soil erosion on soil fertility with regard to landscape units classes; and second, to identify hot spots of soil erosion and bright spots of soil conservation in a spatially explicit manner. Soil organic carbon (SOC) is an important indicator of soil fertility. The aim of this study was to conduct a spatial assessment of erosion and its impact on SOC for specific landscape classes. Input data consisted of extensive ground truth, a digital elevation model and Landsat 8 and Sentinel imagery. Soil spectral reflectance readings were measured using a Field Spec 3 diffuse reflectance spectrometer and calibrated with results of SOC chemical analysis using HCN analyser. Since 75 % of the area is field crops land use system includes 64 % of rugged terrain under intensive monoculture. Soil erosion on sloping agricultural land poses a serious problem for the environment as well as for soil quality. In areas with highly erodible soils, such as those in steep slopes zones, application of soil and water conservation measures is crucial to sustain agricultural fields and to prevent or reduce land degradation. The various datasets were linked in the hot-bright spot matrix, which was developed to combine soil erosion incidence information and SOC content levels (for uniform landscape classes) in a scatter plot. The different of the plot show different stages of degradation, from well-conserved (healthy) land to hot spots of soil degradation. The approach helps to gain a better understanding of the impact of soil erosion on soil fertility and to identify hot and bright spots in a spatially explicit manner. The results show distinctly lower SOC content levels on large parts of the test areas, where field crop cultivation (monoculture) was dominant. On the other hand, there are strong indications that agroforestry has been successful in conserving soil resources.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Monitoring of the state of coastal oases in Tunisia by MOD13Q1 products (Case of the oasis of Gabes)

Cherine Ben Khalfallah*, Dalel Ouerchefani, Eric Delaitre, Laurent Demagistri, Faiza Khebour-Allouche, Darragi Fadhila, and Frédérique Seyler

Tunisia

*Corresponding author email: cherinebenkhalfallah@yahoo.com

Abstract

A semi-automated procedure will be proposed to monitor the coastal oases of the Gabes region of Tunisia from earth observation systems between 2000 and 2017, this long-term analysis is based on MOD13Q1 images (Product: NDVI) of the MODIS to monitor the vegetation cover of irrigated areas.

We have specified test points consisting of just one MODIS pixel, to extract the MOD13Q1-NDVI time series from February 2000, until September 2017, in order to sample all irrigated perimeters in the Gabes region with at least one test point by perimeter. The obtained NDVI time series of MOD13Q1 were decomposed using the decomposition function of the R project software into three types of curves using moving average: one trend line over the entire period, one annual seasonal trend and a noise curve. Results showed high differences especially in trend lines over the entire period and less for the mean seasonal curve. A hierarchical ascending classification (CAH) was applied to trend curves. The various groups selected in the end are being interpreted, according to their interannual stability and variation.

These results demonstrate that NDVI time series trend analysis is suitable for detecting vegetation change areas and for monitoring land degradation and dynamics vegetation.

Keywords: MOD13Q1, NDVI, oases, Gabes, decomposition



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

Mapping Land Use and Dynamics of Vegetation Cover in South-eastern Arabia using the Remote Sensing Technology: The Study Case of Wilayat Nizwa (Oman) from 1987 to 2016

Fairouz Megdiche-Kharrat*, Rachid Ragala, and Mohamed Moussa

Laboratory of Eremology and Combating Desertification, Institute of Arid Regions, Tunisia

**Corresponding author email: feirouzmekdish@gmail.com*

Abstract

The Arabian Peninsula is known for its arid climate as one third of its area is covered by the world's largest sandy desert Al-Rub Al-Khali which is bounded by Oman's mountains Al-Hajar in its east. At the foothill of Al-Hajar chain, many oasis cities subsist due to ground water availability, namely, the cities of Nizwa and Birkat Al-Mouz in Wilayat Nizwa. This region is characterized by very high temperature and low irregular rainfall. Local farmers rely on irrigation to maintain their lands productive, they get water by means of ancestral water acquisition systems called aflaj (plural of falaj) that Channel surface flow, convey springs' water or drain groundwater from aquifers. The global objective of this paper is to study the landscape of this area by focusing on ground occupation and its spatio-temporal dynamics using a method based on multispectral electromagnetic spatial remote sensing. The processing of data from satellites Landsat 5 TM, Landsat 7 ETM+ & Landsat 8 OLI & TIRS relative to January 1987, October 2000, February 2009 and January 2016 allowed us to extract information on the landscape components; then, to establish a ground occupancy map and to trace the dynamics of the vegetation cover with separating the irrigated class from the non-irrigated one. The results show that it is mainly a mountainous region, rugged with many ravines, characterized by an important geological diversity and large sedimentary valleys and river beds, with 6 different classes of which the clay / sandy sedimentary soils and the very clayey rocky / gypsum blocs are the most important ones. The information extracted from the perpendicular vegetation Index calculated for each date show that the area of irrigated vegetation varies visibly at the studied dates. Combined with other parameters, these results are good indicators to anticipate the evolution of the local landscape.



Evaluation of land degradation using Geo-Spatial modeling approach: A case study in Koutine watershed (Médenine-Tunisia)

Mongi BEN ZAIED* and Mohamed OUESSAR

Institut des Régions Arides, Tunisia

*Corresponding author email: benzaied_m@yahoo.fr

Abstract

Land degradation constitutes a major concern of countries in the Sahelian region of North Africa and especially in Tunisia. Therefore, in the context of climatic change, it is important to study this phenomenon at spatial and temporal scales and analyze the interaction between the various elements of the environment in relation to soil dynamics and human activity. In order to develop an integrated approach to quantify soil erosion on different spatial scales in southeastern Tunisia by using field observations from small-scale watershed experiments, laboratory simulations and soil erosion models. We used a new and innovative approach for modeling at local scale. The Geospatial approach offers an explicit theoretical response based on simulation of erosion processes, making use of land-use, topographic, soil and climatic data. The model estimates water and sediment delivered to stream channels. The study area covered the watersheds of Koutine (278 km²) which are localized in southeast Tunisia. According to the application of a Geo-spatial model soil erosion is more important in the upstream than on the middle and downstream. Due to quality of soil, land use, climate change and topography of the study area, the mean annual erosion is significant in wet year. In fact, soil erosion rich more 4t/ha, on 20% of the watershed area.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

100

Cartography of olive trees in the delegation Zarzis (governorate of Medenine) by Landsat 8 OLI: Impact of climate change

Achraf Katar*, Bouajila Essifi, and Hamouda Aichi

The Higher School of Agriculture of Mograne. Zaghouan, Tunisia

*Corresponding author email: katar.achraf.ing@gmail.com

Abstract

This study is interested in monitoring the dynamics of land use on climate change and the spatial and temporal assessment of the effect of olive groves in the arid region of Zarzis (Medenine) by using Landsat 5TM and Landsat 8 OLI during the period 2007- 2014.

The choice of this area is justified given that this region is threatened by a complete ecosystem degradation (vegetation, soil, etc.) caused by severe climatic factors: low rainfall, high temperature and other factors on grazing, plowing, water stress, soil fragility and silting over this delegation offers the highest raise of olive production in the governorate of Medenine. This monitoring requires resources and techniques to control the entire area. In this context appear remote sensing as the right tool. The development of the ground occupation map requires the mining and processing of spatial data through the IDRISI software.

The main results showed that the change detection allowed show an improved effect of olive groves in the region for trees on silted soil / bare soil and mapping to distinguish the land use units. These results therefore constitute a good indicator for monitoring and ecosystem stability in Zarzis delegation.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY

101

Contribution of remote sensing and GIS in land use mapping and water erosion modeling in the Negueb subwatershed - Case of Medenine governorate

TERWAYET BAYOULI Olfa*, ESSIFI Bouajila, JEBARI Sihem, and AICHI Hamouda

Institut des Régions Arides (IRA). Médenine, Tunisia

Institut National Agronomique de Tunisie (INAT). Tunis, Tunisia

**Corresponding author email: beyouli.olf@gmail.com*

Abstract

Soil erosion is a major problem in arid environments in southern Tunisia arising from land degradation, agricultural intensification, and other anthropogenic activities. Assessment of soil erosion is useful for watershed planning and conservation activities. The integration of remote sensing and GIS data into erosion modeling can provide a quantitative and consistent approach to estimate soil loss in a given watershed.

The present study aims at mapping the spatiotemporal evolution and the change detection of land use based on Landsat remote sensing images over a 18-years-period (1998-2016) on one hand, and the modeling of erosion processes in the Negueb watershed (166 km²), which is a sub-catchment in the large basin of Oum Zessar in southeastern Tunisia on the other hand. The RUSLE model parameters were estimated using remote sensing data and GIS. The analysis of satellite data allowed the realization of the land-use map using Landsat satellite imagery facilitating hence the identification of the main types of land use and the vegetation cover map, which is an important factor in estimating soil loss by the RUSLE model.

The integration of the various factors of the Universal Soil Loss Equation in the GIS has made it possible to prioritize the different zones of the watershed, by producing a synthetic map of the distribution of erosion sensitivity degrees and determined the average erosion rate.

The results can certainly help in the implementation of sustainable soil management and conservation practices to reduce soil erosion in the Negueb watershed.

Keywords: Change Detection, Geographic Information System, Negueb Watershed, Mapping, Remote Sensing, RUSLE, Tunisia, Water Erosion.



The use of AHP within GIS in identifying suitable sites for rainwater harvesting technologies in the wadi Oum Zessar watershed, Tunisia

Nesrine Kadri*, Naceur Mahdhi and Hammouda Aichi

Institut des Régions Arides, Tunisia

*Corresponding author email: nesriinekadri@outlook.fr

Abstract

The identification of potential sites for rainwater harvesting techniques is an important step towards maximizing water availability and land productivity in (semi-) arid regions. The aim of this research was to present a methodology that enable water managers to better identify suitable sites for RWH techniques by integrating biophysical and socio-economic criteria using the Analytical Hierarchy Process (AHP) supported by the Geographic Information System (GIS). This methodology was applied in Oum Zessar watershed (south-eastern Tunisia). Biophysical and socioeconomic suitability criteria were selected based on an extensive literature review and the opinion of experts and farmers. Weights were assigned to the criteria based on their relative importance for RWH using AHP method. With ArcGIS, maps of potential sites for different RWH technologies were then generated. Results showed that 40.23% of the study area is very highly suitable for constructing sites for RWH techniques. Very highly suitable area for jessour was 37%, buried stone pockets (34.03%), recharge units (26.03%), flood spreading (12.72%) and cisterns (24.14%). Finally, the findings of this research can be used to assist in the efficient planning of the water resources management to ensure a sustainable development of water in Tunisia and in other areas suffering from water scarcity.



INTERNATIONAL CONFERENCE ON
WATER, ENVIRONMENT, ENERGY, AND SOCIETY
ICWEES'2018



TEXAS A&M
UNIVERSITY®

103

Analysis of Vegetation Response to Climate Variability in Southeast Tunisia Using MODIS Time Series Data

Hanen Dhaou Msadki*, Ouerchefani Bouzaida D., Didan K., Munoz A. B. and Ouessar, M.

*Eremology and Combating Desertification Laboratory, Institute of Arid Regions, Medenine, Tunisia
VIP Lab., ECE Dept&ABE Dept. The University of Arizona, Tucson, AZ 85721, USA
Corresponding author email: hanen_dhaou@yahoo.fr*

Abstract

The analyses of vegetation dynamics are essential particularly in arid regions where climate is largely driven by interannual variations in rainfall and vegetation growth is limited by water-availability. In this paper, multi-temporal analysis of the relationships between the Normalized Difference Vegetation Index (NDVI) and the Enhanced Vegetation Index (EVI), derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) product, and the main climate drivers (precipitation and temperature) has been carried out to assess indices suitability for monitoring vegetation dynamics in Medenine province, southeast Tunisia during the period 2000-2014.

Furthermore, Pearson correlation has been performed to analyse the relationship between vegetation indices and climate parameters at different temporal scales (1, 3 and 12 month). The results showed similar temporal patterns of vegetation indices (NDVI, EVI) with varying magnitudes. Good significant correlations were also obtained between VI and the cumulative precipitation especially during wet and dry periods. However, the temperature was weakly negatively correlated to both indices, particularly for monthly analysis. In general, the results indicated that NDVI reflects well precipitation fluctuations in the study area promising a possibility for early warning necessary for drought management.



Actual evapotranspiration estimation over a semi-arid heterogeneous land surface using coupled remote sensing data with surface energy budget and crop water budget models

Saadi Sameh*, Boulet Gilles, Simonneaux Vincent, Mougenot Bernard, Lili Chabaane Zohra, Bahir Malik, Brut Aurore, and Fanise Pascal

Institut National Agronomique de Tunisie, Université de Carthage
Centre d'Etudes Spatiales de la Biosphère, France

*Corresponding author email: sameh.saadi.inat@gmail.com

Abstract

Efficient agricultural water management is a major issue in semi-arid areas, where agricultural production is restricted by water availability. The design of tools providing regional estimates of evapotranspiration (ET) may help the sustainable management of water resources.

In this study, spatially distributed estimates of ET (or its energy equivalent, the latent heat fluxes LE) in the Kairouan plain (Central Tunisia) were computed by applying the energy budget based model: Soil Plant Atmosphere and Remote Sensing Evapotranspiration (SPARSE) fed by low resolution remote sensing data (Terra and Aqua MODIS) and the crop water budget-based model: Satellite Monitoring of Irrigation (SAMIR) fed by high resolution remote sensing data (SPOT5 images).

The SPARSE model was run to compute instantaneous estimates of LE fluxes at the satellite overpass time over the study area for the 2012-2013 and 2013-2014 seasons, and then daily LE estimates were extrapolated from instantaneous estimates. On the other hand, SAMIR model was run to spatialize daily ET. The work goal was to assess the operational use of the two models and the accuracy of the modelled daily ET over a heterogeneous semi-arid landscape. Results of both models were validated using extra-large aperture scintillometer (XLAS) measurements along a pathlength of 4 km over the study area.

