THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

# Abstract Book

## 10th Annual International Forum on Water
## 11-14 July 2022, Athens, Greece

Edited by
Saif Uddin & Olga Gkounta

2022

# 10th Annual International Forum on Water

## 11-14 July 2022, Athens, Greece

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First published in Athens, Greece by the Athens Institute for Education and Research.
ISBN: 978-960-598-515-8
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9 Chalkokondili Street
10677 Athens, Greece
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# TABLE OF CONTENTS

*(In Alphabetical Order by Author's Family Name)*


| | | |
|---|---|---|
| **Preface** | | 9 |
| **Editors' Note** | | 11 |
| **Organizing & Scientific Committee** | | 12 |
| **Conference Program** | | 13 |
| **1.** | **Development of an Online Climate Change Course to Change Environmental Behavior and Commitment in Pre-Service Teachers**<br>*Anat Abramovich & Sophie Shauli* | 17 |
| **2.** | **Sinjar Anticline Northwest of Iraq: A Tectonic Geomorphological Study**<br>*Nadhir Al-Ansari & Varoujan Sissakian* | 19 |
| **3.** | **On Hemiurus Appendiculatus (Rud, 1809) Looss, 1899 and Gymnotergestia Chaetodipteri (Nahhas and Cable, 1964) Trematodes from Serranus Cabrilla Marine Fish from the Mediterranean Sea**<br>*Dayhoum Al Bassel* | 20 |
| **4.** | **Cyclic Lateral Behavior of NLFEA Heat-Damaged Circular CFT Steel Columns Confined at the End with CFRP Composites**<br>*Rajai Al-Rousan* | 21 |
| **5.** | **Beating Barriers: Hydrolysates from Tropical Legumes, New Alternative to Obtain Bioactive Molecules for Nutraceutic Foods**<br>*Arturo F. Castellanos Ruelas & Genovevo Ramirez Jaramillo* | 22 |
| **6.** | **Design of a Hybrid Forced Dryer Using Waste Air from a Hydroelectric Plant with a Solar Support System in Costa Rica**<br>*Guillermo Castro Badilla, Tomás de Jesús Guzmán Hernández, Leonardo Cardinale & Daniel Chavarría Vargas* | 24 |
| **7.** | **Analysis of Preparedness towards Implementation of Ballast Water Management Convention: Challenges and Opportunities of Croatian Ports**<br>*Maja Covic, Gorana Jelic Mrcelic, Tatjana Stanivuk, Merica Sliskovic* | 26 |
| **8.** | **Middle-late Pleistocene Chronology of Palaeoshorelines and Uplift History in a Low-rising to Stable Foreland: Overprinting and Reoccupation**<br>*Vincenzo De Santis, Giovanni Scardino, Giovanni Scicchitano, Marco Meschis, Paolo Montagna, Edwige Pons-Branchu, Josè Eugenio Ortiz, Yolanda Sanchez-Palencia & Massimo Caldara* | 27 |
| **9.** | **The Effect of Long-Term Tillage Systems on Yield and Yield Components of Soybean (Glycine Max (L.) Merr.)**<br>*Agnieszka Faligowska, Katarzyna Panasiewicz, Grazyna Szymanska & Karolina Ratajczak* | 29 |
| **10.** | **Parasitological Evaluation of Vegetables Petroselinum Crispum Sold in Municipality in the Interior of Brazil**<br>*Francisco Fambrini & Virginia da Cunha Bueno* | 31 |

| | | |
|---|---|---|
| **11.** | **Analysis of Local and Regional Impacts of Agribusiness in the Immediate Region of Rio Verde – Goiás**<br>*Tania Marcia Freitas, Jesiel Souza Silva, Silvia Salustiano, Pedro Abel Vieira Junior & Durval Dourado Neto* | 32 |
| **12.** | **Influence of Nutrients and Quality Work Indices on Production of Peas, Sunflower, Corn and Wheat**<br>*Gabriel Valentin Gheorghe* | 34 |
| **13.** | **Challenges and Opportunities for Treated Wastewater Irrigation – A Case Study from Palestine**<br>*A. Rasem Hasan* | 35 |
| **14.** | **Ballast Water Discharge Profile of a Port as a Tool for Ballast Water Risk Management – A Case Study of Port of Ploče, Croatia**<br>*Nermin Hasanspahic, Marijana Pećarevic & Niko Hrdalo* | 36 |
| **15.** | **Future Impacts of Climate on Wheat Production and Quality in a World with a Higher Atmospheric $CO_2$ Level**<br>*David Helman, Duo Jiang & Gabriel Mulero* | 37 |
| **16.** | **The Discursive and Institutional Scalar Transformation of the State: (Re) Production and (Re)Configuration of the Hydro-social Territories in Iran**<br>*Leila Khodabakhsh* | 39 |
| **17.** | **Coal Mine Reclamation – The Role of Periphyton Community in Phosphorus Cycling in Oligotrophic Post-Mining Lakes**<br>*Eliska Konopacova, Klara Rehakova, Jiri Nedoma & Miloslav Pouzar* | 40 |
| **18.** | **Considerations and New Data for Insects of the Carabidae Family in the Area of Malesia e Madhe (Northern Part of Albania)**<br>*Ariana Striniqi Lacej* | 42 |
| **19.** | **Holistic Pedagogies Adopted in a Graduate Course on Climate Change Education Fostering Ecojustice and Deep Love and Respect for Nature**<br>*Jing Lin* | 43 |
| **20.** | **Building Automated Flows with AI Capabilities for Quality Control in Big Environmental Projects**<br>*Mihail Mateev* | 45 |
| **21.** | **SIPForSAT: Spatial Insect Population Model Driven by a Weather Forecasting Model and Satellite Data**<br>*Yaron Michael & David Helman* | 46 |
| **22.** | **Major Air Pollutant Levels in the Urban Agglomeration of Ploiesti, Romania, Based on Four-Year Monitoring Dataset**<br>*Bianca Mihalache, Sabina Stefan, Marilena Colt & Gabriela Iorga* | 48 |
| **23.** | **The Seeds Quality of Soybean (Glycine Max (L.) Merr.) Cultivated Under Long-Term Reduced Soil Tillage Systems Conditions**<br>*Katarzyna Panasiewicz, Agnieszka Faligowska, Grazyna Szymanska & Karolina Ratajczak* | 50 |

| | | |
|---|---|---|
| **24.** | **Efficient Electroactive Bacteria Isolated from Caribbean Mangrove Sediment**<br>*Fatima Radouani, Adele Silbande, Florent Robert & Paule Salvin* | 52 |
| **25.** | **Corporate Sustainability Reporting Amongst Selected JSE-Listed Mining Companies in South Africa**<br>*Isaac Rampedi & Dambuza Siphesihle* | 54 |
| **26.** | **Fluorescent Bioaerosol Automatically Collected with Rapid-E Particle Counter and Human Health Implications**<br>*Ana-Maria Rosianu, Sabina Stefan, Luminita Marmureanu & Gabriela Iorga* | 55 |
| **27.** | **Contribution to the Improvement of the System of Action in the Event of Sudden Marine Pollution**<br>*Dani Sabalja & Marko Đorđević* | 57 |
| **28.** | **Coastline Morphological Dynamic of the Djerba Island (South Shore of the Mediterranean, SE-Tunisia)**<br>*Hanen Saïdi* | 58 |
| **29.** | **Sustainable Rural Development Index: The Importance of Agribusiness for the Brazilian Economy**<br>*Silvia Salustiano, Jesiel Souza Silva, Tania Marcia Freitas, Claudecir Gonçale, Divina Lunas, Pedro Abel Vieira Junior & Durval Dourado Neto* | 59 |
| **30.** | **Snow Height and Snow Water Equivalent Estimation from Snow Cover Fraction Using Sentinel-2 Satellite Images in North Kazakhstan**<br>*Zhanassyl Teleubay, Farabi Yermekov, Zhanat Toleubekova, Bauyrzhan Shmatov, Yernar Raiev & Aigerim Assylkhanova* | 61 |
| **31.** | **The Change of the Hydromechanical Properties of Gypsum Rocks Submitted to Water Dissolution**<br>*Coppée Thibault & Myriam Duc* | 63 |
| **32.** | **Relationship Between the Dynamics of Landslides in the Flysch Carpathians and Rainfall**<br>*Bartłomiej Warmuz* | 65 |
| **33.** | **Geophysics of Los Contreras Maar, Santo Domingo Phreatomagmatic Field, Central Mexico**<br>*Vsevolod Yutsis, Claudia Rigel Peredo Mancilla, Gaston Venegas Rodriguez, Pablo Davila Harris & David Ernesto Torres Galvan* | 67 |
| **34.** | **Aquaporins in Halophytic Grasses Provide Important Clues for Enhancing Salt Tolerance in Crops**<br>*Janusz Zwiazek, Maryamsadat Vaziriyeganeh, Shanjida Khan & Micaela Carvajal* | 69 |
| **References** | | 70 |

# Preface

This book includes the abstracts of all the papers presented at the *10th Annual International Forum on Water* (11-14 July 2022), organized by the Athens Institute for Education and Research (ATINER).

A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this forum will be considered for inclusion in one of ATINER's many publications only after a blind peer review process.

The purpose of this abstract book is to provide members of ATINER and other academics around the world with a resource through which they can discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. ATINER was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world can meet to exchange ideas on their research and consider the future developments of their fields of study.

To facilitate the communication, a new references section includes all the abstract books published as part of this forum (Table 1). I invite the readers to access these abstract books –these are available for free– and compare how the themes of the symposium have evolved over the years. According to ATINER's mission, the presenters in these symposiums are coming from many different countries, presenting various topics.

**Table 1.** *Publication of Books of Abstracts of Proceedings, 2014-2022*

| Year | Papers | Countries | References |
|---|---|---|---|
| 2022 | 34 | 23 | Uddin S and Gkounta O (2022) |
| 2021 | 11 | 10 | Papanikos (2021) |
| 2020 | 8 | 6 | Papanikos (2020) |
| 2019 | 29 | 18 | Papanikos (2019) |
| 2018 | 27 | 17 | Papanikos (2018) |
| 2017 | 41 | 23 | Papanikos (2017) |
| 2016 | 39 | 23 | Papanikos (2016) |
| 2015 | 87 | 43 | Papanikos (2015) |
| 2014 | 45 | 26 | Papanikos (2014) |

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world can regularly meet to discuss the developments of their disciplines and present their work. Since 1995, ATINER has organized

more than 400 international conferences and has published over 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this forum and its subsequent publications together. Specific individuals are listed after the Editors' Note.

**Gregory T. Papanikos**
**President**

# Editors' Note

These abstracts provide a vital means to the dissemination of scholarly inquiry in the field of Water. The breadth and depth of research approaches and topics represented in this book underscores the diversity of the symposium.

ATINER's mission is to bring together academics from all corners of the world in order to engage with each other, brainstorm, exchange ideas, be inspired by one another, and once they are back in their institutions and countries to implement what they have acquired. The 10th Annual International Forum on Water accomplished this goal by bringing together academics and scholars from 24 different countries (Albania, Brazil, Bulgaria, Canada, Costa Rica, Croatia, Czech Republic, Egypt, France, Germany, Iraq, Israel, Italy, Jordan, Kazakhstan, Martinique, Mexico, Palestine, Poland, Romania, South Africa, Sweden, Tunisia, and USA), which brought in the forum the perspectives of many different country approaches and realities in the field.

Publishing this book can help that spirit of engaged scholarship continue into the future. With our joint efforts, the next editions of this forum will be even better. We hope that this abstract book as a whole will be both of interest and of value to the reading audience.

**Saif Uddin & Olga Gkounta**
**Editors**

# 10th Annual International Forum on Water, 11-14 July 2022, Athens, Greece

## Organizing & Scientific Committee

All ATINER's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of ATINER, who contributed by reviewing the submitted abstracts and papers.

1. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, U.K.
2. Saif Uddin, Director, Center for Environmental Pollution, Climate & Ecology (CEPCE) & Senior Research Scientist, Kuwait Institute for Scientific Research, Kuwait.
3. Panagiotis Petratos, Vice President of Administration and ICT, ATINER, Fellow, Institution of Engineering and Technology & Professor, Department of Computer Information Systems, California State University, Stanislaus, USA.
4. Ronald Griffin, Academic Member, ATINER & Professor, Florida A&M University, USA.

# FINAL CONFERENCE PROGRAM

## 10th Annual International Forum on Water, 11-14 July 2022, Athens, Greece

## PROGRAM

**Monday 11 July 2022**

**09.00-09.30**
**Registration**

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**09:30-10:00**
**Opening and Welcoming Remarks:**

- **Gregory T. Papanikos**, President, ATINER

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**10:00-11:30 TIME SLOT 1 – MORNING PRESENTATIONS**

**Coordinator: Jing Lin**, Professor, University of Maryland, USA.

1. **Nadhir Al-Ansari**, Professor, Lulea University of Technology, Sweden.
   **Varoujan Sissakian**, Lecturer, University of Kurdistan Hewler, Iraq.
   ***Title**: Sinjar Anticline Northwest of Iraq. A Tectonic Geomorphological Study.*
2. **Eliska Konopacova**, PhD Student, University of Pardubice and Biology Centre CAS, Czech Republic.
   ***Title**: Coal Mine Reclamation – The Role of Periphyton Community in Phosphorus Cycling in Oligotrophic Post-Mining Lakes.*
3. **Janusz Zwiazek**, Professor, University of Alberta, Canada.
   **Maryamsadat Vaziriyeganeh**, PhD Student, University of Alberta, Canada.
   ***Title**: Aquaporins in Halophytic Grasses Provide Important Clues for Enhancing Salt Tolerance in Crops.*

**11:30-13:00 TIME SLOT 2 – MORNING/NOON PRESENTATIONS**

**Coordinator: Hanen Saïdi**, Professor, University Tunis El Mar, Tunisia.

1. **Jing Lin**, Professor, University of Maryland, USA.
   ***Title**: Holistic Pedagogies Adopted in a Graduate Course on Climate Change Education Fostering Ecojustice and Deep Love and Respect for Nature.*
2. **David Helman**, Assistant Professor, Hebrew University of Jerusalem, Israel.
   ***Title**: Future Impacts of Climate on Wheat Production and Quality in a World with a Higher Atmospheric $CO_2$ Level.*
3. **Yaron Michael**, Researcher, Hebrew University of Jerusalem, Israel.
   ***Title**: SIPForSAT: Spatial Insect Population Model Driven by a Weather Forecasting Model and Satellite Data.*

**13:00-14:30 TIME SLOT 3 – AFTERNOON PRESENTATIONS**

**Coordinator: Eliska Konopacova**, PhD Student, University of Pardubice and Biology Centre CAS, Czech Republic.

1. **Katarzyna Panasiewicz**, Professor, Poznan University of Life Sciences, Poland.
   ***Title**: The Seeds Quality of Soybean (Glycine Max (L.) Merr.) Cultivated Under Long-Term Reduced Soil Tillage Systems Conditions.*
2. **Agnieszka Faligowska**, Professor, Poznan University of Life Sciences, Poland.
   ***Title**: The Effect of Long-Term Tillage Systems on Yield and Yield Components of Soybean (Glycine Max (L.) Merr.).*
3. **Rajai Al-Rousan**, Professor, Jordan University of Science and Technology, Jordan.
   ***Title**: Cyclic Lateral Behavior of NLFEA Heat-Damaged Circular CFT Steel Columns Confined at the End with CFRP Composites.*

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**14:30-15:30**
**Lunch**

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**15:30-17:00 TIME SLOT 4 – AFTERNOON PRESENTATIONS**

**Coordinator: Mr. Konstantinos Manolidis** (ATINER Administrator).

1. **Bartłomiej Warmuz**, PhD Student, Polish Geological Institute – National Research Institute, Poland.
   ***Title**: Relationship between the Dynamics of Landslides in the Flysch Carpathians and Rainfall.*
2. **Vsevolod Yutsis**, Professor, Instituto Potosino de Investigación Científica y Tecnológica, Mexico.
   ***Title**: Geophysics of Los Contreras Maar, Santo Domingo Phreatomagmatic Field, Central Mexico.*
3. **Arturo F. Castellanos Ruelas**, Professor/Researcher, Autonomous University of Yucatá, Mexico.
   ***Title**: Beating Barriers: Hydrolysates from Tropical Legumes, New Alternative to Obtain Bioactive Molecules for Nutraceutic Foods.*

**17:00-18:30 TIME SLOT 5 – AFTERNOON PRESENTATIONS**

**Coordinator: Ms. Olga Gkounta**, Researcher, ATINER.

1. **Dayhoum Al Bassel**, Professor, Fayoum University, Egypt.
   ***Title**: On Hemiurus Appendiculatus (Rud, 1809) Looss, 1899 and Gymnotergestia Chaetodipteri (Nahhas and Cable, 1964) Trematodes from Serranus Cabrilla Marine Fish from the Mediterranean Sea.*
2. **Guillermo Castro Badilla**, Professor, Costa Rica Institute of Technology, Costa Rica.
   **Tomás de Jesús Guzmán Hernández**, Professor & Researcher, Costa Rica Institute of Technology, Costa Rica.
   ***Title**: Design of a Hybrid Forced Dryer Using Waste Air from a Hydroelectric Plant with a Solar Support System in Costa Rica.*
3. **Tania Marcia Freitas**, Researcher, Federal Institute of Education, Science and Technology Goiano – IF Goiano – Rio Verde – GO, Brazil.
   ***Title**: Analysis of Local and Regional Impacts of Agribusiness in the Immediate Region of Rio Verde – Goiás.*
4. **Silvia Salustiano**, Professor, Federal Institute of Education, Science and Technology Goiano – IF Goiano – Rio Verde – GO, Brazil.
   ***Title**: Sustainable Rural Development Index: The Importance of Agribusiness for the Brazilian Economy.*

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**20:30-22:30**
**Greek Night**

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**Tuesday 12 July 2022**

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**TIME SLOT 6 – MORNING PRESENTATIONS**

| **08:00-09:30 Time Slot 6a1** | **08:00-11:00 Time Slot 6b** |
|---|---|
| **Coordinator: Mr. Konstantinos Manolidis** (ATINER Administrator).<br>1. **Maja Covic**, PhD Student, University of Split, Croatia.<br>***Title**: Analysis of Preparedness towards Implementation of Ballast Water Management Convention: Challenges and Opportunities of Croatian Ports.*<br>2. **Nermin Hasanspahic**, Researcher, University of Dubrovnik, Croatia.<br>***Title**: Ballast Water Discharge Profile of a Port as a Tool for Ballast Water Risk Management – A Case Study of Port of Ploče,* | **Old and New-An Educational Urban Walk**<br><br>The urban walk ticket is not included as part of your registration fee. It includes transportation costs and the cost to enter the Parthenon and the other monuments on |

*Croatia.*

3. **Leila Khodabakhsh**, PhD Candidate, Catholic University of Eichstätt-Ingolstadt, Germany.
   ***Title**: The Discursive and Institutional Scalar Transformation of the State: (Re) Production and (Re)Configuration of the Hydro-social Territories in Iran.*
4. **Vincenzo De Santis**, Researcher, University of Bari, Italy.
   ***Title**: Middle-Late Pleistocene Chronology of Palaeoshorelines and Uplift History in a Low-Rising to Stable Foreland: Overprinting and Reoccupation.*

**09:30-11:00 Time Slot 6a2**

**Coordinator: Mr. Konstantinos Manolidis** (ATINER Administrator).

1. **Anat Abramovich**, Lecturer, Gordon Academic College, Israel.
   ***Title**: Development of an Online Climate Change Course to Change Environmental Behavior and Commitment in Pre-Service Teachers.*
2. **Mihail Mateev**, Assistant Professor, University of Architecture, Civil Engineering and Geodesy, Bulgaria.
   ***Title**: Building Automated Flows with AI Capabilities for Quality Control in Big Environmental Projects.*
3. **Isaac Rampedi**, Associate Professor, University of Johannesburg, South Africa.
   ***Title**: Corporate Sustainability Reporting Amongst Selected JSE-Listed Mining Companies in South Africa.*
4. **Dani Sabalja**, Assistant Professor, University of Rijeka, Croatia.
   ***Title**: Contribution to the Improvement of the System of Action in the Event of Sudden Marine Pollution.*

the Acropolis Hill. The urban walk tour includes the broader area of Athens. Among other sites, it includes: Zappeion, Syntagma Square, Temple of Olympian Zeus, Ancient Roman Agora and on Acropolis Hill: the Propylaea, the Temple of Athena Nike, the Erechtheion, and the Parthenon. The program of the tour may be adjusted, if there is a need beyond our control. This is a private event organized by ATINER exclusively for the conference participants. Some participants have videotaped the event. Click here for an example.

**11:30-13:00 TIME SLOT 7 – MORNING/NOON PRESENTATIONS**

**Coordinator: Jing Lin**, Professor, University of Maryland, USA.

1. **A. Rasem Hasan**, Director of Water and Environmental Studies Institute, An-Najah National University, Palestine.
   ***Title**: Challenges and Opportunities for Treated Wastewater Irrigation – A case study from Palestine.*
2. **Coppée Thibault**, PhD Student, Gustave Eiffel University, France.
   ***Title**: The Change of the Hydromechanical Properties of Gypsum Rocks Submitted to Water Dissolution.*
3. **Zhanassyl Teleubay**, Head/Big Data Analysis Lab, S. Seifullin Kazakh Agrotechnical University, Kazakhstan.
   ***Title**: Snow Height and Snow Water Equivalent Estimation from Snow Cover Fraction using Sentinel-2 Satellite Images in North Kazakhstan.*

**13:00-14:30 TIME SLOT 8 – AFTERNOON PRESENTATIONS**

**Coordinator: A. Rasem Hasan**, Director of Water and Environmental Studies Institute, An-Najah National University, Palestine.

1. **Hanen Saïdi**, Professor, University Tunis El Mar, Tunisia.
   ***Title**: Coastline Morphological Dynamic of the Djerba Island (South shore of the Mediterranean, SE-Tunisia).*
2. **Ariana Striniqi Lacej**, Head, University of Shkodra Luigj Gurakuqi, Albania.
   ***Title**: Considerations and New Data for Insects of the Carabidae Family in the Area of Malesia e Madhe (Northern Part of Albania).*

3. **Gabriel Valentin Gheorghe**, Researcher, INMA Bucharest, Romania.
   ***Title**: Influence of Nutrients and Quality Work Indices on Production of Peas, Sunflower, Corn and Wheat.*

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**14:30-15:30**
**Lunch**

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**15:30-17:30 TIME SLOT 9 – AFTERNOON PRESENTATIONS**

**Coordinator: Mr. Konstantinos Manolidis** (ATINER Administrator).

1. **Ana-Maria Rosianu**, PhD Student, University of Bucharest, Romania.
   ***Title**: Fluorescent Bioaerosol Automatically Collected with Rapid-E Particle Counter and Human Health Implications.*
2. **Bianca Mihalache**, PhD Student, University of Bucharest, Romania.
   ***Title**: Major Air Pollutant Levels in the Urban Agglomeration of Ploiesti, Romania, Based on Four-Year Monitoring Dataset.*
3. **Fatima Radouani**, Researcher, University of the Antilles, Martinique.
   ***Title**: Efficient Electroactive Bacteria Isolated from Caribbean Mangrove Sediment.*
4. **Francisco Fambrini**, Professor, Municipal Higher Education Braganca Paulista Foundation, Brazil.
   **Virginia da Cunha Bueno,** Professor, Municipal Higher Education Braganca Paulista Foundation, Brazil.
   ***Title**: Parasitological Evaluation of Vegetables Petroselinum Crispum Sold in Municipality in the Interior of Brazil.*

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**19:30-21:00**
**Dinner**

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**Wednesday 13 July 2022**
**Educational Islands Cruise**
**Mycenae Visit**

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**Thursday 14 July 2022**
**Delphi Tour**

**Anat Abramovich**
Lecturer, Gordon Academic College, Israel
&
**Sophie Shauli**
Lecturer, Gordon Academic College, Israel

# Development of an Online Climate Change Course to Change Environmental Behavior and Commitment in Pre-Service Teachers

Global warming is one of the most urgent issues facing governments and individuals alike. The sixth Climate Report (2021) by the Intergovernmental Panel on Climate Change (IPCC) estimates that humanity is responsible for greenhouse gas emissions into the atmosphere and its resulting global climate change. Pre-service teachers (PST), tomorrow's educators, should spearhead the battle against global warming. This study describes an online global warming course for PST covering the cognitive, metacognitive and social-emotional dimensions involved. Drawing on the literature revealing the complexity of behavioral change, we designed ways for PST to engage personally in environmental behavior (EB) to impact EB in families, friends, and students. Thirty-six science and communication pre-service teachers enrolled in an academic college in northern Israel took part. The aim was to evaluate the participants' EB commitment and change during and after the intervention. Using a mixed methods approach, pre- and post- online questionnaires consisting of four main parts were administered: climate change content knowledge (correct/incorrect), awareness of climate change issues (Likert Type scale), daily EB that can influence global warming (Likert Type scale), and an open-ended question on international efforts to reduce greenhouse gas emissions. The post questionnaire included two other open-ended questions: (1) Describe one EB that changed during your participation in the course; (2) Describe EB steps you have taken to encourage climate change in family, friends, and your students. The qualitative analysis of the open-ended questions revealed three categories: (1) Habit-dependent and unexplained behavior, (2) Broadly explained behavior based on "general care" for the environment, (3) Specifically explained behavior motivated by arguments about the complexity of environmental problems and explicit willingness to act to protect the environment. The preliminary results indicated that in the private sphere, the PST were more likely to act than in the public sphere, e.g., when asked to choose one statement that represented their behavior, PST chose various

behaviors in the private sphere (e.g., separating waste, using public transportation). Their justifications for their behavior were habit-dependent or based on general care for the environment.

The participants' learning curves, knowledge, attitudes, and EB will also be presented. Methodologically, this study describes an empirical research tool that can be applied to test knowledge, attitudes, and behavior related to climate change, and an online climate change course and can be used with different types of learners.

**Nadhir Al-Ansari**
Professor, Lulea University of Technology, Sweden
&
**Varoujan Sissakian**
Lecturer, University of Kurdistan Hewler, Iraq

# Sinjar Anticline Northwest of Iraq: A Tectonic Geomorphological Study

The Sinjar Anticline (Mountain) is an outstanding structural and geomorphic feature in the northwestern part of Iraq near the Iraqi – Syrian International boundary. The anticline is a double plunging with almost E – W trend dividing the gently rolling plain in which it is developed into two parts, Al-Jazira Plain in the south and Rabi'a Plain in the north. The highest peak in the mountain is 1421 m, whereas the elevation of the surrounding plains ranges in height between (380 – 515) m. The Sinjar anticline is asymmetrical with steeper northern limb (45 – 80)° and gentler southern limb (15 – 25)°, its length is about 80 km, whereas the width ranges between (9.25 – 12. 5) km. The oldest exposed rocks in the core of the anticline belong to the Shiranish Formation (Late Cretaceous), whereas the youngest rocks belong to the Fatha Formation (Middle Miocene). Different geomorphological and structural forms were observed through visual interpretation of satellite images, geological and topographical maps of different scales, beside field observations. Among the observed geomorphological and structural forms are: Abandoned alluvial fans, radial, inclined, and cross-shaped valleys, whale-back shape, wind gaps, and parasitic folds. All these observed forms are good indications about the lateral growth of the Sinjar anticline. Moreover, Neotectonic measurements were carried out on both sides of the anticline to estimate the rates of upward and downward movements. These estimations were performed by measuring the elevation of the contact between the Fatha (Middle Miocene) and Injana (Late Miocene) formations at different selected locations on both sides of the anticline.

**Dayhoum Al Bassel**
Professor, Fayoum University, Egypt

# On Hemiurus Appendiculatus (Rud, 1809) Looss, 1899 and Gymnotergestia Chaetodipteri (Nahhas and Cable, 1964) Trematodes from Serranus Cabrilla Marine Fish from the Mediterranean Sea

109 specimens of *Serranus cabrilla* marine fish were collected from Misurata fish market in the Mediterranean Sea in Libya. Two different species of trematodes isolated from the intestine of fish. *Hemiurus appendiculatus (Rud, 1809) Looss, 1899 and Gymnotergestia chaetodipteri (Nahhas and Cable, 1964)*. The worms were identified to the species level. Incidence of infection (0.92%) was recorded by *Hemiurus appendiculatus (Rud, 1809) Looss, 1899* and (1.83%) by *Gymnotergestia chaetodipteri*.The present description agreed with the original description, but there are certain minor differences in the body length and some measurements. The present work extends our knowledge about the prevalence of trematodes in the marine fish *Serranus cabrilla* from the Mediterranean Sea in Libya. The present work is reported for the first time in Libya.

**Rajai Al-Rousan**
Professor, Jordan University of Science and Technology, Jordan

# Cyclic Lateral Behavior of NLFEA Heat-Damaged Circular CFT Steel Columns Confined at the End with CFRP Composites

In this study, the nonlinear finite element analysis (NLFEA) method has been adopted to prove the CFRP's effectiveness in restoring the performance of heat-damaged CFT circular steel columns and controlling the columns' failure mode. The simulated CFT column model was firstly checked for validity using previously-conducted experimental research. Then, the model was extended to investigate the impact of the number of CFRP layers (0, 5, 6, 7, 8, 9, and 10 layers) and elevated temperature (20$^{o}$C, 200$^{o}$C, 400$^{o}$C, and 600$^{o}$C). Therefore, this study provides an NLFEA of twenty-eight models for CFT circular steel columns wrapped with various layers of CFRP composites at its end region, which represents the critical location in terms of the lateral load capacity. Also, wrapping the specimens' ends helps prevent the occurrence of outward local buckling, resulting in enhancing the specimens' strength, enlarging net drift, and increasing energy dissipation. The study results showed that using five to ten CFRP layers significantly improved the performance of the NLFEA CFT circular steel column models. Nevertheless, using nine or ten CFRP layers had almost the same impact of using eight layers. The NLFEA results showed that the external repairing of heated damaged CFT column with CFRP composite enhanced the cyclic performance, and the efficiency of CFRP composite increased with the heat damage level.

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# Beating Barriers: Hydrolysates from Tropical Legumes, New Alternative to Obtain Bioactive Molecules for Nutraceutic Foods

Malnutrition and sedentary lifestyle in men are the main causes of the incidence of diseases such as diabetes, hypertension, hypercholesterolemia, among others. Pharmacology provides solutions to these serious diseases. A new option is the use of bioactive protein hydrolysates. They have been obtained from soybean, casein, fish. Tropical legumes could be a new resource to obtain these hydrolysates. Such is the case of the Cowpea (*Vigna unguiculata*) (Chel *et al.,* 2011). However, the agronomic productive potential of this legume in Mexico is still unknown.

Estimate the agronomical area susceptible to grow *V. unguiculata* in the Mexican territory.

Three aspects were considered:

Determination of agroecological requirements. It was integrated based on different bibliographic sources (FAO-Ecocrop, 2018).

Obtaining spatial information. It was taken from the World Reference Base for Soil Resources – WRB in vector format. Climate data was taken from the WorldClim version 2.0 base. The Digital Elevation Model was obtained from the National Institute of Statistics and Geography (INEGI) in raster format with a resolution of 500 m2. The map of slopes, bodies of water, mangroves, urban and rural areas, as well as protected natural areas, were retrieved from the Geoportal of the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), at a resolution of 1:1000000, in vector format.

Data processing. They consisted of classifying the climatic and edaphic attributes in the agroecological ranges established for the natural rainfall conditions.

It was determined that there are more than 13 million hectares of high productive potential for *V. unguiculata* under natural rainfall conditions. A similar number of hectares was found as areas of medium productive potential.

Being certain that agricultural production can be guaranteed, it is still necessary to do research on the microencapsulation of hydrolysates; the technology is already available (Betancur et al., 2011). The evaluation of the toxicological risk and the market studies are still missing. These hydrolizates of natural origin can be an alternative to produce nutraceutical foods (Franco *el al.,* 2017).

More than thirteen million hectares susceptible to being cultivated with *V. unguiculata* were detected in Mexico. This crop could provide raw material for obtaining protein hydolysates required for a future industry.

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# Design of a Hybrid Forced Dryer Using Waste Air from a Hydroelectric Plant with a Solar Support System in Costa Rica

Costa Rica is a country that produces 92 percent of its energy with renewable systems, such as hydro, wind, solar and geothermal energy. Most of the national energy production systems are hydroelectric plants, which produce a large amount of residual energy, which is expelled to the environment, in the form of hot air, in considerable volumes at temperatures above 60 $C^0$. This residual energy can be used in agricultural and agro-industrial processes such as drying and dehydration systems for various agricultural products for human and animal feed.

With the use of the residual hot air from the cooling of the turbogenerator set in a hydroelectric plant, local producers will be able to process, dry and dehydrate seeds, roots and tubers and other agricultural products using clean energy to power the system and shorten process times.

In this work we designed a hybrid forced product dryer that implements the use of residual air from the cooling of a turbogenerator in a hydroelectric plant in "Canalete de Upala", in the northern part of Costa Rica, supported by a hybrid forced solar backup system of air and hot water, as well as a photovoltaic system, which controls the internal conditions of the dryer parts and provides autonomous power for the electrical components and control systems.

The design of this complex hybrid system that integrates two forms of hot air utilization, one forced solar and the other using residual hot air from the hydroelectric plant, as well as a thermosiphonic hot water system with a radiator as heat exchanger, linked to a treatment chamber and a pallet inlet and outlet system, located in an agricultural and

livestock area, will allow a better use of crops and residues from tropical crops in the area.

The public-private partnership, made up of the university, the municipality of Upala, the Hydroelectric Cooperative and the producers' association of the area, as well as the Ministry of Agriculture, will be responsible for the investment, start-up and management of the drying system.

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# Analysis of Preparedness towards Implementation of Ballast Water Management Convention: Challenges and Opportunities of Croatian Ports

As being identified as global issue, identification and analysis of ballast water origins and its trends is of highlighted importance. In accordance with that, aim of this paper is analysis of preparedness for Croatian ports which are in process of implementation of International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM). Quantities and origin of ballast water is observed in ten year interval, with analysis from year 2014 to 2017. All data were presented as mean±standard deviation and sum of all Croatian ports. One-way repeated measures ANOVA was used to identification of significance of differences between observed years (2014-2017). All data was processed using data analysis software system Statistica 13.2 (Dell Inc., Tulsa, USA). Type I error was set at $\alpha$=5%. Additionally, results indicate that Croatian ports are not prepared for implementation of BMW Convention, which is primarily connected to deficit of port based facilities and inadequate monitoring via Croatian Integrated Maritime Information System - CIMIS. The results of this study contain integrated guidelines for implementation of convention and indicate necessity of additional effort investment with aim of minimising risks connected to ballast water transportation, which contain risks regarding protection of ecosystem and human health.

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# Middle-late Pleistocene Chronology of Palaeoshorelines and Uplift History in a Low-rising to Stable Foreland: Overprinting and Reoccupation

The synchronous correlation method was applied to a sequence of raised palaeoshorelines along with: 1) Amino Acid Racemization (AAR) and isoleucine/alloisoleucine epimerization (IE) on *Patella* spp., *Thetystrombus latus, Glycymeris* sp., Ostracods; 2) U-series dating on corals *Hoplangia durotrix* Gosse.

This approach allows us to refine the knowledge about terrace phases and uplift history in the middle-late Pleistocene in a sector of the Apulian foreland (western coast of the Salento Peninsula, southern Italy), a rare case of a foreland shared by two opposite verging chains. We provide the first chronological attribution for several middle-late Pleistocene palaeoshorelines and quantitative assessment of vertical movements in a wide sector of the Apulian foreland, which, to date, has been characterised by a scarcity of reliable chronological data.

With synchronous correlation method we combine uplift rate (constrained by U-series datings and AAR/IE datings made on deposits

associated to palaeoshorelines) with different sea level curves: as a result, we obtained "expected" palaeoshoreline elevations; then, we check the match between digital terrain model/field-observed and expected palaeoshorelines.

Our results show that the best fitting scenario has been obtained using, as entered into the syncronous method: 1) the sea level curves of Waelbroeck et al (2002) until 410 ky BP and Rohling et al. (2014) after 410 ky, and; 2) two different uplift rates: 0.09 mm/y until 130 ky BP (middle Pleistocene or interval MIS 15 - MIS 6; that is, 590 - 130 ky BP) and of 0.07 mm/y from 130 ky BP onwards (late Pleistocene or MIS 5 - onwards).

The palaeoshorelines recognised in the field in this study are associable with the following highstands: 120 ky BP (MIS 5.5, second peak; Hearty et al., 2007; Rohling et al., 2008; Kopp et al., 2009, 2013; O'Leary et al., 2013; Dutton et al., 2015 and references therein; Dusterhus et al, 2016), 127 ky BP (MIS 5.5), 212 ky BP (MIS 7.3), 330 ky BP (MIS 9.3), 410 (MIS 11), 525 ky BP (MIS 13.3), and 590 ky BP (MIS 15).

Our results highlight how, in relatively stable foreland areas, few palaeoshorelines are preserved than in regions with higher uplift rates, suggesting a more prominent effect of the overprinting or re-occupation of younger over older palaeoshorelines. In particular, in our study case, well documented is the re-occupation of MIS 5.5 palaeoshoreline over the MIS 7.3 palaeoshoreline.

In addition, the data arising for the Apulian foreland suggest a sea level of MIS 7.3 highstand nearer to that reported in Waelbroeck et al. (2002) (that is, nearer to the present sea level) than that reported in Siddal et al. (2003), Grant et al. (2014) and Rohling et al. (2014).

Finally, we discuss geomorphological and geological implications of using the synchronous correlation method, driven by age controls, to model raised palaeoshorelines in a geodynamically quasi stable regions, such as the Apulian foreland.

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# The Effect of Long-Term Tillage Systems on Yield and Yield Components of Soybean (Glycine Max (L.) Merr.)

Among Fabaceae, soybean is the most important crop in the world. It is an excellent source of protein for animals feeding. The cultivation of legumes crop is recommended because of many benefits, however the cost of production can be high. The use of reduced and no-tillage in soybean cultivation may increase profitability of production, but the reduced soil tillage systems make sense only if it leads to lower production costs without significantly decreasing of seed yield.

The aim of the presented study was to evaluate effects of conventional, reduced and no-tillage systems on yield and yield components of soybean cv. Merlin.

The field experiment was conducted at the Złotniki Research Station in the Wielkopolska region (52°29′ N, 16°49′ E, Poland) in the years 2016-2019, as a one-factorial design with four replications. The factor was soil tillage system: conventional tillage, reduced tillage and no-tillage. The trials were carried out as a stationary experiment in 4-year crop spacing in the rotation. The following tillage systems were applied continuously since 1997. The conventional tillage consisted of tilling with a disk harrow (2.5 m wide) at a depth of 8 cm and it was done after harvest of the pre-crop. The autumn ploughing was performed to a depth of 30 cm with a 3-furrow reversible plough, in the third week of October. Each year of research in the spring, one week before sowing of soybean, the pre-sowing tillage was performed with a field cultivator, followed by harrowing and rolling to a depth of 8 cm. The reduced tillage was based on the application of glyphosate herbicide (3.0 $l \cdot ha^{-1}$) to control perennial weeds and volunteers plant. In reduced tillage, herbicide application was made in August. Before winter, in the third week of October, tillage operation was performed with only a stubble cultivator (2.5 m wide). In the reduced tillage, one week before sowing the pre-sowing tillage cultivation was performed

with a field cultivator, followed by harrowing and rolling to a depth of 8 cm. The no-tillage consisted in the application of glyphosate herbicide (3.0 l·ha$^{-1}$) and fertilization. It was done after the harvest of winter wheat in August. In the spring, the no-tillage involved also the application of glyphosate herbicide (3.0 l·ha$^{-1}$) and sowing directly into the stubble of the pre-crop. Soybean was harvested in August or September, from the plot of 11.49 m$^2$ (7.6 × 1.5). The seed yield per 1 ha, was recalculated allowing for a standardized moisture 15%.

The yielding of soybean depended on the weather conditions during vegetation period the most. The highest yield was observed in 2017 (3.58 t·ha$^{-1}$) and the lowest in 2018 (1.47 t·ha$^{-1}$). In the case of soil tillage systems, the highest yield was found in reduced tillage (2.54 t·ha$^{1}$) and under no-tillage conditions the seed yield was significantly lower (2.37 t·ha$^{-1}$).

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# Parasitological Evaluation of Vegetables Petroselinum Crispum Sold in Municipality in the Interior of Brazil

This paper describes a methodology an experimental research of coriander vegetables (Coriandrum sativum), chives (Allium fistulosum) and parsley (Petroselinum crispum) sold in establishments such as the public market, supermarkets, street markets and greengrocers in various places, with the objective of investigating the presence of protozoa and other possible parasitic agents that can infect consumers by ingesting them in natura. A bibliographic review was sought in several theoretical contributions. In addition to the sanitizer used for their treatment. A comparison was made with several studies carried out for the same purpose in different municipalities and states, in order to obtain an objective conclusion. There was a discrepancy in the programs aimed at controlling parasites in countries where there are precarious investments in public health and with great social inequalities, which makes it impossible for individuals to have health and well-being, therefore, it is more than essential educational strategies that promote together with producers, sellers and the population in general habits that reduce the risk of contamination in the use and ingestion of raw vegetables. An investment in health education is proposed through popular education in hygienic habits.

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# Analysis of Local and Regional Impacts of Agribusiness in the Immediate Region of Rio Verde – Goiás

The identification of key sectors for the economic development aggregated to the social development of a region is the primitive framework to reflect and elaborate guidelines and subsequently to implement any public policy. The productive structure can be modified with stimulus to certain activities that will provide greater return in terms of production, employment or income generation, depending on the objectives provided for in the local and regional development project. The evaluation must be carried out taking into account the relations between the region and the rest of the economy, as well as its potential, with a view to the existence of local and regional impacts (overflowing effect) of the sector production variation. The Input-Product and Services matrix presents the economic structure of a given region and shows how the sectors interact through the shopping and sale of goods and services. Measuring the number of jobs and the salary mass coming from these jobs is pertinent to obtain an understandable view of how the economy works and how each sector or region becomes more or less dependent on the rest of the economy. To identify the key sectors for the generation of production, employment and income and the economic activities with higher effect value from the overflow index (IT) is the objective of the study. Considering the effect of the production generation in the immediate region of Rio Verde-GO (Location of this study) the key sectors are mainly, in agriculture, with

the production of corn, soybeans, sorghum and sugarcane; livestock, with the creation of bovine animals, pigs, birds and milk production; and agroindustry, which has increased demand for raw material in recent years, expanding grain production areas. To search for the ability to generate income tied to direct economic activities directly or indirectly to the agribusiness segment, constitutes another objective of the study. With a hypothesis that the specificities inherent in the differentiated productive and dynamic structures of each state of the country make the evolution verified for the national context is not the reality for all regions, can be verified in the present study, with the immediate region of Rio Verde, having as hypothesis also to assess whether the economic development of the studied region has a direct relationship with employment related to agribusiness. Agribusiness is a set of economic activities related, directly or indirectly to agriculture (Cepea, 2017). From this concept on, the overflow (IT) index was developed, from the economic activities listed in the CNAs table (National Classification of Economic Activity), considering the class hierarchy at the fourth level (673 groups). These economic activities were distributed in 4 dimensions, namely: a) direct link with agribusiness; b) Apparent direct connection with agribusiness; c) Indirect connection, and; d) without apparent connection with agribusiness. The importance of each activity is verified in the sector as a direct function of the intensity of its binding with agricultural or animal production, as well as the classified segments. Studying this theoretical, technological and methodological framework becomes relevant, being very important the incorporation of space in the econometric models.

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# Influence of Nutrients and Quality Work Indices on Production of Peas, Sunflower, Corn and Wheat

The Influence of nutrients on the production of some cultures with the preparation of the germination bed and uncultivated land, respectively with anchored and chopped vegetable remains. The nutrients (the main macro elements - nitrogen, phosphorus, potassium; the secondary macro elements - calcium, magnesium; they are used by plants depending on the vegetation phase, the requirements being different from one species to another. It should be emphasized that foliar fertilization does not replace basic fertilization, but only complements it, both with macro elements (N, P, K) and especially with microelements. In order for the tests, the pH of the soil is also measured because it can also influence. The application of calcareous amendments is necessary on acid soils, with a pH below 5.8 and a degree of base saturation below 75%. In order for the amendment work to be economical, 50% of the hydrolytic acidity must be neutralized. The highest yields are obtained on loamy and loamy soils, with 3-5% humus, over 8 mg $P_2O5$ and over 20 mg $K_2O$ / 100 kg soil, the degree of base saturation of 75-90% and pH of 6, 5-7.5. Foliar fertilization should be associated with chemical weed control. Nitrogen-only foliar fertilizers can also be used, such as N, at a dose of 11-22 l / ha, applied in a phase of 4-6 leaves, and the treatment can be repeated after 10-14 days. It should be emphasized that foliar fertilization does not replace basic fertilization, but only complements it, both with macro elements (N, P, K) and especially with microelements. Soil favorable to sunflower is those with high fertility, medium texture (clayey or loamy-sandy), deep and with a high-water retention capacity. It is desirable to place the sunflower on soils with a higher content of 130 ppm $K_2O$ and 15 ppm $P_2O5$. The sunflower is a moderately salinity tolerant plant, but grows normally at a pH between 6.4-7.2. Research conducted over 3 years.

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# Challenges and Opportunities for Treated Wastewater Irrigation – A Case Study from Palestine

Reclaiming treated wastewater in irrigation is becoming an acceptable practice globally, and mainly in water-stressed areas. Among several other options for recusing treated wastewater, crops irrigation is the most attractive solution since it contributes to food production and groundwater recharge from one side. On the other side, it replaces agricultural demand for freshwater. In most developing countries, treated wastewater reuse is faced with several challenges and has many opportunities. This paper will discuss the technical, cultural, political, financial, and socioeconomic challenges and opportunities associated with treated wastewater reuse and summarize the results of 10 years of research in the field. The most significant reuse initiatives in Palestine have started in the North of West Bank, mainly in Jenin and Nablus, where most of the collected data are from these two governorates. A conceptual framework was drafted and based on several research methodologies, ranging from data collection through questionnaires, meetings, and focus group discussions to collecting and analyzing soil, water, and crops samples. Soil samples were taken from fields before applying treated wastewater and after five years from the exact location but after irrigation with treated wastewater. Results will also be presented spatially utilizing GIS. Opportunities for treated wastewater reuse can be enhanced but are capital intensive. Treated wastewater reuse will impose a gradual and cumulative impact on soil and so the crops. Though currently, ecological and human health risks are tolerable but are expected to increase over time. A set of recommendations were drafted and are mainly targeting both decision-makers and farmers.

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# Ballast Water Discharge Profile of a Port as a Tool for Ballast Water Risk Management – A Case Study of Port of Ploče, Croatia

Water that was taken onboard a ship as a ballast contains numerous aquatic organisms. Marine organisms found in ballast can pose a severe problem to the local environment and the local population's health. However, not all of these aquatic organisms will survive in the ship's ballast tank due to a lack of food and light. Thus, ballast water is recognised as one of the major vectors of potentially invasive alien species. To efficiently manage ballast water discharges in ports, it is necessary to determine its ballast water discharge profile and, based on obtained data, set parameters for risk mitigation and reduction. Therefore, discharged ballast water data for the port of Ploče (Croatia) was collected and analysed. It was found that most of the ballast water discharged in Ploče originates from the Mediterranean Sea, or more precisely, the Adriatic Sea. Furthermore, the most considerable amount of discharged ballast water was taken from Italian ports on the shores of the Adriatic Sea, and ports of Ravenna and Brindisi were the sources of the most considerable quantities of ballast water discharged. Additionally, visiting ships discharging ballast were analysed according to the flag they are flying, and it was found that ships sailing under Panama and Malta flags were the most frequent visitors discharging ballast water in Ploče. Based on the findings, proposals for efficient ballast water management measures were given.

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# Future Impacts of Climate on Wheat Production and Quality in a World with a Higher Atmospheric $CO_2$ Level

The combination of a future rise in atmospheric carbon dioxide concentration ([$CO_2$]), warming, and drought will significantly impact wheat production and quality. Genotype phenology is likely to play an essential role in such an effect. Yet, its response to elevated [$CO_2$] and drought has not been studied before. We simulated future conditions by conducting temperature-controlled glasshouse [$CO_2$] enrichment experiments in which two wheat cultivars with differing maturity timings and life cycle lengths were grown under ambient ($aCO_2$ ~ 400 µmol mol–1) and elevated ($eCO_2$ ~ 550 µmol mol–1) [$CO_2$]. The two cultivars, bred under dry and warm Mediterranean conditions, were well-watered or exposed to drought at 40% pot holding capacity. Leaf latent heat flux (*LE*) was derived to assess evaporative cooling, and radiation use efficiency (RUE) was calculated from the gas exchange and radiation measurements on several dates along the season. Simultaneous hyperspectral and thermal images were taken to derive the photochemical reflectance index (PRI) and the temperature difference between the leaf and its surrounding (ΔTleaf-air) at the leaf and canopy levels. We aimed to explore water×[$CO_2$]×genotype interaction in terms of phenology, physiology, and agronomic trait response and to describe remote sensing-based parameterization of RUE and ΔTleaf-air under future conditions. Our results showed that $eCO_2$ boosted the booting stage of the late-maturing genotype (cv. Ruta), thereby prolonging its booting-to-anthesis period by 3 days ($p < 0.05$) under drought. The prolonged period resulted in a much higher carbon assimilation rate, particularly during pre-anthesis (+87% for Ruta vs. +22% for the early-maturing genotype of Zahir). Surprisingly, transpiration rate and grain protein content were unaffected by [$CO_2$] in both cultivars and water treatments. Ruta's higher photosynthesis rate was not translated into more aboveground biomass or grain yield, whereas both cultivars showed a similar 20% increase under $eCO_2$ and drought. Overall, Zahir had a more efficient source-to-sink balance with

a lower sink limitation than Ruta. There was a decoupling in the PRI-RUE relationship under drought at $aCO_2$, but the relationship remained strong at $eCO_2$. ΔTleaf-air was more strongly affected by [$CO_2$]. For a similar *LE* change of 350 W m–2, ΔTleaf-air changed by ~3.5°C under $eCO_2$ while it changed by more than 10°C under $aCO_2$. PRI, RUE, ΔTleaf-air, and *LE* decreased linearly with canopy depth, displaying a single model throughout the canopy layers. The complex water×[$CO_2$]×genotype interaction in this study implies that future projections should account for multifactor interactive effects.

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# The Discursive and Institutional Scalar Transformation of the State: (Re)Production and (Re)Configuration of the Hydro-social Territories in Iran

The existing research on the hydrosociology in Iran is mainly characterized by two different approaches. The first view frames the state as the main, dominant, and even the only political actor; while the second perspective entails an abstract anthropological explorative standpoint towards nature-society interactions, excluding the role of the state—on other levels, particularly on the local scale.

By taking "politics of scale" and Historical Political Ecology (HPE) as the theoretical framework, this paper discusses how both above-mentioned perspectives have led to the de-politicization of water issue in Iran, which consequently made the political mobilization for environmental emancipation impossible.

Through a critical systematic review of interdisciplinary scholarly literature and historical and legal documents over the course of the last six decades, the study sheds light on the hegemony of these approaches and their embeddedness in the context of politico-economic and development discourses of "modernized" Iran. In so doing, the paper illustrates the discursive and institutional change of the Iranian state and the subsequent transformation of core-periphery relations, which led to new political power dynamics and mechanism around water supply and water management in the region.

Lastly, the study discusses and emphasizes integration of inter-scalar approaches for any eco-political contribution in the context of Iran.

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# Coal Mine Reclamation – The Role of Periphyton Community in Phosphorus Cycling in Oligotrophic Post-Mining Lakes

Brown coal has been for a long time an important supply of an energy. However, its mining has significant impacts to the environment causing radical transformations of the landscape. After a coal mining termination, there are several ways, which can be used to recover the post-mining area. Except the foresting or agriculture, flooding is a common option, considered as the most (economically) advantageous. Many areas in the central Europe have been planned to be recultivated in this way, therefore better understanding of the lake's ecosystem is necessary.

Phosphorus (P) is a nutrient often limiting primary production in the freshwater waters. Its uptake traits have been mostly studied for phytoplankton, however in the environment where the periphytic biomass is prominent, its contribution on P cycling might not be marginal. Periphyton is an assemblage of aquatic organisms attached to substrate, composed of photoautotrophs and heterotrophs, in which photoautotrophs form the dominant component. It performs numerous functions such as nutrient cycling and self-purification of aquatic ecosystems.

There is a unique series of three recently flooded post-miming lakes Milada, Medard and Most in the north-west region of the Czech Republic. All lakes studied can be characterized by wide littoral zone with dense periphyton mats. As a prerequisite to understand the role of periphyton in the P cycling in above-mentioned lakes, we monitored changes in the kinetic parameters maximum uptake velocity (*Vmax*), half-saturation constant (*Ks*) and specific P uptake affinity (*SPUA,*

*Vmax/Ks*, a parameter quantifying the ability of microorganisms to acquire dissolved P) during the year. Multiple types of benthic species have been measured in presented study such as epilithon (covering stones), epiphyton (covering submerge macrophyte) and macroscopic benthic algae *Chara* sp. and *Vaucheria* sp. Isotope labelling technique (radionuclide $^{33}P$) linked with the liquid scintillation counting has been employed to study P uptake kinetics.

The results showed that epilithic specific P uptake affinity is decreasing with increasing P deficiency (decreasing P availability) of the lake ecosystem. Opposite was expected since the high specific P uptake affinity gives an advantage in the competition of organisms for P from the lake-water. In comparison, P uptake affinity of epiphyton and both macroscopic benthic algae were increasing with increasing P deficiency.

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# Considerations and New Data for Insects of the Carabidae Family in the Area of Malesia e Madhe (Northern Part of Albania)

Insects, especially coleopters, represent living things with the greatest biodiversity of the animal world. Recognition of the values of this biodiversity plays an important role and undoubtedly constitutes a contribution to the recognition of the Albanian coleoptera fauna based on the publications of various authors on the Albanian coleoptera fauna (German Expedition of 1961, 1933, 1935, 1936), as well as a series of articles published by Misja K, Paparisto A, Striniqi A, in this paper it is, intended to give new data on coleopters and especially data on species of the family Carabidae (Order Coleoptera).

Data are given for 16 species representatives of this family, giving the identification, bio-ecology, data on the zoogeographical grouping, the number of exemplars studied and the area and subzone where this species has met. The data are the result of expeditions carried out during the years 2018-2022, in the area of Malesia e Madhe located in the northern part of Albania.

From the 16 collected species of this family, compared to the materials of other authors, there are 7 species referred for the first time to Albania.

A special analysis pertains to the species referred for the first time to the Albanian coleoptera fauna

The Malesia e Madhe area presents a variety of relief forms, which are premises for the biodiversity of coleopters species, as well as representatives of the Carabidae family. The paper is accompanied by a detailed database of coleoptera (Carabidae) of this area.

I think that the recognition of the values of this biodiversity contributes to the recognition of the biodiversity values of Albania and undoubtedly helps in the assessment and management of the environment.

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# Holistic Pedagogies Adopted in a Graduate Course on Climate Change Education Fostering Ecojustice and Deep Love and Respect for Nature

Our world is facing a devastating crisis of ecological degradation, wars, famine, natural disasters, pandemics, conflicts, and species extinction. These crises reflect our relationship with each other and with nature, based on relentless exploitative capitalist ethos and a belief in human superiority to nature. Higher education from past to present has been steeped in the Western culture which sees nature through a condescending lens focusing on what we can grab from nature, rather than looking at the interdependence between humans and nature (Glacken, 1992). Nature is called "wild" which is to be feared or tamed (Deloria, 2001), or to be blown open or cut down for "resources." The climate change we are experiencing directly results from the unquenchable thirst for wealth and power by nations and individuals.

One main problem in higher education is that we have cut connections with nature rather than build deep bonding with her. In universities, learning takes place in enclosed buildings; students are siloed in various disciplines and learning tend to focus on the mind while our heart and spirit are seldom engaged. With scientific positivism, higher education mainly focuses on building objective knowledge through the scientific method (Abrahamson, 1998). The didactic teaching methods that are more impersonal and maintain distance between the material and the learner has been a big problem. We need learning that is centered around personal experiences, is focused on interaction, relationships, feelings, and actions (Abrahamson, 1998). All in all, we need ecological justice pedagogies that awake the learners' hearts to the suffering of nature and foster a consciousness of we-togetherness and we inter-are.

In this paper, I share that cultivating an eco-identity is possible through contemplative pedagogies. I will share an example which is about a course taught by me on global climate change and education. Through meditation, mindfulness, nature contact, meditative walks, arts, games, and simulations, students cultivate a sense of intimacy with nature, or a sense of we-togetherness with nature. From there, they feel indignation, anger, and frustration when seeing destruction of nature. They also learn through readings, videos, dialogues, guest speakers, etc, finding ways to transform their anger and frustration into

actions, empowered by teamwork and building alliance. This holistic ecojustice pedagogy integrates the students' body, mind, heart, and spirit. Students open their hearts to nature, connecting their own well-being with the well-being of nature. They also see the parallel of injustice among human beings and the injustices between human beings and other nonhuman species. Most importantly, they opened their heart to the sacred beauty of nature. They see divine sparks in all existence. Nature becomes intelligent and alive, and a true sense of interbeing is fostered. Employing also place-based pedagogy, students visited a nearby forest and played like young children there, hugging trees and cleaning vines. They wrapped signs around the trees to speak in their voices, protesting a decision to cut down the trees for commercial housing. The place became dear to them as they return again and again there, to check its wellbeing. Through this example, we hope to illustrate what deep, ecojustice pedagogies entail, which can foster deep love and respect for nature. Students in the class are co-authors of this article.

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# Building Automated Flows with AI Capabilities for Quality Control in Big Environmental Projects

Big environmental projects nowadays include complex automated workloads, where data from different sources, that need to be approved, managed, processed and later shared for specific analysis.

Quality control of data is one of the most important parts in workflows, realized in such projects. It has different aspects – from control of documents content to management of the quality in complex data models. Quality control and quality assurance need automation floes with smart functionalities to evaluate data quality fast and precise.

AI brings quality control to a new level. It expands automation capabilities, accelerates decision making, and even helps decrease the risk of error. Nowadays for data quality often is used a democratized artificial intelligence approach, represented via low code/no code AI services like AI Builder, AI Cognitive Automation, modelling complex flows using Digital Twins and Document Automation.

This paper makes an overview of different options to build modern automated flows for quality control using AI functionalities. In the research are included real life cases, based on automation flows with AI capabilities using Microsoft Azure and Microsoft Power Platform

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# SIPForSAT: Spatial Insect Population Model Driven by a Weather Forecasting Model and Satellite Data

The pink bollworm (*Pectinophora gossypiella*) is a major pest found in cotton fields worldwide, which damage can be devastating to cotton production. In countries where growing transgenic cotton is not permissible (e.g., Israel), the damage can reach huge losses of up to 50%. The conventional ways to treat the pink bollworm in such places are through pheromone wires for sexual dysfunction, maintaining cleanliness at the field level (sanitation), and using chemical pesticides. Despite the use of pheromone wires and sanitation, pesticide application is usually still required to reduce the damage of the pink bollworm.

Previous studies indicated that even a change in sowing and harvesting timing could minimize infestation. However, the ability to predict the pest spread across time and space is relatively small. It is currently based primarily on visual inspection by the farmer in the field, which is limited in its spatial representation. Forecasting the pest development in time and space are, therefore, crucial for efficient planning of the crop as well as for the application of an integrated pest control management at both the field and the regional scale. Here we developed a numerical model that uses satellite data and weather information acquired from a forecasting model to provide the timing and location of the pest development (SIPForSAT: Spatial Insect Population model driven by Forecasting model and SATellite data). We applied the SIPForSAT model in two fields in Israel and used field data to assess its accuracy. The Weather Research and Forecasting model (WRF) data were combined with the NDVI product of the MODerate resolution Imaging Spectroradiometer (MODIS) to drive SIPForSAT in terms of life stages development and plant phenology occurrence. Cotton bolls were inspected for infection with the pink bollworm larva and eggs in several dates and places across the two fields to evaluate the model. Our results show that SIPForSAT is capable of modeling the pest development in time quite accurately and that the satellite data is a meaningful addition in SIPForSAT to predict the spatial spread of the pest. Since SIPForSAT does not require local calibration and is a generic

insect population dynamics model, it can predict the spread of other pests (other insects than the pink bollworm) under any environmental conditions and in different places around the globe.

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# Major Air Pollutant Levels in the Urban Agglomeration of Ploiesti, Romania, Based on Four-Year Monitoring Dataset

The Ploiesti city is located in the central-northern part of Romanian plain, and north of Bucharest, which is the highest polluted city in Romania. Some of the most important Romanian oil refineries operate in Ploiesti. Moreover, the city represents an important transportation hub, linking Bucharest and the southern Romania with the northeastern and western parts of the country (Transylvania). Although such significant anthropogenic sources exist here, and a systematic monitoring air quality is performed since 2000s, a long-term study on assessment of the level of air quality/air pollution was not performed by now. Therefore, the aim of this study represents an air quality evaluation in the urban agglomeration of Ploiești. A comparison of pollution levels with those from other representative Romanian cities has been performed, as well.

The mass concentrations of major air pollutants, both particulate matter ($PM_{10}$, $PM_{2.5}$) and gaseous species ($NO_2$, CO, $SO_2$, $O_3$), were extracted from the air quality monitoring stations in Ploiești, which belong to the National Air Quality Monitoring Network in Romania. A synthetic database covering a four-year period (2018-2021) consisting of time series of hourly and daily values of each pollutant mass concentrations was constructed. Statistical analyses were performed in order to understand the typical pollution situation over the entire city area, from inner part to its outskirts, and to investigate the annual and seasonal pattern. A special attention was dedicated to the identification of major pollution sources that contribute the measured concentrations.

Analysis of measured data from all monitoring stations shows that the problem of air pollution is not specific to a limited area of the city. Although there are a few days and hours in a day when the pollution is

most intense in a certain location, the phenomenon is widespread throughout the city.

*Acknowledgments*

The data regarding ground-based air pollution was extracted from the public available Romanian National Air Quality Database, www.calitateaer.ro, last accessed in January 2022. BM, SS and GI acknowledge the support from NO Grants 2014-2021, under Project EEA-RO-NO-2019-0423, contract no 31/01.09.2020.

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# The Seeds Quality of Soybean (Glycine Max (L.) Merr.) Cultivated Under Long-Term Reduced Soil Tillage Systems Conditions

The interesting of soybean cultivation is growing during the last years in Poland. In 2010 there was only 48 ha of certificated soybean seeds production but in 2019 already 1 132 ha (PIORIN data). Minimalizing the cost of cultivation involves searching of possibility to improve tillage systems. In Poland conventional tillage systems is common the most, but the different variants of reduced soil tillage systems are often used in the largest farms.

The aim of the presented study was to evaluate effects of conventional, reduced and no-tillage systems on sowing value and vigor of soybean cv. Merlin.

The field experiment with soybean cultivar Merlin was conducted at the Złotniki Research Station in the Wielkopolska region (52°29′ N, 16°49′ E, Poland). The study was carried out in the years 2016-2018, as a one-factorial design with four replications. The factor consisted of soil tillage system: conventional tillage, reduced tillage and no-tillage. The following tillage systems were applied continuously since 1997 (before 1997 conventional tillage was used). Soybean was harvested from the plot of 11.49 $m^2$ (7.6 × 1.5) depending on weather conditions in August or September. After the harvest all samples were stored in brown paper bags under cool conditions. All analyses pertaining to the viability and vigour of the seeds were based on the seed samples collected from each experimental plot. The analyses were made in a laboratory at the Department of Agronomy, Poznań University of Life Sciences, from January to February.

There were considerable differences in the conditions of soybean growth and development in individual years of the research. The weather conditions during vegetation period, had the biggest influence on soybean seeds quality. The highest sowing value was observed in

2016 where the germination was found about 94%. In years 2017 and 2018 the seeds germination was significantly lower 83% and 85%, respectively. Vigour of seeds according to results of electrical conductivity test was found: 24.7 µS $cm^{-1}$ $g^{-1}$ under conventional tillage conditions, 25.4 µS $cm^{-1}$ $g^{-1}$ under reduced tillage and 26.5 µS $cm^{-1}$ $g^{-1}$ in case of no-tillage.

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# Efficient Electroactive Bacteria Isolated from Caribbean Mangrove Sediment

At the crossroads between energy and environment, we find the microbial fuel cells (MFC). These devices make it possible, thanks to microorganisms, to produce electricity by degrading organic matter (which can be industrial or domestic waste). They could therefore be part of the dynamics of clean energy production.

Previous work of our team identified mangrove as an interesting source of Electroactive bacteria which can be easily used in MFC system thanks to its salinity. The use of Mangrove water and sediments allow to form a complex bacterial consortium in the anodic compartment able to transfer electron to an electrode. The importance of planktonic bacteria, their collaboration and influence in biofilm community was highlighted in *Clostridium* enriched MFC. But, since water and sediment of the mangrove are used together in MFC system, the exact origin of anodic biofilm, and the role of each bacterial species in the consortium remain unclear.

In this work, on one hand, the use of high throughput sequencing analysis of DNA in mangrove sediment, water and anodic biofilm makes it possible to clearly identify sediments as the origin of anodic bacterial communities. The anodic biofilm was formed in air-cathode MFC under a resistance of 1,000 ohms and water and sediments as inoculum. Water and sediments were collected at the beginning and at the end of experiment, while, the anodic biofilm, was collected only at the end. Communities of each compartment were compared between each other at the phylum and genus level.

On the other hand, complex consortia usually allowed to obtain better performances than pure cultures in part thanks to inter-species cooperation. However, to understand the role of most bacterium in the consortia, the electroactivity of pure bacteria species was evaluated by chronoamperometry in three-electrode device, with a poised potential

at -0.2V vs SCE, with BHI as a medium and acetate as electron donor. The identification of species was carried out via 16S DNA sequencing. Three occurrences out of twenty isolated ones were electroactive and show an interesting current density which could reach 1A par squared meter.

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# Corporate Sustainability Reporting Amongst Selected JSE-Listed Mining Companies in South Africa

Corporate environmental and sustainability reporting (CESR) is important for the mining sector given the negative social and environmental impacts the industry generates across the world. Mining affects the natural and social environments in several ways, including being the cause of major environmental pollution, forced community resettlements and associated socio-economic disruptions. With such reporting, companies have the opportunity to communicate with stakeholders on their key environmental, social and governance initiatives, as well as other related operational concerns. Such reports give periodic summaries and disclosures of information on key sustainability issues, thereby making sure that organisations are accountable and sustainable when conducting their affairs. In this paper, the aim was to compare the patterns of CESR amongst selected Johannesburg Securities Exchange (JSE)-listed mining companies in South Africa. Judgmental or purposive sampling was used to select a sample of five mining companies listed on the JSE. The results indicated that the extent of environmental sustainability disclosures amongst companies was particularly low between the year 2015 and 2018 as the majority of them either made disclosures to a lesser extent or reported nothing. Despite this, there were some improvements from the year 2019 as more of them began to provide additional details and some integration in their disclosures. Disclosures that were best contextualised between 2015 and 2020 were concerning organisational ecological footprints involving greenhouse gas emissions and water consumption. However, no further details were given regarding the adoption of renewable energy sources to reduce greenhouse gas emissions and how the companies will transition to carbon-neutral operations. Similarly, the various environmental impacts associated with their product life cycles were seldom reported; and if they were, the companies only revealed appropriate mitigation measures without an account on targets reached. Lastly, the paper offers several recommendations for improved CESR practices in the South Africa's mining sector.

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# Fluorescent Bioaerosol Automatically Collected with Rapid-E Particle Counter and Human Health Implications

Pollen is a primary bioaerosol spread in the atmosphere whose effects are very important both in terms of human health and of development, evolution, and dynamics of ecosystems. Pollen can also influence the hydrological cycle and therefore the climate system even at larger scales, because it can be transported over very long distances.

The level of scientific understanding of pollen role in the environment is quite low, despite of many research efforts. For Romania, a substantial lack of information exists in regarding the monitoring, variations, or health impact of pollen levels. The present study adds to a very small number of papers focused on pollen in Romania. Its aim was to identify the diurnal, weekly and seasonal variations in the larger metropolitan Bucharest area, Romania and to look for correlations with human health data.

Pollen concentrations were obtained using an automatic sampling method for the period of 2018-2021. This method is based on the fluorescence signal collected using the Rapid-E particle counter, which is located in Bucharest_Magurele.

The study represents a continuation of a previous study on correlations between allergenic pollen, major air pollutants, and meteorological parameters in Bucharest based on a long-term (2014-2019) observational dataset (Rosianu et al., 2021, in press). A comparison of pollen concentrations collected automatically with the previous collected pollen data with a volumetric Hirst-type collector, was also performed.

This study may be used for future intensive research on the link between mortality, respiratory disease, and pollen concentrations.

*Acknowledgments*

This work was supported by European Regional Development Fund through Competitiveness Operational Programme 2014–2020, Action 1.1.3 creating synergies with H2020 programme, project Support Center for European project management and European promotion, MYSMIS code 107874, ctr. no. 253/2.06.2020, Romanian National Core Program Contract No.18N/2019. AMR was supported by the University of Bucharest, PhD research grant. SS and GI acknowledge the support from NO Grants 2014-2021, under Project EEA-RO-NO-2019-0423, contract no 31/01.09.2020.

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# Contribution to the Improvement of the System of Action in the Event of Sudden Marine Pollution

The continuous increase in maritime traffic from year to year results in greater opportunities for oil pollution of the sea. The danger of marine pollution from oils threatens not only tankers but also other ships that have a significant amount of oil in their tanks using for propulsion. The application of MARPOL significantly reduced the number of maritime accidents that resulted in greater pollution of the sea with oils While in the 1970s there were 24.5 large (> 700 tonnes) oil spills per year, in the 2010s the average number of large oil spills decreased to 1.7 oil spills per year. In addition to all the rules introduced, maritime accidents still occur with oil pollution. It is very important that countries with closed seas such as the Mediterranean have well-developed action plans because otherwise, the consequences for their economy of oil pollution can be disastrous. The most important thing in such cases, in addition to well-developed action plans, is to have suitably educated people and equipment. It is not uncommon in such cases to lack educated personnel and equipment to act in the event of sudden oil pollution of the sea. This paper aims to point out the options for proper education of people that would be available 24/7 with the possibility of prompt action in such situations. In addition to the above, it is desirable to show the option of continuous storage of the necessary equipment to act in such situations.

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# Coastline Morphological Dynamic of the Djerba Island (South Shore of the Mediterranean, SE-Tunisia)

The island of Djerba (southern shore of the Mediterranean basin, SE-Tunisia) has recently been classified by UNESCO as an international heritage of great importance.

Morphological changes of this island were determined by studying the evolution of its coastline over a period of 45 years, from 1975 to 2020, using aerial photographs (mission 1995) and satellite images (Landsat 1 MSS, Landsat 7 ETM +, Landsat 8 OLI_TIRS and Sentinel 2 A).

Different positions of the coastline were automatically extracted by determining the MNDWI water index (Modified Normalized Difference Water Index) and the calculation of their evolution rates (m/year) was done using the DSAS (Digital Shoreline Analysis System) extension of Arc GIS software.

The coastline evolution, during the period 1975-2020, shows a general erosion along the entire coastline of the island which has reached more than 10 m/year, between the port of Aghir and the spit Borj El Kastel sandblast. Indeed, the island is losing the sediments of its beaches.

Among the erosion factors, the increase in wind speed from 1970 to 2019, the exposure to dominant energetic waves, the absence of riverine solids due to the absence of watercourses, the effect of tidal currents (the tidal range which is 2 m is the most important in the Mediterranean), the increase in sea level rise due to global warming and the destruction of dunes by series of hotels ...

The situation of the Djerba island is alarming, requiring an urgent intervention, especially since the acceleration of the coastline retreat during those last four years, between 2016 and 2020.

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# Sustainable Rural Development Index: The Importance of Agribusiness for the Brazilian Economy

Rural production is integrated to the management of a complex system, in which many areas of knowledge are included, to understand in a better way this social, economic and environmental context, inside and outside the limits of an establishment, is essential in the process of planning and conducting agricultural, forestall and pastoral activities of a municipality, conciliating preservation and the rational use of natural resources. The objective of this research is to study the immediate geographical region of Rio Verde, from the Sustainable Rural Development Index (SRDI), which is formed by three dimensions: the Economic Development Index (EDI), the Social Development Index (SDI) and the Environmental Performance Index (EPI) on. It is also aimed at elaborating and calculating the methodology for the overflow index (OI) and infrastructure index (IEI). The problem is to determine to what extent the articulation between the economic, social, environmental and institutional dimensions, around indicators and parameters, is able to evidence the sustainability of agribusiness, basis of the Brazilian development, in local contexts. The study hypothesis is that the determination of the sustainability of agribusiness in

determined places depends on the articulation of economic, social, environmental and institutional dimensions, around specific indicators and parameters according to their different forms of productive organizations, and that the isolated consideration of these Dimensions and disregarding forms of productive organizations, makes the determination of agribusiness sustainability in local contexts. The methodology will be calculated for Overflow Index (OI) and Infrastructure Index (IEI) that will be added to the Sustainable Rural Development Index (SRDI). The research will be developed in the immediate region of Rio Verde, which comprises fourteen Municipalities from Goiás state: Aparecida do Rio Doce, Cachoeira Alta, Caçu, Castelândia, Itajá, Itarumã, Lagoa Santa, Maurilândia, Montividiu, Porteirão, Rio Verde, Santa Helena de Goiás, Santo Antônio da Barra and Turvelândia, which according to the estimates of the Brazilian Institute of Geography and Statistics - IBGE, in 2020 totalized more than 370 thousand people. The data will be collected mainly in secondary sources, but it may also be necessary to survey some information on primary sources. Economic, social, environmental and institutional data from the municipalities of the researched region will be used considering databases of official statistics institutes. The scientific relevance of this study stems from the importance of disclosing the complexity of the rural world, from the classification of the municipalities on, based on the Sustainable Rural Development Index (SRDI), Overflowing Index (OT) and Infrastructure Index (IEI), considering the heterogeneous social, technical, environmental, economic, demographic, and regional, characteristics which are reflected in the development of the regional territory, since rural development is a multidimensional phenomenon and it is necessary to know its particularities. Information generated from this research will serve as a basis for managers, producers and other agents, such as companies that are responsible for water supply and hydroelectric power generation, entrepreneurs, associations, trading unions, industries, and also in the solution of collective social problems.

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# Snow Height and Snow Water Equivalent Estimation from Snow Cover Fraction Using Sentinel-2 Satellite Images in North Kazakhstan

Due to the high spatio-temporal variability of snowpack and its quick directional alterations under the effect of changing climate, the elaborating of methodologies for gathering accurate data about snow over large areas is essential. Climate change's influence on snowpack (early melting, shorter durations of stable snow) can have major consequences for natural and anthropogenic processes. Water resources (spring flood level changes, high evaporation) and agri-business which depend on winter precipitation are highly affected by variations in a snowbank and melting regimes. This work demonstrates comparison results of the snowpack thickness estimation in the LLP "North Kazakhstan AES" adopting distinctive techniques (quadratic, exponential and linear functions) for assessing Fractional Snow Cover (SCF) and demonstrating Snow Water Equivalent (SWE) on the one hand, and in-situ perspective on the other. Between the 26–29 of February 2020 a field measurement was managed on the territory of the agricultural enterprise with an area of 25 000 hectares. Accordingly, the thickness of the snowpack was surveyed at 560 points and its' density was measured at 70 points. For quick and convenient movement during the snow survey, snowmobile was used, and the measurements were

carried out applying a VS-43 weight snow gauge and a wooden snow batten. Because of the high cloudiness of the study area, it wasn't possible to obtain cloudless images on the same days when the field snow survey was carried out, but only on March 8, 2020. Applying existing methodologies of SCF computation, it became obvious that the quadratic equation provides more reliable results at RMSE of 0.01 m, followed by a linear - 0.12 m and exponential - 0.13 m methods. The Snow Water Equivalent map from the quadratic mathematical statement demonstrated a minimum water level of 8 mm, a median of about 45 mm and maximum level of 60 mm. The application of this work showed a strong correlation between snow height and SCF, namely the quadratic function of estimating the SCF in Northern Kazakhstan. Thus, to assess snow cover, predict spring floods and soil moisture, and during any hydrological studies, we decidedly propose using Sentinel-2 multispectral satellite data and the quadratic mathematical statement.

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# The Change of the Hydromechanical Properties of Gypsum Rocks Submitted to Water Dissolution

The extension of human activities leads to a development of infrastructures in areas subject to the development of "cavity" hazards induced by gypsum dissolution. Such natural hazard is identified in the case of former operations such as quarries or structures (tunnel, karst ...) but it remains poorly localized in the presence of isolated pockets of gypsum and/or scattered in the sedimentary areas. Like all saline rocks, gypsum shows a rapid dissolution kinetic and the dissolution is mainly described as a surface phenomenon. However, gypsum-rich materials are characterized by a more or less developed porosity allowing fluid circulation and potential calcite recrystallization phenomenon in supersaturated conditions. If the dissolution kinetic of gypsum materials has been widely studied in laboratory, the change of hydromechanical properties of such materials was less studied. Moreover, depending on the local context, gypsum masses can be interspersed with clay and oxide interbeds, which makes complex the water flow in porous medium considering the channeling role or flow limiting of such mineralogical discontinuities.

The present communication aims at describing the mineralogy, the microstructure (porosity) and the mechanical properties of 3 types of gypsum materials (two almost pure gypsums from Parisian basin and a Triassic clay-rich gypsum from South-East of France near Alpine region). The evolution of the gypsums characteristics is described when the material is submitted to water circulation. The triassic gypsum including clayey beds and oxides allowed to describe the role of such heterogeneities on the material behavior.

The description of the porous network in a quantitative way (total porosity, pore size distribution, trapped porosity measured by water porosity or by porosimetry by mercury intrusion) or qualitative (by observation in optical and electronic microscopy) allows to better understand the permeability and the water flow through gypsum materials. As the porous network changes under gypsum dissolution, the conditions of fluid circulation depend directly to the increase of void volume. These microstructural evolutions also impact the

mechanical properties measured locally by non-destructive method such as the speed of sound and the resonance frequency. Finally, results should contribute to better understand the cavities development in gypsum rich areas and predict their initiation and evolution considering hydrological characteristics of sites.

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# Relationship between the Dynamics of Landslides in the Flysch Carpathians and Rainfall

The study area covers the southern part of Poland. It is a mountainous region belonging to the outer flysch Carpathians. Landslides in this area are a frequent phenomenon that shapes the slopes of the mountains and determines the way the land is used. They are especially visible in periods of long and intense rainfall. The southern part of Poland is characterized by scattered development, a dense road network and a high population density. The Polish Geological Institute monitors 60 landslides in this area, where the risk of activation is particularly high. Monitoring is carried out within the Framework of Landslide Counteracting System (SOPO).

This study concerns the activity of several large landslides subject to instrumental monitoring over a period of about 10 years. The results of GNSS measurements of geodetic benchmarks, the results of inclinometric measurements and the recording of rainfall data were used. GNSS and inclinometric measurements are performed twice a year. In order to correlate these measurements with atmospheric precipitation, rain gauges were installed on the landslides, and next to each inclinometer column there is a piezometric hole equipped with a sensor recording continuously fluctuations in groundwater level.

The analysis shows the temporal distribution of the dynamics of these landslides in relation to precipitation and geological structure. In order to expose these relationships, landslides were divided into two groups. The first group of landslides is located in the areas where the geological basement is made up of flysch formations with predominance of clay rocks. The second group of landslides is located in areas with predominance of sandstones in the basement rocks.

The analysis of the 10-years record of observation period show that, in the areas where the geological structure is dominated by clay, the landslides present constant (continuous) activity with displacements not exceeding a dozen mm/year. In the case of areas where in the geological basement is dominated by sandstones, landslide movements were more often impulsive. Dislocations were recorded mainly after intense, long lasting precipitation or heavy rainstorms. In extreme situations the dynamics of displacements resulted in total destruction of the measuring column.

The analysis of the relationship between the dynamics of large landslides in the Carpathians and the geological conditions and rainfall is an extension of the issues previously described by the author with newer data and additional monitoring methods. The trends described above are also observed in other monitored landslides.

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# Geophysics of Los Contreras Maar, Santo Domingo Phreatomagmatic Field, Central Mexico

The Maar Los Contreras is located within the Santo Domingo volcanic (Phreatomagmatic) field, which belongs to the intraplate volcanic region of central Mexico. A complex of geological and geophysical studies was carried out in this area, including ground-based and satellite gravity, terrestrial and aero-magnetometry, TEM electromagnetic sounding, gamma-spectrometry, and measurements of radon and thoron concentration in sediments. The main results can be summarized as follows:

1. Gravimetric field in the area of the volcanic structure is characterized by alternating anomalies with an amplitude of 25-30 mGal. In the area of the Los Contreras caldera, Bouguer anomalies have negative values. Isostatic anomalies have a mosaic form, indicating that the region is generally uncompensated.
2. The magnetic field as a whole has a northwestern and northern strike. Its configuration is related to the basement faults and the general tectonic structure of the Santo Domingo volcanic field region. The anomalies in the caldera zone are concentric in shape. Zones of high gradients correspond to discontinuities. A chain of volcanic formations associated with deep faults of the basement can be traced in the plan.

3. Spectral gamma ray analysis was performed on 115 samples. The obtained data allowed to reveal regularities in the concentration distribution of radioactive isotopes of uranium, thorium and potassium, which are one of the important sources of radiogenic heat. Thorium concentration reaches 9-10 ppm, uranium - 5-6 ppm, while potassium content does not exceed 0.5%. The eTh/eU ratio varies greatly from 1-2 to 20-28. Obviously, this is associated with high heat flux caused by the manifestations of volcanism.
4. The high content of radon (about 10,000 $Bq/m^3$) and thoron (up to 15-20,000 $Bq/m^3$) in some samples indicates modern crustal activity. This is also confirmed by the recorded seismicity in the studied area. The magnitude of earthquakes here is generally low and varies in the range of 2-4.
5. Electromagnetic TEM sounding showed the presence of a conductive layer in the area of the crater Los Contreras, located at a depth of 350-400 meters from the surface. This layer can probably be interpreted as a magma chamber. In general, Los Contreras appears to be consistent with the classical Maar Lorentz model.
6. The Curie isotherm depth map was constructed using spectral analysis of aeromagnetic data reduced to the pole. The geothermal gradient here is 12.34 to 34.59 °C/km. According to our models, the Mojo surface depth at Mesa Central, within which the Los Contreras maar is located, reaches 40 to 52 km with a relatively cold crust (-35 to -45 $mWm^{-2}$); compared to the thinner crust (34 to <40 km) and increased heat flux (-50 to -85 $mWm^{-2}$) in the Sierra Madre Oriental zone. The results of the study suggest a high level of enthalpy in this region.

*Acknowledgments*

This work was partially supported by CONACYT project A1-S-29604.

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# Aquaporins in Halophytic Grasses Provide Important Clues for Enhancing Salt Tolerance in Crops

Soil salinization is among the most detrimental soil factors affecting crop plants worldwide. Although halophytes may provide important clues concerning salt tolerance in plants, many unanswered questions remain to be addressed, including the processes of water transport regulation under salinity conditions. In the present study, we examined the effects of salt on the water transport properties and the structure and function of aquaporins in three related grass species varying in salt tolerance. The grasses included relatively salt-sensitive *Poa pratensis*, moderately salt-tolerant *Poa juncifolia*, and the salt-loving halophytic grass *Puccinellia nuttalliana*. We also carried out transcriptomic and metabolomic analyses to better understand the features enabling salt-tolerant plants to maintain efficient water transport under salinity conditions. The results showed that, contrary to the more salt-sensitive *P. pratensis*, sodium enhanced the cell-water transport in the roots of halophytic *P. nuttalliana* plants and triggered an increase in gene expression of the main water-transporting *PnuPIP2;2* aquaporin. Pore shape modeling revealed that PnuPIP2;2 protein has an hourglass shape and increasing diameter conical entrance that could increase the channel water permeability. The water homeostasis strategy of *P. nuttalliana* also included the downregulation of gene expression levels of the main water transporting tonoplast protein *PnuTIP1;1*. The stimulating effects of sodium on the aquaporin-mediated root water transport in halophytic plants was among the principal factors that enhanced transpiration rates and net photosynthesis in *P. nuttalliana*, resulting in growth enhancement. The study results point to the aquaporins as the candidate genes for the improvement of tolerance and growth of crop plants in salt-affected areas.

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