.DEMO.CRATIA

DEMOCRATIA – AQUA – TECHNICA

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Ulrike Gayh is Professor for Environmental and Process engineering and is the Dean of the Master´s program in Water Technology (M.Eng.) at the School of Engineering and Architecture of the SRH University Heidelberg. She conducts international research activities in the field of water technology solutions for the prevention and reduction of local and regional water conflicts. Together with colleagues from the Serbian partner university, the University of Novi Sad, she established the Democratia-Aqua-Technica initiative which deals with the question of innovative technical concepts for sustainable water resource management. She has further research interests in the fields of biogas, wastewater management and water protection. The focus being mainly alternative sanitation systems as well and the removal of micropollutants using alternative adsorbents.

PROF. DR. MAJA TURK-SEKULIĆ

Maja Turk-Sekulić is a Professor of Environmental Engineering at the Department of Environmental Engineering and Occupational Safety and Health, Faculty of Technical Sciences, University of Novi Sad. She is a Chair of Master´s academic studies program Water Treatment and Safety Engineering, and Vice President of the Serbian Chemical Society (Section for Environmental Chemistry). Her main activities and responsibilities are teaching, research and leadership in national and international scientific projects. Her main areas of specialization are green technologies for wastewater treatment, wastewater management, monitoring and low-cost decontamination and remediation; The partitioning, dispersal and retention of organic pollutants in Biotic and Abiotic Systems; Analysis, environmental processes, and the fate of POPs in the environment, biotic and abiotic transformations. Other fields of specialization are air pollution, gas/particle partitioning, and the partitioning of polychlorinated biphenyls.

FOREWORD

The idea of the initiative Democratia-Aqua-Technica is about transforming local and regional water conflicts into pathways to peace and democracy incorporating innovative science and technology approaches.

The project is funded as part of the DAAD programme “East-West Dialogue“, and three events have been planned for 2020 which will deal with the question of innovative technical concepts for sustainable water resource management. The events were organized together with the Serbian partner university “University of Novi Sad” and other partner universities in Russia, Hungary and Turkey. The special feature of this project was that the students and doctoral candidates should work together on projects throughout the year, even between courses.

The initial project plan consists of the following three events.

- Study Visit in Germany: crossing the bridge from higher education to water practice and technology;
  - Objective: to develop sustainable and innovative project ideas to solve the most common conflicts related to water technologies, as well as getting to know different companies involved in this field.

Planned in Heidelberg and Munich (IFAT), dates: 04/05/20 - 08/05/20.

- Young Scientist Research Week in Serbia: traveling projects at UNS.
  - Objective: to obtain an overview of the water conflicts in Serbia, and to develop a research project in teams with the purpose of comparing the current technical stand of the water supply and different ways of engaging civil society.

Planned in Novi Sad, dates: 29/06/20 - 03/07/20.

- Workshop with Partner Universities
  - Objective: to expand the geopolitical “catchment area” of the project and to increase the variety of perspectives, experiences and practical examples.

Planned in Novi Sad, dates: 24/09/20 – 29/09/20.

Because of the Covid-19 pandemic, the whole project plan was changed to a digital format. Using a cross-media approach with different digital components, the project could be successfully realized. The main digital components were:

- Web-based network portal: **www.democratia-aqua.org**
- Digital game application - Explorer app
- 24-hours hackathons with different challenges (took place on September 1st and 2nd)
- Digital Conference (took place on September 24th and 25th)

This E-book provides an overview of our cross-media approach by presenting the main results of using the different digital components.

One of the main advantages of the digital concept of the Democratia-Aqua-Technica initiative 2020 was that not only partners from the Western Balkans, but from all over the world participated in the Hackathon and the conference to find and discuss innovative technical concepts for sustainable water resource management, in order to promote the reduction of regional and local distribution conflicts.

Thanks are due to all participants and partners who made the Hackathon a success, and made the conference so exciting for everybody.

In the future, further projects at the EU level are to follow under the umbrella of the Democratia-Aqua-Technica initiative. We are looking forward to carrying out the second Democratia-Aqua-Technica conference in September 2021.

PROF. DR. MAJA TURK-SEKULIĆ &
PROF. DR. ULRIKE GAYH

THE BACKGROUND

SRH HOCHSCHULE HEIDELBERG

The SRH University Heidelberg was founded in 1969, and it is one of the oldest and largest private universities nationwide. It sets standards in the field of education, and at six schools 42 study programs are offered. A highly important part of this process is the close cooperation between students and tutors. The concept for success: offering new, practical courses of study, individual support and a fast track to the labour market. For the students, this means the best chance of an optimal start in professional life - with a tight network of connections to enterprises and educational institutions worldwide. Cooperation with business enterprises or integration in research projects and colloquia enable the students to make use of the knowledge and skills they have acquired. 92% of the students graduate successfully.

The “CORE-Principle” – Competence-Oriented Research and Education – places the acquisition of occupational competence at the center of the studies. This approach goes far beyond the delivery of theoretical knowledge. The term occupational competence denotes all the skills that enable the students to act independently and successfully in the labour market. Occupational competence can be attained at many levels by acquiring professional competence, methodological competence, self-competence and social competence. Instead of having to deal with numerous subjects at the same time, the students can focus entirely on a maximum of two subjects within one 5-week period. To ensure that students remember what they are learning, the university takes a practical approach to teaching, using case studies, seminars, team projects, role plays and presentations. From the profusion of examination methods available, the method that best fits the skills taught in a particular module is chosen. Scheduling a great number of exams within a short period of time is now a thing of the past, thanks to the new program. The graduates are capable of proving themselves in a real business environment after their studies. In their roles as mentors and coaches, the teaching staff assist the students in every way possible, be it subject-specific content, study organization or in personal matters.

The School of Engineering and Architecture offers an excellent education that is subject-specific: ready for take-off in working life, with a unique mix of theoretical basics, field trips and internships. Today, being an engineer not only involves planning, designing and optimizing, but it is also about developing design and technical solutions by taking the ecological, social and economic factors into account and staying competitive in the global market. Great importance is placed on the issues of energy efficiency and sustainability, so that future challenges can be met successfully and responsibly.

WATER TECHNOLOGY

MASTER OF ENGINEERING

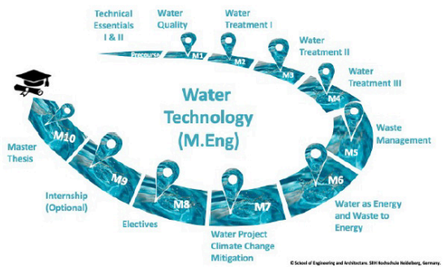
The Master´s Program Water Technology (M.Eng.) provides an overview of the main challenges related to the availability and supply of water, its use as a source of energy, and the treatment of wastewater.

OBJECTIVES OF THE PROGRAM

- To understand the major challenges related to the availability of clean water
- To learn how to mitigate the climate change
- To analyze methods of wastewater treatment and water supply
- To recognize the role of water as a source of energy and how to turn waste into energy

DISCUSSION / OUTLOOK

- At the end of the program, students can develop sustainable solutions to fight the environmental pollution and help mitigate climate change
- Job opportunities exist in global water companies, technology providers in the water sector, research centers or institutes and communal companies in the water sector



PROGRAM DURATION

- Main Course (90 CP): 18 months
- With the preliminary course (120 CP) or optional internship in Semester 3 (120 CP): 24 months

PROGRAM OVERVIEW

- Semester 1 modules: Water Quality, Water Treatment I, Water Treatment II, Water Treatment III
- Semester 2 modules: Waste Management, Water as Energy and Waste to Energy, Water Project - Climate Change Mitigation, Elective
- Semester 3: Master Thesis

FOR MORE INFORMATION, PLEASE CHECK OUR HOMEPAGE

CECILIA GARCIA, ULRIKE GAYH

SRH University Heidelberg, Germany

THE BACKGROUND

UNIVERSITY OF NOVI SAD

FACULTY OF TECHNICAL SCIENCES

With over 1,200 staff and more than 14,000 students currently attending all levels of academic studies, the Faculty of Technical Sciences (FTN) is the largest single faculty of the University of Novi Sad and Serbia, educating over 2,000 post-graduate and nearly 1,000 PhD students at the moment. Founded in 1974, FTN traces its roots back to the establishment of the Faculty of Mechanical Engineering in 1960. Today, the Faculty is comprised of 13 departments conducting research in virtually all areas of engineering.

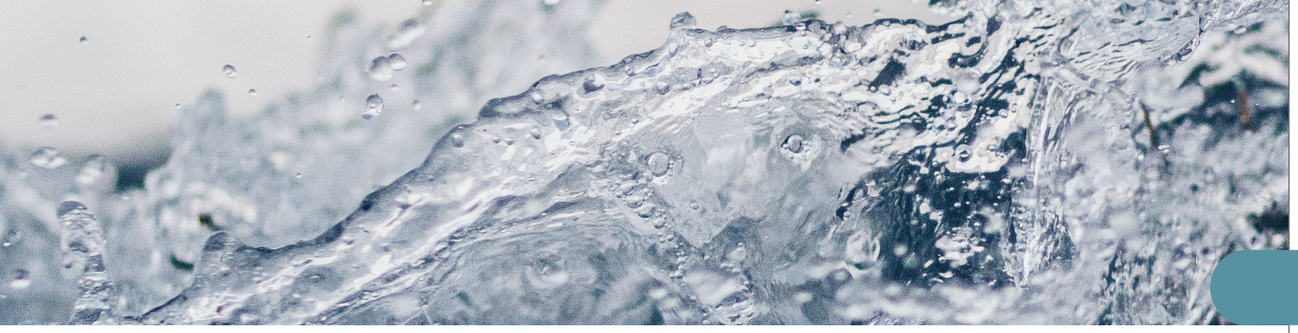
In addition, FTN encompasses many centers designed to focus intradepartmental efforts, including the Industry/University Collaborative Research Center for Advanced Knowledge Enablement (KOI), established in 2016 as a collaborative effort with the Florida Atlantic University, USA. The main objective of KOI is promotion, support and organization of joint research projects between the industry and FTN researchers.

A regional leader in technology transfer, over the last two decades FTN has spun off over 100 companies, mostly in the domain of ICT, with a turnover of 100 million euros, making this the most important industry locally. To illustrate the dynamics, 40 of these companies were created between 2005 and 2010, employed 850 engineers and were generating 18 million euros already in 2007. Today the spin-offs of FTN employ about 4,000 IT engineers in the region. The two largest ones (Schneider Electric and RT-RK) account for 1,700 of these.

When it comes to research activities of FTN, they are primarily oriented towards the research projects which are directly or indirectly aimed at practical application in industry, supporting innovation and technology development. So far, FTN has successfully completed around 200 projects supported by the Serbian and Provincial Ministry of Science and Technology and more than 150 international projects realized within different frameworks: FP6, FP7, H2020, EUREKA, COST, IPA, TEMPUS, ERASMUS+ and CEEPUS.

In order to keep up with the high level of performance, the Faculty has co-invested in the development of the Novi Sad Science-Technological (ST) Park, which opened its doors in January 2020, adding 10,000m^2 of laboratory and office space to its facilities.

The University of Novi Sad, with around 50,000 students and 5,000 employees, is one of the largest educational and research centers in Central Europe. It belongs to the group of comprehensive universities which are characterized by providing training in nearly all fields of science and higher education.



THE PROGRAM

DIGITAL CONFERENCE DEMOCRATIA-AQUA-TECHNICA

24.09.2020

9:00 - 9:30	Welcome from Prof. Dr. Carsten Diener (Rector SRH)
9:30 - 10:15	Welcome and Keynote speech: Prof. Dr. Ulrike Gayh (SRH)
10:15 - 11:00	Keynote speech - Research activities at the Department of Environmental Engineering and Occupational Safety and Health: Prof. Dr. Maja Turk-Sekulić, Prof. Dr. Jelena Radonić (UNS)
11:00 - 11:45	Introduction and Review Hackathon, Results Hackathon Challenge 1: Prof. Dr. Benjamin Zierock (SRH)
11:45 - 12:00	Introduction Poster Session (Overview of topics + Participants + Procedure): Prof. Dr. Ulrike Gayh / Prof. Benjamin Zierock (SRH)
12:00 - 13:30	Lunchbreak - Poster Session
13:30 - 14:15	Sustainable wastewater management and resource recovery systems through novel anaerobic and bioelectrochemical processes: Assist. Prof. Dr. Yasemin Dilsad Yilmazel (METU)
14:15 - 15:00	Wastewater Treatment from Nitrogen Compounds in the Trickling Biofilter: Olga Yantsen, Prof. Dr. Elena Gogina (NRU)
15:00 - 15:45	Introduction Digital Games-Application - Explorer App + Hackathon Challenge 4: Oliver Schlenker (SRH)
From 16:00	Final discussion + Poster session: Prof. Dr. Maja Turk-Sekulić (UNS) / Prof Dr. Ulrike Gayh (SRH) Digital city ralley Heidelberg - water and architecural highlights of the city

25.09.2020

9:00 - 9:15	Welcome from Prof. Dr. Maja Turk-Sekulić (UNS)
9:15 - 9:45	Health risk assessments of polycyclic aromatic hydrocarbons in ambient air in Novi Sad, Serbia: Prof. Dr. Jelena Radonić (UNS)
9:45 - 10:15	The emission of BTEX compounds during the motion of passenger cars in accordance with the NEDC: Prof. Dr. Dragan Adamović (UNS)
10:15 - 11:00	Improvement of the Drought Management: Prof. Dr. Sándor Szalai (SIU)
11:00 - 11:45	Fuelling Fire with Water: A Case Study on Conflicts around Lake Chad: Emil Unrath, Nikolaus Reeg (HIIK)
11:45 - 12:15	Water, the New Weapon: Cheikh Diallo (Species Analysis, Senegal)
12:15 - 13:30	Lunchbreak - Poster session
13:30 - 14:00	Results of the Hackathon Challenge 3 - Water Conflicts and Methods of Limitation: Ajeesh Nellikunnel Jose, John Lugongo, Prof. Dr. Ulrike Gayh (SRH)
14:00 - 14:30	The Influence of Water on a Rural Environment in its Economic and Ecological Aspects, Shown in the example of the river Alb in the Albtal (Alb-Valley): Mathias Naar (SRH)
14:30 - 15:00	Designing a democratic future: Making a Case for Transdisciplinary Research Approaches: Belen Zevallos (SRH)
15:00 - 15:30	Steps towards Green Technology: the Utilisation of Natural „Low-Cost“ Coagulant in Wastewater Treatment: Sanja Radovic (UNS)
15:30 - 16:00	Treatment and Potential Uses of Contaminated Biomass after the Phytoremediation of Landfill Leachate: Katarina Antić (UNS)
16:00 - 16:30	Contaminations of the Danube Sediment: Effects of Brominated Flame Retardants effect: Maja Brboric (UNS)
16:30 - 17:00	Conclusion and Outlook of the Democratia-Aqua-Technica Initiative: Prof. Dr. Maja Turk-Sekulić (UNS) / Prof Dr. Ulrike Gayh (SRH) / Prof. Dr. Jelena Radonić (UNS)

SUSTAINABLE WATER RESOURCES MANAGEMENT

There are a lot of global challenges in the world. The topic of clean water is one of them. The United Nations (UN) has defined the access to drinking water as a human right, but billions have a shortage. [UN 2019] Resources of water are surface waters, such as river water or lake water, and sea water, groundwater, rain water, air humidity and leachate. More than 70 % of the earth´s surface is covered in water, but most of this is salt water in oceans and just a small amount is fresh water. About the half of the world's population faces the risk of water shortage and the global water demand is projected to increase by 55% by 2050. [UN 2019] Furthermore the amount of clean drinking water in many regions is decreasing owing to pollution. Effects related to climate change, such as flooding or aridity are intensifying challenges of water supply. In addition to that the increasing energy production requires water, but also clean water requires energy. There are several factors influencing the quality of water. Some are man-made, such as industry and land-use and well as the treatment for water supply and wastewater. But conditions, such as climate, sediments, and other hydrological conditions have an influence on the water quality in different regions, too.

Within the framework of sustainable water resources management, there are different topics to be dealt with. Redesigning cities and public spaces so that they are able to be resilient is as important as the adaptation and mitigation as the main short-term factors for climate resiliency. The relationship with water is important, as water is an essential resource for the daily life and is included in today´s sustainability goals and urban development strategies. The objective should be to develop a future strategy and integrating innovative scenarios.
With regard to water sensitive cities, new alternative sanitation systems are an important topic to deal with. The concept of source separation of wastewater is in the focus of new alternative sanitation systems. Source separation means the direction of wastewater into separate black water and grey water divisions, and is linked to the topic of domestic wastewater recycling. Black water is defined as the wastewater from toilets, which consists of urine, faeces, flushing water and toilet paper. It can be further divided into yellow water (urine) and brown water (faeces). Grey water is defined as the wastewater from all other sources than the toilet, e.g. from the kitchen, from the bathroom as well as from the washing machine. Figure 1 shows the composition of the domestic wastewater.

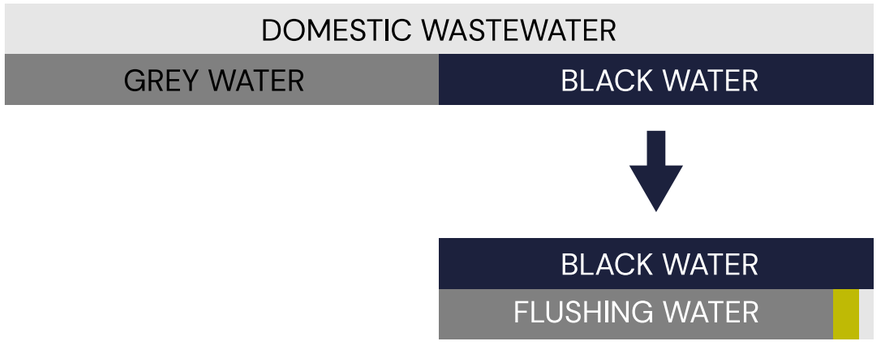


Fig 1: Percentage composition of domestic wastewater

From figure 1 it is obvious that the main volume flow of domestic wastewater comes from the sources for grey water. The volume flows of yellow water and brown water are negligible, but with regard to the organic load, the main part is in the brown water. The brown water also contains problematic substances (e.g. faecal bacteria, pharmaceutical residues) of the domestic wastewater. The yellow water, is in comparison with the other domestic wastewater streams, rich in nutrients such as nitrogen and phosphorus. So, in general, the black water is mainly responsible for the effort needed to cleanse domestic wastewater efficiently, as the grey water is not loaded with organic matter, nutrients and further substances. Surfactants are the main critical group in this wastewater stream. New alternative sanitation systems use the composition of the different wastewater streams in adapting the source separation in an efficient ecological way. In addition to grey and black water, rain water is often integrated in new alternative sanitation systems.

With regard to domestic wastewater recycling the main recycling processes are the black water recycling process (LooLoop-Process) and the grey water recycling process (BlueLoop-Process). Both could be realised by a bio-membrane treatment and re-using the water for toilet flushing. Also the collection of rain water and use of a sand filtration can be a simple process for re-using rainwater for toilet flushing.

New alternative sanitation systems could be integrated in the technical design of residential areas. The source separation is the key factor here, as well. Concepts available are, for example, using vacuum toilets and feeding the black water, together with bio waste from the kitchen, into a biogas plant. The heat and electricity produced are used in the residential area and the fermentation residues are used in agriculture. All other waste water streams, i.e. the grey water, are treated in a constructed wetland and seeped away or are drained into surface waters following treatment.

Thus, no conventional wastewater treatment plant is necessary. This concept has been applied in the residential area of Lübeck-Flintenbreite, Germany. [Ott 2009].

Source separation also helps in improving the climate in cities. The future of roof greening in cities is directly linked with topics, such as the cleansing of grey water on the roof surfaces of houses or car parks in constructed wetlands or in biofilters, as well as the use of purified grey water for irrigation of intensive roof areas or for evaporation in water retention boxes.
A world map showing best practice examples of public spaces in different countries that are next to a river, water front or a place that establishes a relation to a water site has been developed by the participants in the international summer school Neckar Now.

Figure 2: Best practice examples of public spaces developed during the summer school Neckar Now

REFERENCES

[Ott2009] - OtterWasser GmbH, 2009, Ecological housing estate, Flintenbreite, Lübeck, Germany - Draft. Case study of sustainable sanitation projects, Sustainable Sanitation Alliance (SuSanA)

[UN2019] - United Nations World Water Development Report 2019, United Nations Educational, Scientific and Cultural Organization, UNESCO 2019, ISBN 978-92-3-100309-7

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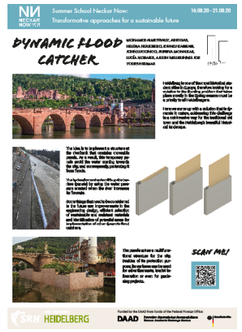
SUMMER SCHOOL NECKAR NOW

The School of Engineering and Architecture presented the first interdisciplinary Summer School "Neckar Now: Transformative approaches for a sustainable future", which took place from 16th until 21st of August 2020.

The Neckar Now Summer School addressed the potential and challenges of a city along the river from an engineering and architectural perspective. Heidelberg provides the perfect setting to learn about current trends and methods of sustainable innovation and design. Field trips, input sessions and expert feedback rounds gave the participants the ability to develop different approaches to local problems, as well as to create their own projects in an immersive experience. It was an exciting one-week program for those considering future studies in Water Technology (M.Eng.) or Architecture (B.A. or M.A.).

Owing to the current Covid-19 pandemic, this Neckar Now Summer School was carried out as a hybrid model. That means, that some participants were physically in Heidelberg, while others participated online.

FOUR DIFFERENT PROJECTS HAVE BEEN DEVELOPED BY THE PARTICIPANTS:



FIND OUT MORE:

DESIGNING A DEMOCRATIC FUTURE: MAKING A CASE FOR TRANS-DISCIPLINARY RESEARCH APPROACHES

CONTEXT

The world is currently living in the middle of a pandemic; this has exacerbated the gap between the haves and have-nots making environmental and social issues even more visible. The questions of how we want to live and what we can do have suddenly become central.

By following the model of Constanza (2003) it is possible to see our resources as unlimited or limited, and so to develop either pessimistic or optimistic views of the world.
In this sense, it is possible to live in either a "Start Trek" world with unlimited resources and an optimistic view of the world, or in, the opposite of that, a Mad Max world with limited resources and a pessimistic view of the world.
I like to think we want to live in an "Ecotopia".

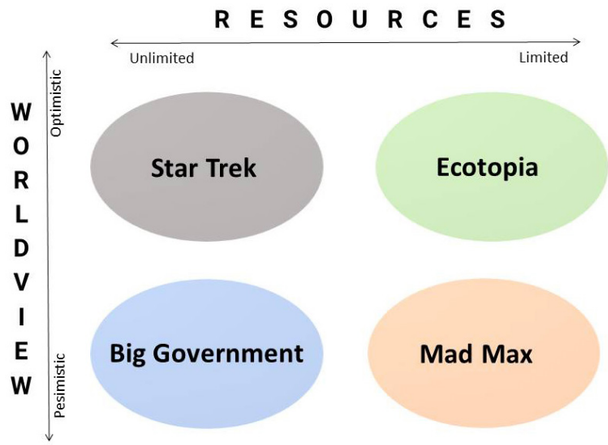


Fig. 1: Based on the Model of Constanza (2003:665)

Callenbach describes how his "Ecotopians" attach fundamental importance to environmental and social stability within which variety can flourish.
This sounds like a great place, but how can we get there?

According to the Merriam Webster Dictionary, democracy is defined as "A government in which the supreme power is vested in the people and exercised by them directly or indirectly through a system of representation usually involving periodically held free elections." Here it is important to note that it is defined in terms of representation of people, but how can this happen if often the decision makers look like a scene from the movie "12 Angry Men" (1957)? We need to create diverse spaces where all people are represented, as only in this way we can create a future that works for everyone.

WHAT CAN WE DO AS RESEARCHERS?

So often researchers produce research that is either too far away from reality or too complicated to understand for the users that need this research to solve a specific problem. This often happens because of a lack of diversity in research teams, they tend to be blindsided by the heterogeneity in their disciplines. However, this can be changed, and it is proven to yield extraordinary results.


Fig. 2: Film frame form the movie "12 Angry Men" (1957)


Fig. 3: Transdisciplinary approaches, Workshops with different actors. Reallabor STADT-RAUM-BILDUNG (2019)

ABOUT TRANSDISCIPLINARITY

Transdisciplinarity connotes a research strategy that crosses many disciplinary boundaries to create a holistic approach. It applies to research efforts focused on problems that cross the boundaries of two or more disciplines.
What happens if we take research outside of the bubble?
Based on our experience with the "Reallabor STADT-RAUM-BILDUNG", the German for Real-World Laboratory: City-Space-Education, real-world laboratories give researchers the chance of developing solutions for real-world problems.

Schäpke et al. (2015) describe real-world laboratories as the targeted set-up of a research "infrastructure" or a "space" in which scientific actors and actors from civil society cooperate in the joint production of knowledge in order to support a more sustainable development of society. […] He then addresses two key challenges of real-world laboratories: 1. both scientists and civil society actors are involved in the process of knowledge production; and 2. knowledge production takes place in real-world environments instead of scientific laboratories. By creating transdisciplinary teams to develop research, it is possible to develop solutions for real problems while at the same time dealing with the actors that face this problem. Transdisciplinary research can be applied to any research field; it is time we work not just for society, but with(in) the society.

REFERENCES

- Arnstein, Sherry R.(1969) A Ladder Of Citizen Participation
- Schäpke N., Singer-Brodowski M., Stelzer F., Bergmann M. and Lang D. J. (2015). Creating space for change: Real-world laboratories for sustainability transformations. The case of Baden-Württemberg. GAIA, 24, 4: 281-283. [online] (DOI): 10.14512/gaia.24.4.17
- Space Transcribers (2020):Space Transcribers. [online] www.spacetranscribers.com, [online] Retrieved March 16, 2020.
- Stadt Raum Bildung (2019): Stadt Raum Bildung.[online] www.stadt-raum-bildung.de, [online] Retrieved March 16, 2020.
- Urban Catalyst Studio (2020):Schutzenmatte [online] www.urbancatalyst.de, [online] Retrieved March 16, 2020.

BELEN ZEVALLOS

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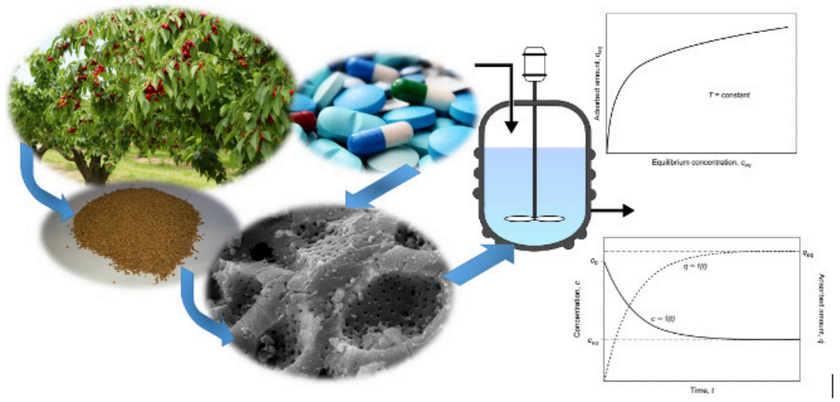
LINKING ECONOMIC AND ENVIRONMENTAL GAINS:

CONVERSION TECHNOLOGIES AND APPLICATIONS IN SUPPORT OF CIRCULAR ECONOMY

Exploring new and sustainable technologies for low-cost, eco-friendly and efficient wastewater remediation and decontamination present environmental, economic and human health challenges. Modern society supports transition towards an economy in which different materials are kept as long as possible while reducing the generation of waste. Nowadays, the majority of generated organic solid wastes are either applied to the land or sent to landfills. Knowledge, research and innovation are an essential part of the systemic changes needed for the revision of the conventional methods of treating different waste streams, with the main goal of tapping into their largely unrealized potential in terms of environmental and economic benefits. Another critical environmental and human health challenge is presented by micropollutants in wastewater. Commercial activated carbon can effectively remove them, but its production is energy intensive and expensive. Inspired by these current issues, our team is focused on different materials development - multifunctional biochars and activated carbons capable of highly efficient separation of a wide range of micropollutants (heavy metal ions, chlorophenols, pharmaceutical compounds [sulfamethoxazole, carbamazepine, diclofenac, naproxen, ketoprofen, ibuprofen] and radionuclides) within different waste treatment systems. In this paper we will present the novel design and synthesis details, characterization (performed by elemental analysis, scanning electron microscopy, energy-dispersive X-ray spectroscopy, Fourier transform infrared spectroscopy, and the Brunauer, Emmett and Taller technique), the evaluation of their capability of highly efficient separation, batch studies performed, desorption and regeneration study results, as well as eco-design, life-cycle assessment, comparative adsorption study and cost analysis of the processes. The results of the study should add significant capacity to green remediation, decontamination and waste utilization efforts.



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REFERENCES

- Pap, S., Kirk, C., Bremner, B., Turk Sekulic, M., Shearer, L., Gibb, S., Taggart, M. (2020). Low-cost chitosan-calcite adsorbent development for potential phosphate removal and recovery from wastewater effluent. Water Research, Volume 173, 15 April 2020, 115573.
- Pap, S., Kirk, C., Bremner, B., Turk Sekulic, M., Gibb, S., Maletic S., Taggart, M. (2020). Synthesis optimisation and characterisation of chitosan-calcite adsorbent from fishery-food waste for phosphorus removal. Environmental Science and Pollution Research: https://doi.org/10.1007/s11356-019-07570-0.
- Turk Sekulić, M., Boskovic, N., Milanović, M., Grujić-Letić, N., Gligorić, E., Pap, S. (2019). An insight into the adsorption of three emerging pharmaceutical contaminants on multifunctional carbonous adsorbent: Mechanisms, modelling and metal coadsorption. Journal of Molecular Liquids: Vol. 284, pp. 372–382.
- Paunović, O., Pap, S., Maletić, S., Taggart, M. A., Boskovic, N., Turk Sekulic, M. (2019). Ionisable emerging pharmaceutical adsorption onto microwave functionalised biochar derived from novel lignocellulosic waste biomass. Journal of Colloid and Interface Science: Vol. 547, pp. 350-360.
- Turk Sekulic, M., Boskovic, N., Slavković, A., Garunović, J., Kolaković, S., Pap, S. (2019). Surface functionalised adsorbent for emerging pharmaceutical removal: Adsorption performance and mechanisms. Process Safety and Environmental Protection: Vol. 125pp. 50–63.

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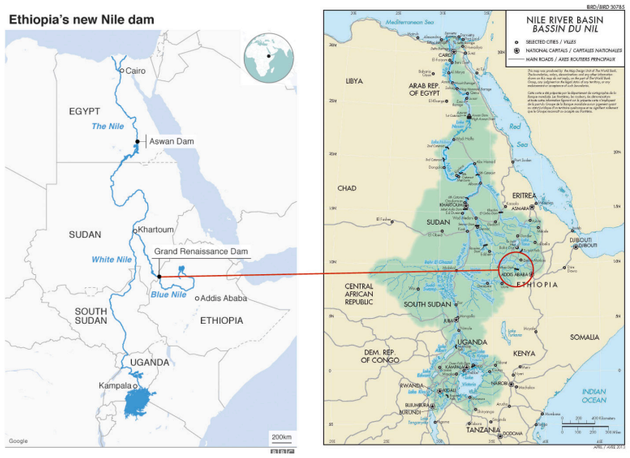
WATER CONFLICTS & LIMITATION METHODS

A CASE STUDY OF WATER CONFLICT IN EGYPT & ETHIOPIA

BACKGROUND AND SOURCES OF THE CONFLICT

- The River Nile is shared by 11 riparian countries.
- Egypt, Sudan and Ethiopiaall depend on the river for their social-economic activities.
- Approximately 95% of water in Egypt is sourced from the river.
- Social-economic activities relating to water uses from the river have created huge tensions between the countries.
- Ethiopia is constructing a mega-dam with a capacity of 74 billion m³ for electricity generation.
- The estimated annual volume of the river is 110 billion m³.
- Ethiopia proposes to fill the reservoir in less than 7 years, while Egypt proposes taking more than 15 years to do this.
- There is no equitable distribution of water flow between the riparian countries, which has resulted in this conflict.



SOCIAL IMPACTS

- Cultural ecosystem services, including the use of the Blue Nile for recreational purposes, will be negatively affected.
- Provision ecosystem services, including the Blue Nile as a source of fish for Egypt and Sudan, will be negatively affected.
- Water as a provision ecosystem service for Egypt and Sudan will diminish significantly.
- The Grand Renaissance Dam will help the economies of Ethiopia, Egypt and Sudan to grow through reliable power generation.
- The Grand Renaissance Dam will expand the economies of rural communities in all three countries.
- Displacement of human populations.

POLITICAL IMPACTS

- The lack of water may drive the countries into riots and social and political chaos.
- This would entail a strain on diplomatic relations between Ethiopia, Egypt and Sudan, possibly resulting in a war.

ENVIRONMENTAL IMPACTS

- Increasing probability of a seismic event.
- Negative impacts on local fish populations.
- Downstream sediment erosion.
- The disappearance of archaeological and historical sites.
- Riparian habitat fragmentation and habitat loss.
- Flooding and the destruction of surrounding habitats and ecosystems.

SOLUTIONS TO THE CONFLICT

- Adherence to the principle of cooperation by Egypt, Ethiopia and Sudan, based on their water needs, is key to averting a full-blown water-related conflict
- The principles of development, regional integration, and sustainability will ensure the peaceful co-existence of Ethiopia and her neighbours Egypt and Sudan, given that the Blue Nile will be generating clean and sustainable energy which will contribute to the economic growth of all three countries.
- The principle of not causing significant harm is important if Egypt and Sudan are to be assured that, in the absence of an agreement, harm will be alleviated, and, if need be, appropriate compensation will be paid.
- The principle of impartial and suitable use will ensure that Ethiopia protects and preserves the Blue Nile, being mindful of the socioeconomic needs of Egypt and Sudan with reference to the usage of the Blue Nile.
- The principle of cooperation in the preliminary filling of the reservoir and management of the dam will avert a water conflict between Egypt, Ethiopia, and Sudan through the implementation of the International Expert Committee's recommendations on the initial filling, and rules and guidelines on the annual operation of the Grand Renaissance Dam.
- The principle of trust building is key for the amicable resolution of any conflict that may emanate from Ethiopia's sale and Egypt' and Sudan's purchase of power generated by the Grand Renaissance Dam.
- The principle of the peaceful settlement of conflicts and the principle of dam safety will ensure transparency and drastically ease tensions with reference to the safety of Egypt and Sudan during the operation of the Grand Renaissance Dam.
- The principle of sovereignty and unity of the region will ensure that Egypt, Ethiopia, and Sudan exhibit good intentions on the basis of equal sovereignty, unity of the region and mutual benefit, settling all conflicts consensually through consultations and negotiations.
- The principle of the peaceful settlement of conflicts is of great relevance in ensuring a conflict-free Nile basin with an overall lasting peace between Egypt, Ethiopia, and Sudan.

CASE STUDY: WATER CONFLICT IN EGYPT & ETHIOPIA

CONCLUSION

- If a potential water conflict between Egypt, Ethiopia and Sudan is to be averted, all three Nile basin countries should respect the 10 principles of "The Declaration of Principles on the Grand Ethiopian Renaissance Dam", which encompasses the resolution of disputes through peaceful coexistence.
- The riparian countries must agree on procedures to share the available water supply.
- Downstream countries can claim their share of water by helping Ethiopia with financial aids and other technical services.
- A solution to this conflict without the cooperation of all these countries and trust of each other is impossible.
- There should be some arrangement to respond to shortages in the water supply during drought crises.
- Transboundary water conflicts may be exacerbated as population increases if effective cooperation is not improved.

WORLD MAP OF WATER CONFLICTS

FOR MORE DETAILS!

REFERENCES

- www.bbc.com/news/world-africa-50328647
- https://www.nytimes.com/interactive/2020/02/09/world/africa/nile-river-dam.html
- https://fanack.com/sudan/history-past-to-present/blue-nile-dispute/?gclid=CjwKCAjw4rf6BRAvEi-wAn-2Q76jaggkp62WTX3W3131caBl1qodww0YYLoounCF9eGLP-m9y-W8a3MNRoCCVQQAvD_BwE
- https://www.ethiopoint.com/who-owns-the-nile-egypt-sudan-and-ethiopias-history-changing-dam/
- https://www.researchgate.net/publication/341655131_THE_CONFLICT_BETWEEN_EGYPT_AND_ETHIO-PIA_OVER_THE_NILE_WATER
- www.hydropower.org/case-studies/ethiopia-grand-ethiopian-renaissance-dam-gerd
- Tawil N. E. (June 2020). Declaration of Principles on Renaissance Dam is ‚exclusive agreement' bin-ding Egypt, Ethiopia, Sudan together: intl. law expert https://www.egypttoday.com/Article/1/88909/Declaration-of-Principles-on-Renaissance-Dam-is-ex-clusive-agreement-binding [September 1 2020]
- Salman S.M.A. (2017). The Declaration of Principles on the Grand Ethiopian Renaissance Dam: An Analytical Overview. In: Yihdego Z., Desta M., Merso F. (eds) Ethiopian Yearbook of International Law 2016. Ethiopian Yearbook of International Law, vol 2016. Springer, Cham. https://doi.org/10.1007/978-3-319-55898-1_9

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WATER, THE NEW WEAPON

The annual consumption of drinking water over the past 50 years has doubled to 3800 km³. In 1990, more than 1 billion people did not have access to drinking water. The minimum water requirement is 50l per day per person, and the need tends to increase. Every 12 seconds someone is a victim of poor water quality. 80% of the diseases in underdeveloped countries come from poor water quality.

By 2025, more than 7.9 billion people will be living in countries with a scarcity of water.
In several regions, there are currently systems of water supply crossing several countries. A number of bi- or multilateral treaties exist between the countries involved for cooperative exploitation of water resources to the benefit of their inhabitants, but usually these treaties are not respected, which leads to bad outcomes.

SOME CONFLICTS AROUND THE WORLD

Nile	1902:	Egypt - Sudan-Ethiopia
	1929 und 1959:	Egypt - Sudan
Senegal	1989:	Senegal - Mauritania
Euphrat	1987:	Turkey - Syria
	1990:	Syria - Iraq
Jordan	1994 :	Israel - Jordania
Yarmuk	1987 :	Syria - Jordania
Indus	1947/48:	India - Pakistan
Tanganyka Lake		Congo (Kinshasa) - Tanzania - Zambia
Akpa Yafi	1998:	Nigeria - Cameroon
Lake Chad		Cameroon - Chad - Niger – Nigeria
Gabcikovo	1998:	Hungary - Slovakia...

For historical reasons, instruments of cooperative conflict settlement are not very well developed , especially in arid regions.
Here, the right of the strongest was dominates in political relations.

CHEIKH DIALLO

Speciesanalytik, Senegal

FUELLING FIRE WITH WATER

A CASE STUDY OF CONFLICTS AROUND LAKE CHAD

How can (non-)violent political conflicts be measured? What is international conflict management and which new problems does it face? Are the ongoing conflicts around Lake Chad illustrative of these?

The study of political conflict is a complex field, and comprehensive and reliable information is seldom found. The presentation will therefore outline basic do's and don'ts of conflict research - and thus give the listener a first guide on how she can herself think critically about political conflict. Focusing on the "Heidelberg Approach" and a material understanding of conflict (i.e. excluding the digital realm), we will try to achieve this in a short amount of time.
Additionally, an empirical spotlight is provided, focusing on new developments of political conflicts. Historically, we can observe these especially with the onset of globalization in the 1980s and the end of the so-called Cold War. Münkler´s concept of the "New Wars" shall exemplify these developments of privatization, asymmetry and autonomization.

In the second part, we will look at methods of how to contain violence, namely international conflict management. Different approaches are then discussed. We will also look at the problems this faces, especially considering the aforementioned new developments of violent political conflicts.

The third part will deal with the consequences of the Lake Chad water crisis. Special attention will be paid to the negative effects that bad water management and conflict management can have on conflict developments. The situation at Lake Chad serves as an example to illustrate the cycle of water scarcity, misguided crisis management, and negative impacts on democracy.

Since the 1970s, several droughts have hit Lake Chad. More intensive agriculture, rapid population growth, and poor regional water management have resulted in the lake losing nearly 90 percent of its water surface. However, recent studies show that the lake has now regained about half of its original water volume. In contrast to previous decades, the water in the lake and the amount of precipitation in the region are subject to wide fluctuations and have similar negative effects.

Overall, the above factors are conducive to the outbreak of several conflicts of different types in Lake Chad, especially intrastate conflicts.
In the context of water conflicts, intrastate conflicts often arise over the use and distribution of water as a source to provide livelihoods for individual (ethnic) groups. Water scarcity and water unpredictability have direct and indirect negative effects on intrastate conflicts. Direct effects are disputes over the allocation of water between different users and uses. Less reliable access to water can also threaten the sustainability of different types of livelihoods, which can have various effects, all of which have the potential to cause or intensify intrastate conflicts. These effects can include mass migration, increased urbanization, and loss of trust in institutions.

Indirect negative effects are caused by inadequate strategies used by security forces to counter violent conflict. Heavy-handed military responses, e.g. banning access to certain areas that were formerly used for fishing or cattle herding, creates a situation in which people cannot rely on their former livelihoods.

When considering the direct and indirect effects of water scarcity in the Lake Chad Basin, it becomes clear that these have negative impacts on democracy and the cohesion of society in the Lake Chad Basin thus creating a new starting point for another deadly cycle of violence.

EMIL UNRATH, NIKOLAUS REEG

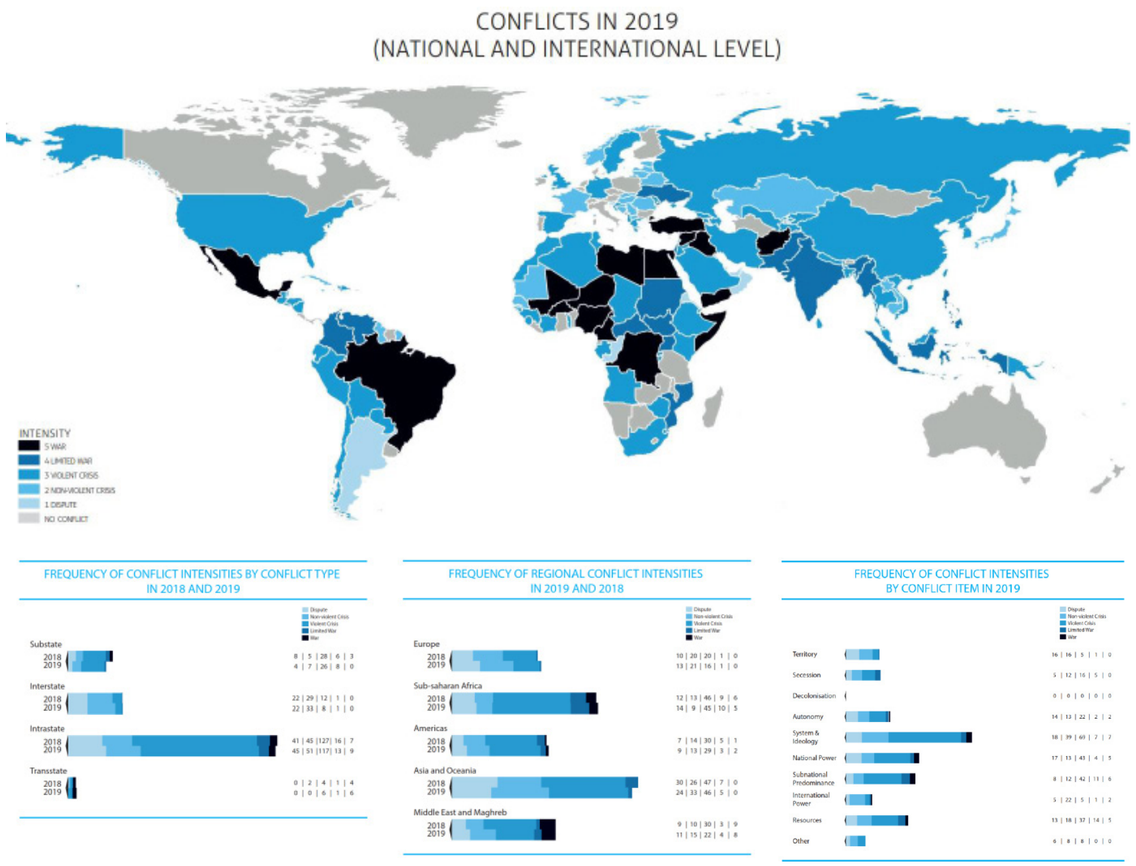
Heidelberg Institute for International Conflict Research, Germany

FUELLING FIRE WITH WATER:

CONFLICT RESEARCH & LAKE CHAD CRISIS

WHEN WAS THE LAST TIME YOU THOUGHT ABOUT WAR AND VIOLENCE ?

The moment we turn on the news, watch Netflix, play games, we often engage with violent content . But what do we actually know about these things? This poster shall give a (very) short overview of how we think about these matters. It will further make you familiar with intense water conflicts“, which are often overlooked in the media.



CONFLICT RESEARCH - THE HEIDELBERG APPROACH

The Heidelberg Institute for International Conflict Research (HIIK) is a non-profit organization based at the Institute of Political Science of the University of Heidelberg, and is devoted to the research, documentation, and evaluation of intra- and interstate political conflicts. It continually updates and maintains the CONTRA database. The Institute´s publication, the Conflict Barometer, is produced annually and presents research results on all political conflicts occurring throughout the world in one calendar year. We refrain from any deeper analysis, limiting ourselves to neutral and verifiable observations. Our basic research therefore serves as a starting point for other scientists studying the dynamics of collective violence.

DO YOU KNOW WHERE CONFLICTS OF HIGH INTENSITY ARE HAPPENING ? CAN YOU SAY WHICH PARTIES ARE FIGHTING , AND ABOUT WHAT OR WHY?

A state usually has the monopoly on violence. This means that the police and military have the legal authority to force, or even hurt, people to ensure that they abide by the government‘s rules. Broadly speaking, if many people inside a country challenge this authority, HIIK acknowledges this as a political conflict. The central questions are then, how do we assess conflicts and measure “violence”?

HIIK has a unique approach which shall be briefly introduced here. A five-level scale shows the intensity of a conflict (see on the right), two of which signify non-violent situations. The scale is computed by the aggregated conflict measures of one calendar year. A conflict measure can contain qualitative, as well as quantitative indicators. These are conflict-related deaths, personnel, and internally displaced persons or refugees (quantitative indicators), and levels of destruction (of infrastructure, housing, etc.) and weapon usage (qualitative indicators). Can you think of other ways to measure collective violence?

Around 200 conflict observers collect all this information by having a look at open source material, such as newspapers or NGO reports. Naturally, they focus on the reliability of the data presented, because, as a famous quote has it: “The first casualty of war is truth”(origins dis puted). On the right, below the world map, you can find a graphical representation of the findings of 2019. The “conflict type” denotes the structure of a conflict. Are only non-state actors fighting inside the same state (substate), two states against each other (interstate), a state against a group inside its territory (intrastate), or one (or several) non-state actor(s) against several states (transstate)? This is an important distinction, because the conflict dynamics differ substantially between these types. The findings show a large number of conflicts by conflict type. This corresponds with the conflict items; the most frequent and fiercest fighting has been about the distribution of power (inside) a state.

For the specific conflict descriptions or a deeper explanation of HIIK´s methodology, visit our website (hiik.de) or take a look at the Conflict Barometer 2019, which can be downloaded for free.

EMIL UNRATH, NIKOLAUS REEG

Heidelberg Institute for International Conflict Research, Germany

IMPROVEMENT OF DROUGHT MANAGEMENT

1. INTRODUCTION

The most general effect of the climate change on precipitation is the increasing of intensity. This can lead to the reduction of available water content even at those the places with an increasing quantity of precipitation. The Carpathian basin is such a special place. According to the same models and scenarios, precipitation will increase, but some other models and scenarios project decreasing precipitation. Increasing drought frequency, duration and severity are foreseen for the region.

2. BACKGROUND

The drought project was launched in the framework of the Danube Transnational Programme with the title: Drought Risk in the Danube Region. 7 EU and 3 non-EU countries took part in the project under the leadership of ARSO/DMCSEE (Slovenia). New monitoring tools have been developed and introduced, drought risk assessment methodology and examples have been created and a drought strategy has been set up in the scope of the project.

Fig. 1: Participating countries in the DriDanube project

3. MONITORING

The is a Web-based interactive homepage (droughtwatch.eu) for near-real-time drought monitoring through different drought indices and in-situ observations undertaken with new techniques. The basic two information sources are as follows,

3.1 User Involvement

Interaction with volunteer reporters has been set up. Reporters have to fill out a questionnaire on a weekly basis, and their result are collected and visualised on the homepage.

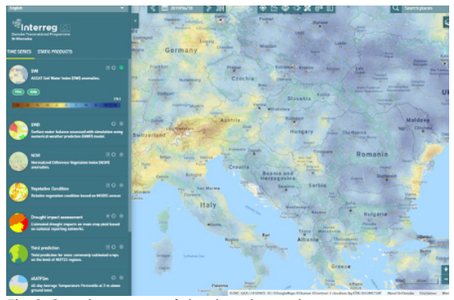


Fig. 2: Opening screen of the droughtwatch.eu page

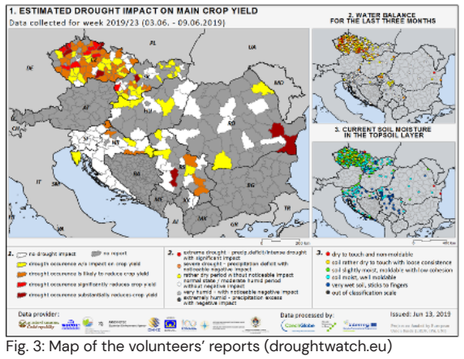


Fig. 3: Map of the volunteers' reports (droughtwatch.eu)

3.2 Remote Sensing

Drought indices are calculated and mapped on the homepage, based on satellite measurements. The most important variable is the soil moisture from Sentinels. It makes the calculation of different drought indices with soil moisture involvement possible.

4. DROUGHT RISK ASSESSMENT

Risk assessment and mapping of the drought risk are the key parts of a successful drought risk-oriented management process. As far as qualitative risk definitions are the most accepted ones, the practical realisation could be quite different in different countries (or even within individuals countries), as has been shown by an appropriate questionnaire filled out by the participants of the project.

The DriDanube project helped harmonize the drought risk calculation for the agricultural sector and obtain insights into the risk of loss of crop yield across the whole region. Procedures implemented in the software calculated the probability (frequency) of reduced crops, based on time series data and indicators of drought and non-drought years.
Besides maps, results were presented in the form of a matrix for four main regional crops (maize, wheat, rape and barley).

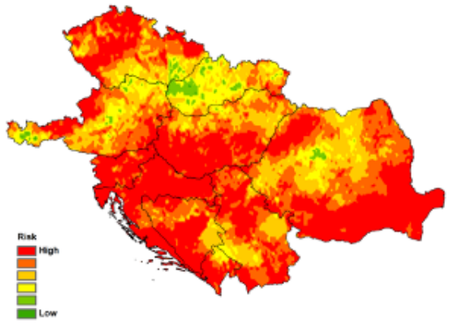


Fig. 4: Risk map for maize (period 5-7 months, drought probability 20%) (Szentimrey, 2018)

5. DROUGHT STRATEGY

An optimal model of drought risk management model was developed and a pilot project investigated its possible applicability in Serbia and Hungary. The basic structure can be harmonized, but the individual parts could be very different according to the different national governmental structures. The most important part of the management model is the determination of appropriate measures in each drought development phase. The suggested strategy contains 5 scale drought development and behaviour.

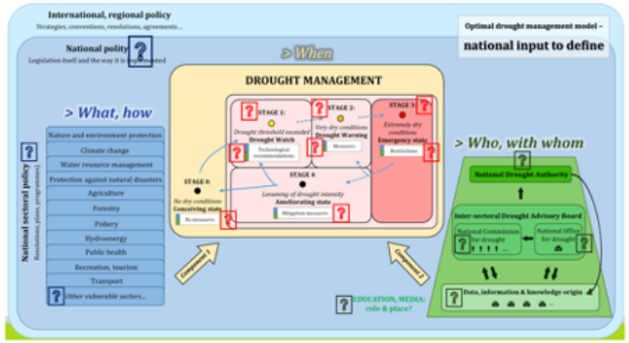


Fig. 5: Optimal Drought Management Model (ARSO/DMCSEE, 2019)

6. CONCLUSION

Drought plays an increasing role in the Danube catchment area. More successful actions require a transnational approach and common measures, and should be based on harmonized monitoring, information networks, risk assessment and drought management models. The DriSanube project gives a good example of how this can be done.

SANDOR SZALAI

Szent Istvan University, Hungary

SUSTAINABLE WASTEWATER MANAGEMENT AND RESOURCE RECOVERY SYSTEMS THROUGH NOVEL ANAEROBIC AND BIO-ELECTROCHEMICAL PROCESSES

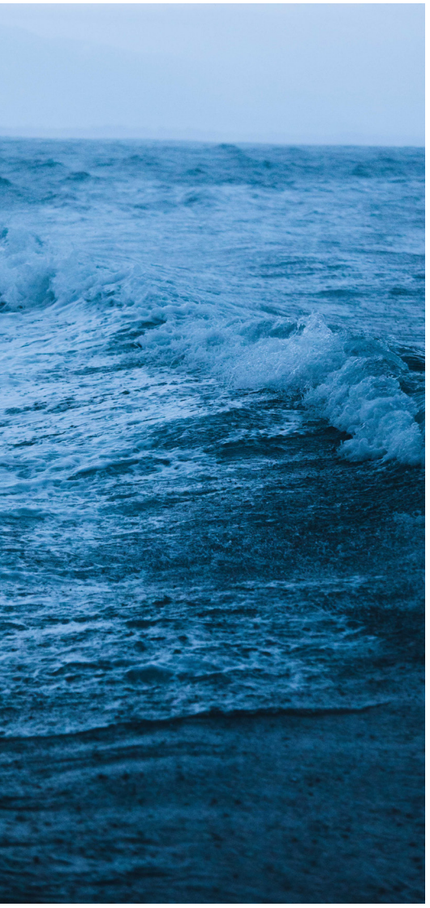
The Middle East Technical University (METU) is an international research university located in the capital of Turkey, Ankara. The Department of Environmental Engineering was established in January 1973 as the first department in an environmental engineering program in Turkey. Currently, our Department is operating with 12 full-time faculty members conducting research in many different areas of Environmental Engineering, such as water resources management, solid waste management, mathematical modelling of environmental systems, biological and physico-chemical wastewater treatment processes, biofuel generation and novel environmental biotechnology systems. The department fully supports international collaboration and has a large number of past collaborations. For further information, please go to the official website at **https://enve.metu.edu.tr** .

In the Democratica - Aqua – Technica presentation, Assist. Prof. Yasemin Dilsad Yilmazel, Vice Chairperson of the Department of Environmental Engineering, focused on research conducted by the Bioprocess Engineering Research Group (BioERG) at METU. The topics covered recent updates and research in her group on bioelectrochemical systems and novel anaerobic systems that are used for waste treatment. Her most recent research projects include a combination of anaerobic digestion-microbial electrolysis cells for improved methane production from animal wastes and the operation of microbial electrolysis cells and dark fermentation for improved hydrogen production from renewable feedstocks.

YASEMIN DILSAD YILMAZEL

Middle East Technical University, Turkey

WASTEWATER TREATMENT FROM NITROGEN COMPOUNDS IN THE TRICKLING BIOFILTER



Water bodies are the basis of the environmental safety and comfort of the population living in cities and towns. Availability of water and wastewater systems is a mandatory element of a comfortable environment for human life. Wastewater treatment systems must ensure the quality of the water in the water bodies. This issue is as relevant for small towns as it is for big cities.

In Russia, the norms for discharge into water bodies do not vary depending on the amount of discharged wastewater, unlike many other countries, particularly those in the European Union.
Thus, in Russia the issues of intensification of processes of small capacity wastewater treatment plants are especially important.

The article describes effective wastewater treatment technology from nitrogen compounds and phosphorus, methods of intensification of the biofilters. The article shows the research results of the operation of biofilters, and the analysis of different feeding materials. Along with the control reactors with the sanitary and chemical analyses, the researchers implemented regular monitoring of the microbiological investigations of biomass, using light and electron microscopy.

The article considers the methodology of modelling processes of wastewater treatment in the biofilters: laboratory models for hydraulic modelling and simulation processes of denitrification-nitrification in the biofilters was developed. A mathematical model was then developed.

OLGA YANTSEN, ELENA GOGINA

Moscow state university of civil engineering, Russia

STEPS TOWARDS GREEN TECHNOLOGY

UTILISATION OF NATURAL "LOW-COST" COAGULANT IN WASTEWATER TREATMENT

Coagulation/flocculation (CF) is one of the most implemented technologies extensively used in industrial-scale wastewater treatment. CF is based on the destabilisation of suspended and colloid particles in aquatic meda that further leads to enhanced particle agglomeration and precipitation. One downside of this process is that many commercial coagulants are themselves potentially toxicants (e.g., aluminium, and ferrous salts and synthetic organic polymers), which could cause environmental and health problems. One possible solution might be the use of more sustainable coagulants of "green" origin. Natural coagulants can be obtained from different plants, seeds, and crustaceans, since these contain active compounds such as proteins and carbohydrates. In this work, common bean seeds (Phaseolus vulgaris) were used for the production of natural "low-cost" coagulant. Two types of extraction processes were used, conventional solid/liquid and ultrasound extraction, using distilled water and NaCl as extracting solutions. After the extraction, the liquid extracts were dried at 120 °C, by a spray-drying process. The obtained powdered coagulants obtained were tested in terms of turbidity, natural organic matter, two NSAIDs (diclofenac and naproxen), arsenic, phosphorus and nickel removal. Preliminary results showed a high potential for turbidity removal, but lower efficiencies in terms of the removal of other pollutants within the applied working parameters. In future work, optimisation of CF process parameters and integration with other techniques (e.g., adsorption) should be considered to achieve higher removal efficiencies in these complex

ACKNOWLEDGMENTS

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THE LAKE CHAD WATER CRISIS

VIOLENT INTRASTATE CONFLICT IN THE LAKE CHAD BASIN

Boko Haram/Islamic State West Africa Province (ISWAP):

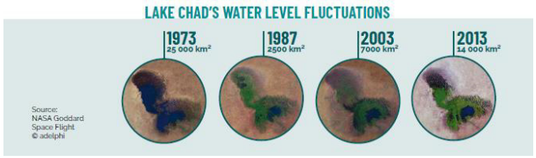
- Conflict Start: 2003
- Affected Countries: Nigeria, Cameroon, Chad and Niger (especially around the shores of Lake Chad)
- Conflict Item: System/Ideology Both groups are fighting to establish an Islamic caliphate.
- Main drivers of the conflict: Religious and socio economic grievances
- Over 25.000 deaths and up to 2 million displaced people

Conflict between Farmers and Pastoralists:

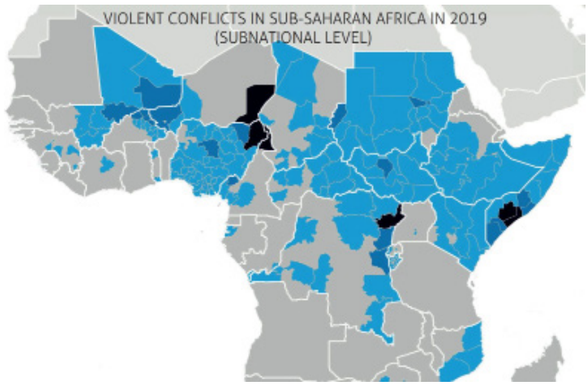
- Conflict Start: 1960
- Affected Countries: Nigeria (similar conflict dynamics can be found throughout the whole Sahel region)
- Conflict Items: Subnational predominance, resources – farmers and nomadic herders clash over arable land and access to water
- Main drivers of the conflict: droughts, desertification and less predictable rainfall
- Up to 10 000 people displaced in the last 10 years and approx. 340 000 internally displaced people altogether

The Lake Chad Water Crisis Facts & Figures

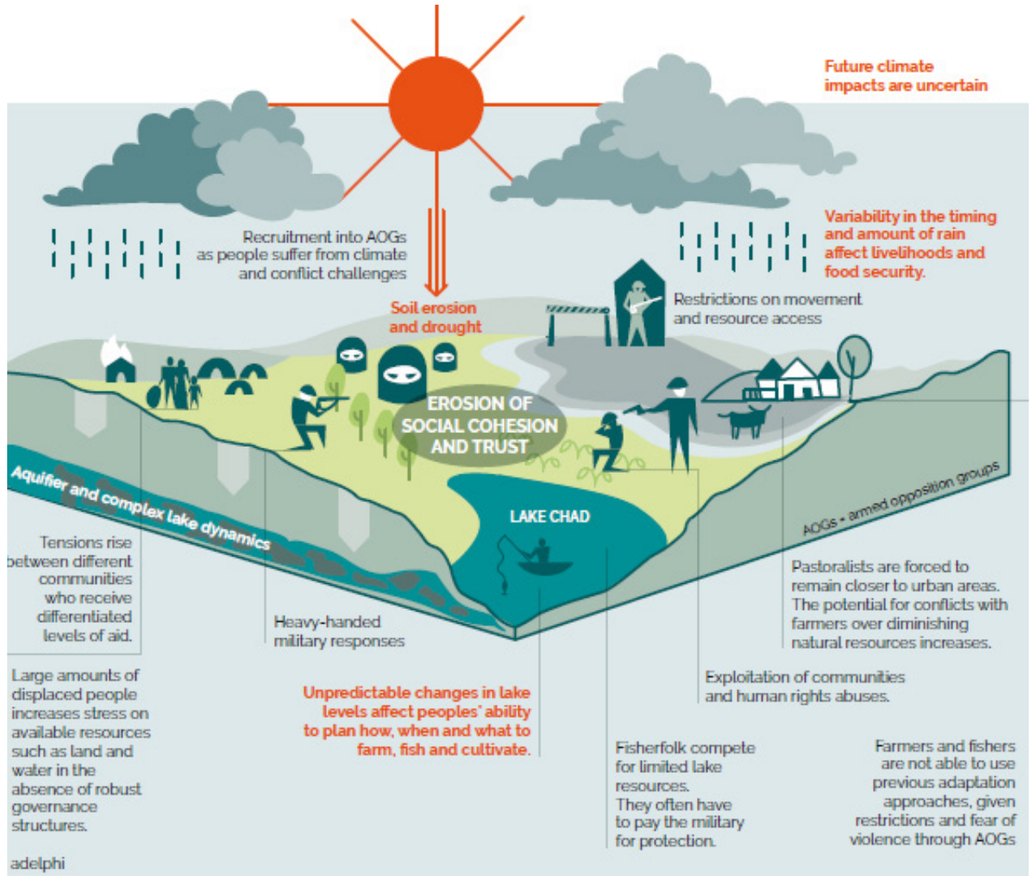
- Lake Chad provided a livelihood for approx. 20 million people
- Due to droughts and insufficient water management, Lake Chad has lost approx. 90 percent of its surface area
- As a consequence of the shrinking, in some areas dense vegetation has made parts of the lake less workable
- Between 1983 and 1994, the volume of water diverted for irrigation accounted for 50 percent of the decrease in the lake's size
- New research shows that Lake Chad has been increasing since 1990 (see right)
- Today, unpredictable rainfall is the main cause for food insecurity and destabilizing effects



Shorting Up Stability - Adressing climate and fragility risks in the Lake Chad region, Adelphi, 2019



Conflict Barometer 2019, p.55



THE NEXUS BETWEEN WATER SCARCITY IN THE LAKE CHAD BASIN AND VIOLENT INTRASTATE CONFLICT:

Direct effects: Livelihoods threatened by water scarcity/unpredictability

1. Allocation of water between different users and uses can lead to conflicts between different identity groups.
2. Less reliable access to water can threaten the sustainability of different types of livelihoods (fishing, farming and cattle herding), which can have various effects, all of which have the potential to cause or intensify intrastate conflicts.

- Mass migration
- Increased urbanization
- Loss of trust in institutions
- Joining an armed group to provide income

Indirect effects: Livelihoods threatened by strategies used by security forces to counter violent conflicts

1. Heavy-handed military responses banning access to certain areas
2. Closure of borders, restriction of access to markets and cross-border trade

The correlation between direct and indirect effects has the potential to create a cycle which fuels violent intrastate conflict.

CASE STUDY OF WATER CONFLICT BETWEEN INDIA AND CHINA

BACKGROUND

Tibet is located in western China, bordered by India, Nepal, Bhutan and Myanmar to the south and east and East Turkistan to the northwest. Tibet is the highest and largest plateau on Earth; its average altitude is approximately 3,350 meters. It is the source of many rivers, such as the Yellow River, the Yangtze River, the Mekong River, the Brahmaputra River, the Salween River and others. India is afraid that China will intercept or even divert the water flow to its north and east regions.

WHY INDIA IS WORRIED?

- One of India's longest rivers, the Brahmaputra, originates from, Yarlung Tsangpo on the Tibetan plateau.
- A large proportion of India's population depends heavily on the Brahmaputra for agricultural, industrial and potable water needs.
- Denial of hydrogeological data by China during high floods
- China's building of multiple dams may give it more leverage at a later stage.

Fig 3: Dry land in the severely water-deficient area of the Loess Plateau in Northwest China

Fig 2: A lady collecting water after walking long distances through barren land in north India

WHY CHINA IS WORRIED?

- Desertification affects a quarter of China's land area.
- The Tibet region is the lifeblood of China's water resources and is related to the country's fundamental interests.
- Water resources per capita are extremely scarce, and large, medium and small cities and rural areas are generally short of water.
- To provide the world's largest population with sufficient water and energy, more water is required than ever.

SOLUTION

- Creating rules and regulations after mutual discussions
- Harvesting rainwater
- Raising awareness among the public on the importance of water preservation and controlled use
- Water re-use and reclamation
- Crop selection based on climatic conditions

CONCLUSION

When two parties are thinking about the problem from their own perspectives, they are forgetting the long road ahead. The Tibetan plateau consists mainly of glaciers; according to some researchers, by 2035 all of the glaciers will melted completely, , if the glaciers keep melting at the current rate in relation to global warming.

All conflicts based on ownership and transport of water from Tibet will be pointless in a decade. Hence, the solution must focus on the bigger picture, by thinking about and researching on water conservation, the efficient use of rainwater, desalination and drip irrigation, and so on.

REFERENCE AND FURTHER INFORMATION!

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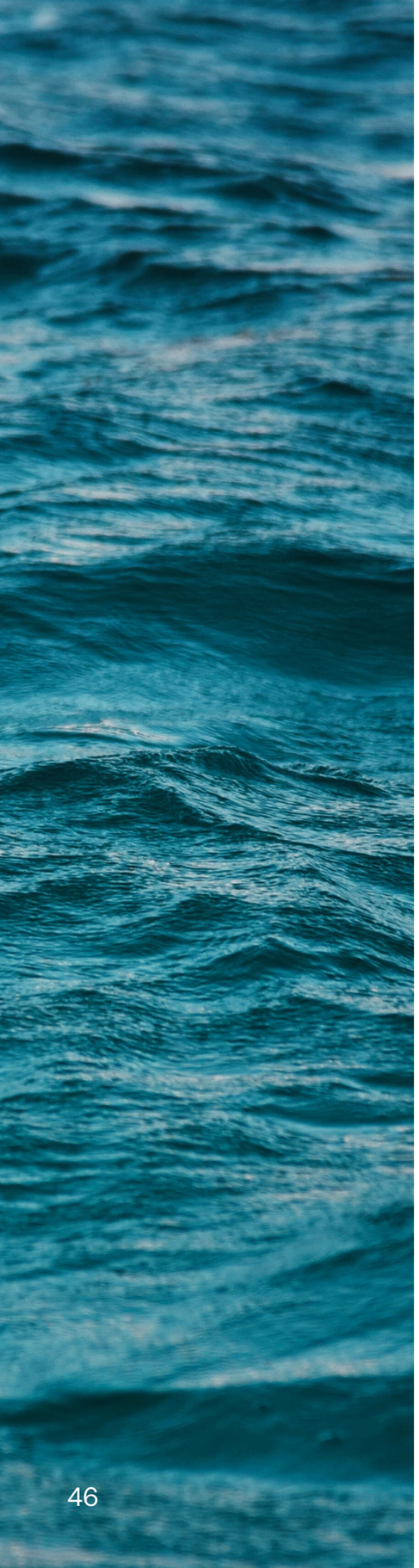

RESEARCH ON THE QUALITY CHANGE OF DOC IN STORED PEAT

ABSTRACT

The aim of this research is to find an answer to the question of what happens to peat when it is extracted, disrupted and stored. For the purpose of building the Shetland Gas Plant (SGP), the peat that covered the surface has been excavated and stored on site for site restitution in two purpose-built stores. In this study, samples of stored peat and surrounding peatland as reference peat, were compared to see if there were changes in the structure and quality of stored peat. The UV-Vis spectroscopy method was used for detecting changes in DOC quality between sites, as well as aromaticity, humification and molecular weight.

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The controls on production and consumption of dissolved organic carbon in peatlands are complex and the research question is ‘what happens to the peat when it is extracted, disrupted and stored’?

The Environmental Research Institute project ‘Bog in a Box’ – (the effect of peat storage on dissolved organic matter properties) was looking for answers to those research questions through analyzing the method of peat storage and its possible changes within the Shetland Gas Plant (SGP).

When the SGP was being constructed, located in the west of the Shetland Islands, one of the first challenges was the extensive peat covering the onshore site. The plan is to restore the site at the end of the plant’s operating life, and because of that the peat has been excavated and stored on site for site restitution in two purpose-built stores. This was considered the best practicable way to achieve site restitution.

The sample results taken from peat storage 1 and peat storage 2 have been compared with the samples taken from the surrounding peatland as reference samples. The UV-Vis spectroscopy method was used for detecting changes in DOC quality between sites, as well as aromaticity, humification and molecular weight.

Table 2 – Condition comparison, PS peat- shallow layer (15 cm) and REF peat - shallow layer (15 cm)

PS PEAT- SHALLOW LAYER (15 cm)	REF PEAT- SHALLOW LAYER (15 cm)
Broad range of molecular size	Lower molecular size
Higher degree of aromaticity	Lower degree of aromaticity
Lower amount of lignin	Higher amount of lignin
Higher aerobic conditions	Lower aerobic conditions
Higher aromatic fraction of DOC	Lower acidity
Aromatic compounds	Lower index of humification
More humic acids	More fulvic acids

Table 3 – Condition comparison, PS peat- deep layer (60 cm) and REF peat - deep layer (60 cm)

PS PEAT-DEEP LAYER (60cm)	REF PEAT- DEEP LAYER (60cm)
Higher molecular weight	Lower molecular weight
Higher degree of aromaticity	Lower degree of aromaticity
Higher degradation	Lower of phenolic/quinoid core of humic acids to simpler carboxylic aromatic compounds
Less quantities of aliphatic structures	Large quantities of aliphatic structures
Higher quantities of condensed aromatic structures	Medium degree of condensation of the chain of aromatic carbons of the humic acids
More humic acids	More fulvic acids
DOC of larger molecular size	DOC of smaller molecular size
Higher acidity	Lower acidity

Based on the results, a comparison of peat conditions in peat storage and referent peat was made between shallow and deep layers as shown in tables 1 and 2, respectively.

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TREATMENT AND POTENTIAL UTILIZATIONS OF CONTAMINATED BIOMASS

AFTER THE PHYTOREMEDIATION OF LANDFILL LEACHATE

INTRODUCTION

Phytoremediation is a technology that involves the use of plants to remove pollutants from the environment. Besides being an economical, energy-efficient, and environmentally friendly method, phytoremediation can be applied to large areas and is useful for treating a wide variety of contaminants (metals, radionucleotides, and organic substances) and growth media (soil, sludge, sediment, and water) (Rascio and Navari-Izzo, 2011). Phytoremediation of pollutants from the contaminated media generally happens through any one or more of the following mechanisms: phytoextraction, phytostabilisation, phytovolatilisation, phytotransformation (phytodegradation or phytostabilisation) and rhizofiltration (Parmar and Singh, 2015).
Plant species that are natural hyperaccumulators of elements can be effectively used in the phytoremediation of particular pollutants. The hyperaccumulator plant species represent plants that actively take up exceedingly large amounts of one or more pollutants from the treated medium. The pollutants are not retained in the roots, but are translocated to the shoot and accumulated in above-ground organs, especially leaves, at concentrations 100–1000-fold higher than those found in non-hyperaccumulating species (Rascio and Navari-Izzo, 2011).

LIGNOCELLULOSIC BIOMASS

Lignocellulosic biomass is mainly composed of three polymers: cellulose, hemicellulose and lignin, together with small amounts of other components, such as acetyl groups, minerals and phenolic substituents. Generally, lignocellulosic biomass consists of 35–50% cellulose, 20–35% hemicellulose, and 10–25% lignin. Proteins, oils, and ash make up the remaining fraction (Iskigor and Remzi Becer, 2015).

Since about half of the organic carbon in the biosphere is present in the form of cellulose, the conversion of cellulose into fuels and valuable chemicals has paramount importance. Disposal of contaminated lignocellulosic biomass in the soil or landfill causes serious environmental problems, but it could be utilized for the production of a number of value-added products.

PRE-TREATMENT METHODS OF CONTAMINATED BIOMASS

One of the most important goals of lignocellulosic biomass refining is to fractionate lignocellulose into its three major components: cellulose, hemicelluloses and lignin. Hence, the pre-treatment of lignocellulosic biomass prior to other treatment methods, is an essential step in order to increase cellulose and hemicellulose accessibility and biodegradability for enzymatic or chemical action (Iskigor and Remzi Becer, 2015). Pretreatment methods are divided into different categories such as mechanical, chemical, physico-chemical and biological methods or various combinations of these.

The most commonly used method of mechanical pre-treatment is torrefaction. Torrefaction is a thermochemical pre-treatment process at 200~300°C in an inert condition, which transforms biomass into a relatively superior handling, milling, co-firing and clean renewable solid biofuel (Song and Kim, 2013).

The most commonly applied chemical methods can be classified in two groups: chemical hydrolysis and enzymatic hydrolysis. Among chemicals, acid and alkali are used as pre-treatment methods. Acids are predominantly applied in chemical hydrolysis. Acid hydrolysis can be divided inturn into two groups, concentrated acid hydrolysis and dilute acid hydrolysis (Dastyar et al., 2019). Dilute acid hydrolysis is commonly applied. But one drawback in this is the formation of undesirable products such as furfural, formic acid, acetic acid, uronic acid, etc.

The biological pre-treatment can be categorized into bacterial consortium, fungal treatments and enzymatic treatments. The commonly utilized microorganisms in this pre-treatment of lignocellulosic biomass are filamentous fungi. Wood-decay fungi are classified into three main groups, white-rot, brown-rot and soft-rot fungi (Isori et al., 2011). Among them, the most effective are basidiomycetes white-rot fungi, because they have the capability to degrade lignin from the holocellulose (cellulose and hemicellulose) surface and cause white-rot on wood or trees, whereas brown- and soft-rot fungi degrade only minimal lignin.

Fig. 1: Color change of biomass samples treated at different temperature: 200°C (left) and 300°C (right) (Song and Kim, 2013)

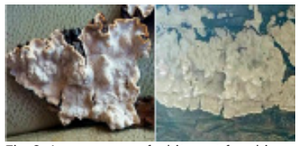

Fig. 2: Appearance of white-rot funghi of Echinodontium taxodii strains developed

Fig. 1: Color change of biomass samples treated at different temperature: 200°C (left) and 300°C (right) (Song and Kim, 2013)

TREATMENT METHODS OF CONTAMINATED BIOMASS

Treatment methods can be divided into three different categories such as production of biomass briquette, preparation of High caloric fuel (HCF) by deoxy-liquefaction and co-production of bio-ethanol, electricity and heat from biomass wastes.

Biomass briquette production procedures are widely used and variable, depending on laboratory conditions.

The direct deoxy-liquefaction technique has been proved to be an effective method to produce high quality liquid oils with lower oxygen content (only about 6%) and higher heating values (more than 40 MJ kg-1). Various types of biomass such as different terrestrial biomasses (soybean stalk, cotton stalk, corn stalk, rice straw, wheat straw, poplar leaves, and Crofton weed) and aquatic biomasses (water hyacinth, E. prolifera and Laminaria japonica) have been successfully converted into high-quality liquid oils via deoxy-liquefaction (Li et al., 2014).

The outlines of conventional ethanol production and the innovative route for co-production of bioethanol, electricity and heat from lignocellulosic biomass are shown in **Figure 5**.

Fig. 4: Water hyacinth briquettes (a) and Maize crop briquettes (b) (Munjeri et al., 2015)

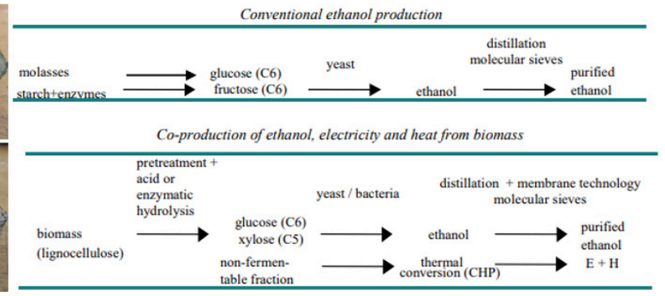

Fig. 5: Outline of conventional ethanol production (above) and the innovative route for co-production of bioethanol, electricity (E) and heat (H) from lignocellulosic biomass (below) (Reith et al., 2011)

CONCLUSION

The concept of linking phytoremediation approaches and thermochemical biofuel production is a potential and promising pathway towards sustainable phytoremediation processes via contaminant-free bioenergy production and compound recovery from used contaminated biomass. Successful commercialisation of the products created from contaminated biomass can lead to increased incomes, job creation and improved environmental management. The use of these methods may help reduce the prevalence of the water weeds in aquatic bodies and also help reduce the intensive use of wood fuel which usually leads to deforestation.

REFERENCES

- Awasthi, M., Kaur, J., Rana, S. 2013. Bioethanol production through Water Hyacinth, Eichhornia crassipes via optimization of the pretreatment conditions. International Journal of Emerging Technology and Advanced Engineering, 3 (3): 42-46.
- Dastyar, W., Raheem, A., He, J., Zhao, M. 2019. Biofuel Production Using Thermochemical Conversion of Heavy Metal-Contaminated Biomass (HMCB) Harvested from Phytoextraction Process. The Chemical Engineering Journal, 358 (2019): 759-785, DOI: 10.1016/j.cej.2018.08.111.
- Iskigor, H.F., Remzi Becer, C. 2015. Lignocellulosic biomass: a sustainable platform for the production of bio-based chemicals and polymers. Polymer Chemistry, 6 (25): 4497-4559, DOI: 10.1039/C5PY00263J.
- Isori, A., Millati, R., Syamsiah, S., Niklasson, C., Nur Cahyanto, M., Lundquist, K., Taherzadeh, J.M. 2011. Biological pretreatment: Review. BioResources , 6 (4): 5224-5259.
- Li, J., Wang, G., Chen, M., Li, J., Yang, Y., Zhu, Q., Jiang, X., Wang, Z., Liu, H. 2014. Deoxy-liquefaction of three different species of macroalgae to high-quality liquid oil. Bioresource Technology, 169 (2014): 110-118, DOI: 10.1016/j.biortech.2014.06.080.
- Munjeri, K., Ziuku, S., ,Maganga, H., Siachingoma, B., Ndlovu, S. 2016. On the potential of water hyacinth as a biomass briquette for heating applications. International Journal of Energy and Environmental Engineering, 7 (2016): 37-43, DOI: 10.1007/s40095-015-0195-8.
- Parmar, S., Singh, V. 2015. Phytoremediation Approaches for Heavy Metal Pollution: A Review. Journal of Plant Science & Research, 2 (2): 139-147.
- Rascio, N., Navari-Izzo, F. 2011. Heavy Metal Hyperaccumulating Plants: How and Why Do They Do It? And What Makes Them So Interesting? Plant Science , 180 (2): 169-181, DOI: 10.1016/j.plantsci.2010.08.016.
- Reith, H.J., Veenkamp, M.J., van Ree, R., de Laat, W.T.A.M., Niessen, J.J., de Jong, E., Elbersen, H.W., Claassen, P.A.M. 2001. Co-production of bio-ethanol, electricity and heat from biomass wastes. In. Proc. The First European Conference on Agriculture & Renewable Energy , 6-8 May 2001, RAI, Amsterdam, The Netherlands, ECN-RX--01-011.
- Song, B.D., Kim, S.O. 2013. Characteristics of Torrefaction with Water Hyacinth. Journal of Biosystems Engineering, 38 (3): 180-184, DOI: 10.5307/JBE.2013.38.3.180.

ACKNOWLEDGEMENTS

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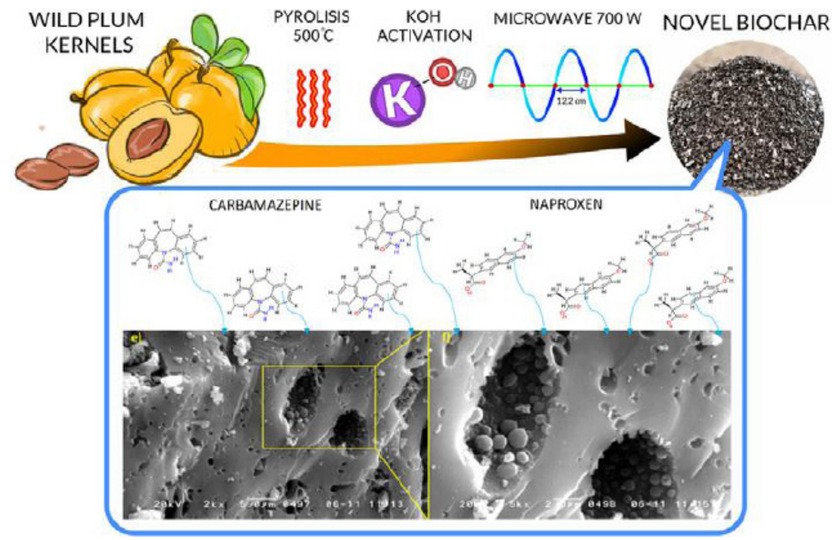
COMPETITIVE STUDY OF PHARMACEUTICAL ADSORPTION ONTO NOVEL BIOCHAR

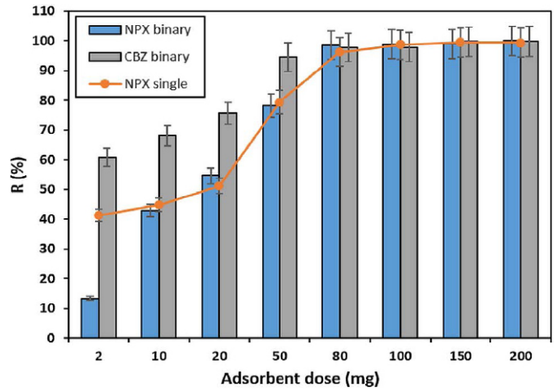
INTRODUCTION

Emerging pollutants, usually present in trace concentrations in industrial and municipal wastewater effluent, commonly are not removed in wastewater plants. Adsorbents synthesized from lignocellulosic waste material are available, economical and effective for the wremoval of various pollutants from water.

ABOUT THE STUDY

Novel low-cost biochar (WpOH) was synthesized from wild plum kernels, using combined processes of pyrolisis, such as conventional heating and microwaves, with chemical activation that was done with potassium hydroxide (KOH) (Fig. 1). The adsorbent thus developed was applied in a competitive study of the removal from water of a basic/amphoteric drug carbamazepine (CBZ) and ionizable naproxen (NPX). The study showed that at lower WpOH dosages CBZ shows higher removal levels, compared to NPX, while at a higher dosage of adsorbent there is a very small difference, which may be explained by the smaller molecular size of CBZ (Fig. 2).





The adsorption mechanism in the mixed system may be explained as follows. Under the pH investigated (6), zwitterionic CBZ molecules exist in their uncharged form, while molecules of NPX are negatively charged. Consequently, the possibility of electrostatic interaction can be almost completely excluded for CBZ, in favour of EDA interactions and H-bonding. This plays a part, as does the structure/configuration of the molecules.

Here, both NPX and CBZ had planar configurations; however, the more planar structure and smaller molecular size of the CBZ comes to the fore when low WpOH dosing is used, i.e. during the competitive study, which resulted in higher adsorption and faster kinetic characteristics.

SUMMARY

This study showed that two different compounds (i.e., a basic vs amphoteric drug) can be adsorbed in the same time. It may be concluded that adsorbent, synthesized biochar of wild plum kernels, combined with potassium hydroxide and microwave activation, is a high quality microporus biochar. These results are very important because they represent a step towards implementation of synthesized biochar in large-scale/complex treatment systems.

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WATER RESOURCE MANAGEMENT TO ACHIEVE SUSTAINABLE DEVELOPMENT

IN BUSHEHR (A COASTAL CITY IN IRAN)

INTRODUCTION

Iran is one of the most semi-arid to arid countries in the world, so comprehensive water study plans, water resource development and consumption management with the aim of sustainable social, economic and environmental conditions in different parts of the country are essential. The definition and implementation of such projects to provide fresh water in the civilian, industrial and agricultural sectors and the development of indicators of social, economic, political and environmental factors is needed. In some parts of the country, freshwater resources barely cover drinking water needs, while people have access to the waters of the Persian Gulf, the Sea of Oman, and brackish rivers. In addition to the lack of safe and suitable water resources, increasing water transfer costs from remote areas and the need to take into account environmental and social considerations, also make the development of water resources as a sustainable process in the southern shoreline is avoidable. The current plan has been formed in this direction and its main focus is the supply of water with the desired quality and quantity in areas along the southern shoreline of the country through the evaluation of desalination systems to gain fresh water from brackish water and salt water.

METHODOLOGY

Bushehr Province (Fig 1.) with ten counties is located in the south of the country, with a long coastline on the Persian Gulf. Owing to its location on the strategic coast of the Persian Gulf, maritime exports and imports, fishing, oil and gas reserves, agriculture and palm groves, and the existence of a nuclear power plant, this province has strategic and economic importance The province has a population of 1 030 386 people and an area of 23160 km^2. The coordinates of Bushehr within Iran are 28 9184 N, 50 8382 E. The present study is a combination of water needs studies, the study of water resources, and that of potential and water shortages in rural and urban areas and finally Bushehr province as a whole. In the selected method for estimating the shortage of drinking water and water for industry on the shoreline, the use of water desalination systems, and the assumption of the possibility of moving and transferring water between consumption centers, especially cities, has been accepted. Therefore, the scenarios in Fig 2 can be suggested to ameliorate water shortages.

Figure 1: Map of Iran and Bushehr Province

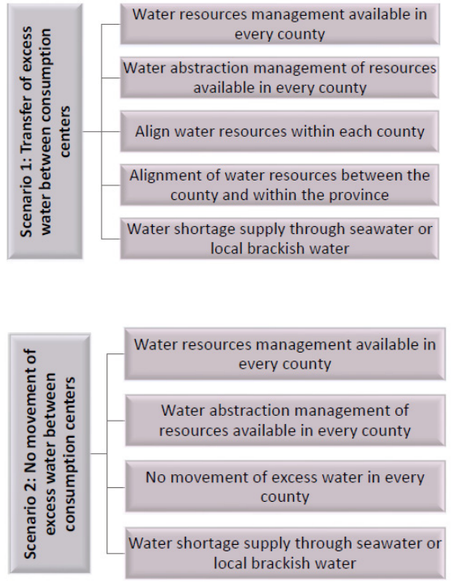

Figure 2: The suggested scenarios to ameliorate water shortage

SCENARIOS

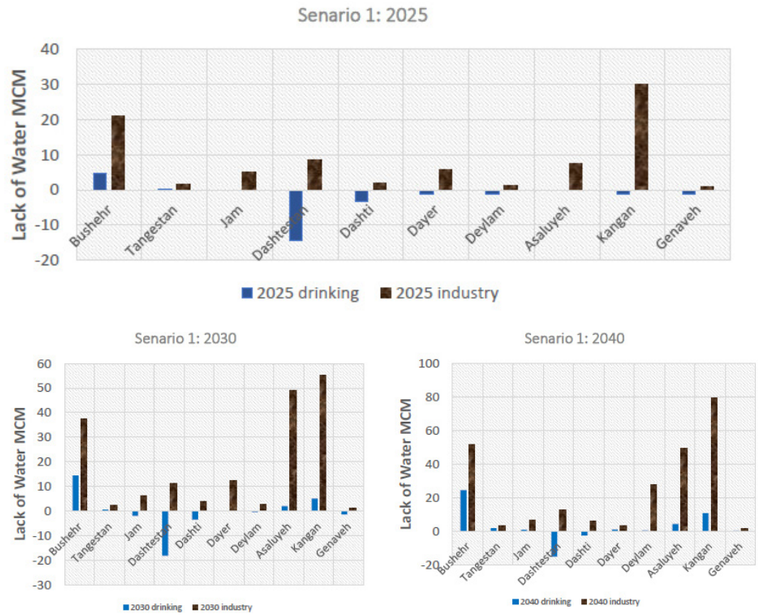

Figure 3 : The amount of water shortage in different horizons according to the first scenario

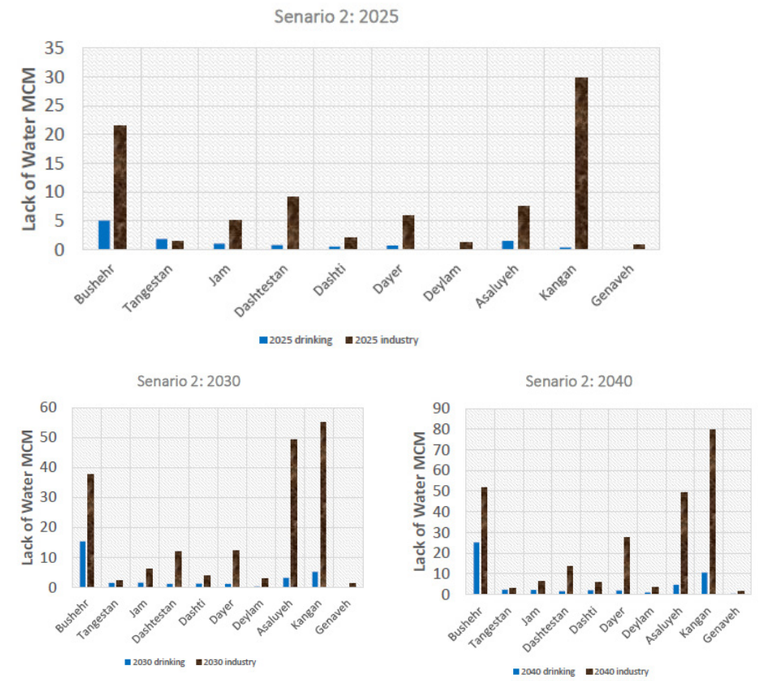

Figure 4 : The amount of water shortage in different horizons according to the second scenario

RESULTS

The amount of water shortage in different horizons according to the first and second scenarios is presented in Figs. 3 and 4, respectively. Based on the graphs in Figure 3, which are related to the first scenario, it is observed that with the consumption of excess water in the drinking sector and allocating part of this to industry, there will be a shortage of water in Dashtestan in other cities. However, in most cities, a small part of this water shortage is related to drinking water. This amount of water needs to be supplied from saline or saline sources According to the graphs of the second scenario and assuming no excess water is transferred within the counties or transferred to neighboring counties, in 2025 the total water shortage in Bushehr province will be 51 54 MCM for the drinking sector and 241 25 MCM for the industrial sector. A part of this water use is related to the industrial sector, which will be supplied through sea by desalination plants.

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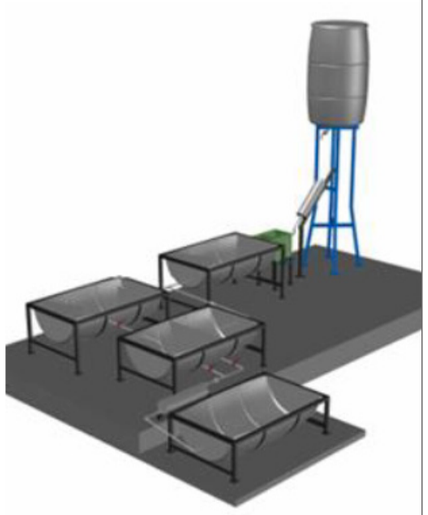
BIOLOGICAL TREATMENT FOR LIQUID WASTE GENERATED IN LIVESTOCK PROCESSES

INTRODUCTION

In the year 2015 in Jalisco, Mexico, 135 862 891 heads of livestock were counted, including poultry, cattle, goats, pigs and sheep (Servicio de Información Agroalimentaria y Pesquera, 2016). This has influenced the index of environmental pollution, since in the same year an average of 4 124 344 tons of excrement were generated, both solid and liquid, which had to be treated, so that quality of wastewater to be dumped in bodies of water, re-used in the cleaning of corrals or used in the form of irrigation would be adequate. These wastes can otherwise have an impact on the environment with water pollution, production of greenhouse gases and soil deterioration due to excess nutrients.

THEORETICAL FRAMEWORK

In Mexico, biodigesters are used that are fed with the liquid and solid waste generated by different livestock activities. This equipment contributes to the reduction of greenhouse gases (GHG) that are generated if the excreta are left in the open air, and it also produces biogas that can be used in different ways. At the same time, a liquid by-product is generated that is used in part as fertilizer, but sometimes it is not possible to take full advantage of it, since large amounts of it are generated and it cannot be directly disposed of in bodies of water because of the amount of organic matter it contains. For this reason, the surplus of these wastes must be treated so that they have an quality adequate to be dumped in bodies of water, re-used in the cleaning of corrals or used in the form of irrigation. There are different methods for the management and treatment of liquid and solid waste from livestock farms, including mechanical separation, compost production, and aerobic and anaerobic digestion (Gómez et al. 2011). For liquid waste, biological filters have been used which have proven to be effective in the treatment of this type of waste. Reed beds have also been proposed which are capable of removing contaminants from effluents, in addition to swamp treatment systems (Agribon,



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METHODOLOGY

A treatment system was designed and built at laboratory level which consists of different stages, namely filtration, an activated sludge reactor, subsurface wetland and a maturation pond. The parameters evaluated were those considered within the Mexican regulations (NOM-001-SEMARNAT-1996) for discharges into water bodies.

RESULTS

The combination of treatments resulted in the removal of 96.6% BOD, 87.6% COD, 84.7% fats and oils, 73.4% total nitrogen, 100% sedimentary solids and 28.1% total suspended solids, while the only parameter that increased was total phosphorus.

PARAMETER	BEGINNING	FINAL
BOD (ppm)	3,546.20	121
COD (ppm)	8,015.04	997.3
Dissolved oxygen (ppm)	0.236	6.5
Fats and oils (ppm)	14.4	2.2
Total Nitrogen (ppm)	807	214
Total Phosphorus (mg/L)	11.41	420
Sedimentable solids (mg/L)	3	0
Total suspended solids (ppm)	320	230
pH	7,6	8,6
Temperature (°C)	25	25
Conductivity (mV)	1856	520
Escherichia coli (NMP/mL)	3	ND
Salmonella	Absent in 25 mL	ND
Helminth eggs	Negative	ND

CONCLUSIONS

The treatment system was effective and should be further studied in order to reach scalability and to be able to treat more waste. It is recommended to continue researching the causes of the increase of phosphorus and its possible solutions.

REFERENCES

- Agribon. Manejo de desechos en granjas pecuarias. 2003. Consultado el 15 de enero de 2018 en: http://www.2000agro.com.mx/pecuarioypesquero/manejo-de-desechos-engranjas-pecuarias/
- Gómez, L. A. D; Bayo, J; Faz, A. Análisis ambiental y económico de la gestión de purín de cerdo. VI Congreso Ibérico de Agroingeniería. Universidad de Évora Portugal. 2011.
- NOM-003-SEMARNAT-1996. Normas Oficiales Mexicanas, Ciudad de México, México, 21 de septiembre de 1998.
- Servicio de Información Agroalimentaria y Pesquera. 2016. Consultado el 10 de enero de 2018 en: https://www.gob.mx/siap/poblacion-ganadera/

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RE-USE OF GREYWATER FOR CONSTRUCTION PURPOSES

OBJECTIVES

- The re-use of greywater in construction purposes and to check the strength of the concrete after 28 days for the C35/45 class of concrete with different water-cement ratios.
- The comparison of the compressive strength of concrete prepared with grey-water, Neckar water and tap water.

Day 1 - Casting of cubes

EXPERIMENTS

- Basic parameter testing of different types of water.
- Preparation of artificial greywater.
- Casting of 18 concrete cubes of the size 0.001 m^3.
- Curing for 7 days in the respective type of water.
- Drying of concrete cubes for 21 days at 26°C.
- Compression testing after a total of 28 days.

Artificial Greywater


Cubes after 24 hours

PREPARATIONS

- The quantity of every product provided by Henkel AG in 2009 was doubled to carry out this project. The artificial greywater prepared is thus very highly concentrated.
- The daily water consumption per pr person varies from country to country.
- In the table, “P” denotes per capita and “d” denotes day.

Composition for preparation of Artificial Greywater			
Product	Quantity		
	Henkel AG	Avasthi	Unit
Toothpaste	2.53	4.83	ml/(P · d)
Bathing Liquid	3.05	7.43	ml/(P · d)
Soap	0.17	0.3	g/(P · d)
Handwash	0.17	5.5	ml/(P · d)
Dishwashing Tablet	7.44	15.2	g/(P · d)
Oil	0.26	0.73	ml/(P · d)
Shampoo	4.63	10.6	ml/(P · d)
Washing Powder	15.15	26.2	g/(P · d)
Cloth Washing Liquid	-	20.8	ml/(P · d)
Dishwashing Liquid	-	7.5	ml/(P · d)
Softener	0.22	10	ml/(P · d)
Bathtub Bubble Liq.	1.81	-	ml/(P · d)
Other	10.14	-	ml/(P · d)

Prof Dr. Ing. Cornel, Prof. Dr. Ing. Wagner, 14.09.2020, Semizentrale Ver- und Entsorgungssysteme für urbane Räume Chinas – Teil-Projekt 2

Compression test after 28 days

Type of Water	Water-Cement Ratio	Number of Cubes	Compressive Strength [MPa]	Amount of water used [l/m^3 of Concrete]
Tap Water	0.47	3	41.4	180
	0.4	3	45.5	152
Neckar Water	0.47	3	31.1	180
	0.4	3	45.4	152
Grey Water	0.47	3	23.1	180
	0.4	3	27.5	152

RESULTS

- The re-use of greywater in construction purposes and to check the strength of the concrete after 28 days for the C35/45 class of concrete with different water-cement ratios.
- Comparison of the compressive strength of concrete prepared with greywater, Neckar water and tap water.

Curing for 7 days

Day 28- Compression Test

CONCLUSION

- Curing the quality of water has a direct impact on the strength of the concrete.
- Approximately 28 litres of water can be saved while preparing 1m^3 of concrete by using a water-cement ratio of 0.4.
- Almost the same compressive strength as with tap water can be achieved by using Neckar water. This is more economical than tap water.
- Tap water and Neckar water can be replaced by greywater for construction purposes.
- To use greywater in producing reinforced concrete structures, some tests still have to be done.

SCAN FOR MORE PICTURES AND DATA RELATED TO THIS PROJECT.

SUBMITTED BY: SUHANSU AVASTHI
SUPERVISORS: ULRIKE GAYH, CHRISTIAN MEYSENBURG, FELIX TETTENBORN

SRH Hochschule Heidelberg, Germany

CLIMATE CHANGE AND WATER RESOURCES ALLOCATION

MANAGING USERS' CONFLICTS THROUGH MODELING

To find effective ways to manage water in regular and extreme conditions and toallocate water according to the needs of users, and to take individual and total benefits and losses into account, using different management strategies requires simulating and assessing their effects over a certain time, and especially over multi-year periods.

MATERIAL AND METHOD

The AcquaNet software is used for 5 years´ simulation of water allocation in a system composed by two reservoirs and four users. System operation is simulated for dry, normal and wet hydrological conditions.

Scheme 1: Res_1 > Res_2 > Dem_2 > Dem_1 > Dem_3 > Dem_4

Scheme 2: Res_1 = Res_2 > Dem_2 > Dem_1 > Dem_3 > Dem_4

Scheme 3: Res_2 > Res_1 >Dem_2 > Dem_1 > Dem_3 > Dem_4

Scheme 4: Res_1 > Res_2 > Dem_4 > Dem_1 = Dem_3 = Dem_2

Scheme 5: Res_1 = Res_2 > Dem_2 = Dem_1 > Dem_3 > Dem_4

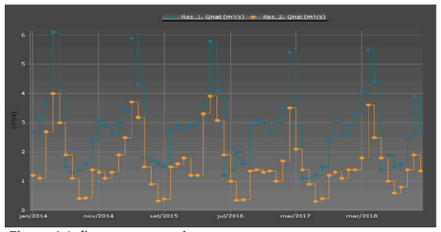

Figure 1: Inflow to reservoirs

	Dem 1	Dem 2	Dem 3	Dem 4
Scheme 1	71.9	88.6	53.5	75.0
Scheme 2	71.3	88.7	54.6	75.0
Scheme 3	69.4	87.1	51.6	73.9
Scheme 4	69.6	75.0	50.5	95.0
Scheme 5	76.6	75.0	53.5	75.0

Table 1: Percentage of delivered water

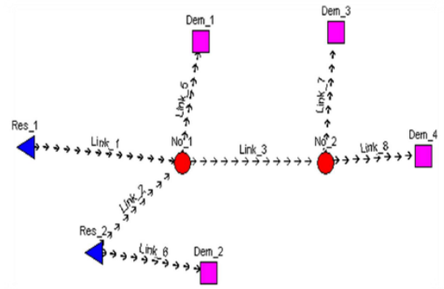

Figure 2: Water management system

RESULTS

Simulations of 5 strategies (five schemes) showed that the quantities of water required at different users' points within a system varied within a range of 50.5 - 95%.

RESULTS

Proper modeling can enable prediction of possible mutual conflicts of water users, and the capacity of reservoirs to distribute the water required (along with following their pre-specified long-term operating rules), and all that in different climatic, hydrological and other uncertain conditions. The powerful AcquaNet software is considered as a tool for supporting the planning of the management of multipurpose reservoir systems aimed at preventing or mitigating the negative effects of climate change.

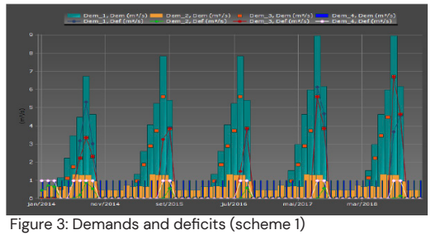

Figure 3: Demands and deficits (scheme 1)

ACKNOWLEDGEMENTS

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HEALTH RISK ASSESSMENT OF POLYCYCLIC AROMATIC HYDROCARBONS IN AMBIENT AIR

INTRODUCTION

Polycyclic aromatic hydrocarbons (PAHs) belong to the group of semi-volatile organic compounds. Sixteen PAHs are regulated by the U.S. Environmental Protection Agency, based on their proven or potential adverse impact on human health and the environment. PAHs are derived from different natural and anthropogenic sources, but one of the most important sources of PAH emissions in urban environments is traffic. PAH compounds can also be emitted from various stationary sources, such as heating and power plants, and industrial processes like coal production, cement manufacturing and oil and natural gas refining. Heating plants are seasonally dependent, while other sources may be assumed to be less influenced by the seasonal temperature changes. Due to the numerous industrial facilities in the city of Novi Sad and its surroundings, the aim of our study was to assess the cancer risk for the inhabitants of Novi Sad through PAH exposure during the heating and non-heating periods.

MATERIAL AND METHODS

The concentration levels of the 16 PAHs were determined at three sampling sites. The first one was the city's industrial zone, in the immediate vicinity of the oil refinery and thermal power-heating plant. The second one was in a high-traffic zone, while the third site was in the city centre, in a residential area. Ambient air was sampled during the two 14-day periods, one in the heating and the other in the non-heating period, using the high-volume active sampler. Only the sampled suspended particles were analysed for the presence of PAHs.

The lifetime lung cancer risk due to PAHs exposure for the inhabitants of Novi Sad was estimated using the WHO quantitative risk assessment model. We have examined three possible scenarios, considering minimum, maximum and average PAH concentrations measured during both periods.

RESULTS AND DISCUSSION

At all three locations, the average values of measured PAH concentration levels were 3.5 to 5 times higher during the heating period compared to the non-heating period. Considering the carcinogenic potency of all studied PAHs, it ranged from 0.25 ng/m3 for the best-case scenario, meaning minimum exposure to PAHs, to 49.54 ng/m3 for the worst-case scenario, meaning maximum exposure. During the heating period, the carcinogenic potency was more than 8 times higher compared to the non-heating period.

During the non-heating period for average exposure, the estimated annual number of lung cancer cases was 7.2 cancer cases per 100,000 exposed inhabitants. During the heating period, it amounted to 6 cancer cases per 10,000 exposed inhabitants, while during the heating period for maximum exposure, meaning the worst-case scenario, the estimated annual number of lung cancer cases was 4.3 cancer cases per 1,000 exposed inhabitants.

CONCLUSIONS

Within the conducted study, we have concluded that the estimated values of the lifetime lung cancer risk were higher than those set by the World Health Organization and that cancer risk due to exposure to PAHs in the study area exists in both time periods. Since the concentration levels of PAHs in gaseous phase have not been determined within the study, we have also concluded that the actual lifetime lung cancer risk in Novi Sad is probably even higher than estimated.

ACKNOWLEDGMENTS

This research has been supported by the Ministry of Education, Science and Technological Development through the project nº 451-03-68/2020-14/200156: "Innovative scientific and artistic research from the FTS (activity) domain".

LITERATURE

Radonić, J., Jovčić Gavanski, N., Ilić, M. et al. Emission sources and health risk assessment of polycyclic aromatic hydrocarbons in ambient air during heating and non-heating periods in the city of Novi Sad, Serbia. Stoch Environ Res Risk Assess 31, 2201–2213 (2017).

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THE EMISSION OF BTEX COMPOUNDS DURING THE MOVEMENT OF PASSENGER CARS IN URBAN ENVIRONMENT

The permanent increase in the need for various forms of energy leads to constant environmental degradation. The energy sector is the largest source of air pollution resulting from human activity, mainly from the combustion of fossil fuels. Constant emissions of pollutants into ambient air affect global processes by increasing concentration levels of pollutants, and so the distribution and allocation between basic environmental compartments, biotic and abiotic matrices. The consequences of uncontrolled emissions of pollutants are related to the presence of large amounts of various gases in the atmosphere, such as SO_2, CO_2, N_xO_y, CH_4, and volatile organic compounds (VOC). In addition to these compounds, there is a large number of specifically hazardous and carcinogenic substances in the atmosphere.

The main intention of this research is to quantify the pollution formation of BTEX compounds from a vehicle engine. The emphasis of the research is placed on engine regimes that are expected most in the urban exploitation of vehicles. To ensure the reproducibility of the experimental tests, the NEDC was selected as the pattern of driving passenger cars in urban driving conditions (Figure 1).

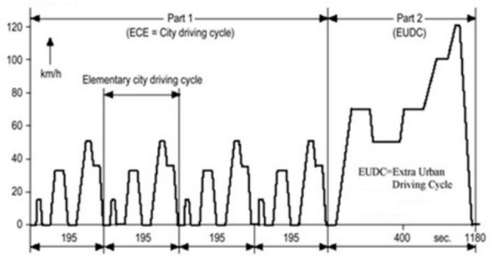

Fig. 1: The New European Driving Cycle (NEDC)

A driving cycle is a fixed schedule of vehicle operation which allows emission tests to be conducted under reproducible conditions. The NEDC is a stylized cycle, with periods of acceleration, deceleration and constant speed, and it is supposed to represent the typical usage of a passenger car in Europe.

For experimental investigations, we use a special category of ECU (Engine Control Unit), which is programmable in order to achieve different working parameters. The programmable ECU may control the amount of fuel injected into each cylinder. This varies, depending on the engine speed in RPM (revolutions per minute) and the position of the accelerator pedal. Using a wide band lambda probe, ECU controls the amount of fuel in the feed mixture in order to achieve stoichiometric (ideal) combustion. In traditional petrol-powered vehicles this air-fuel ratio is 14.7:1. The tuner can find the optimal amount of fuel to be injected into the engine at every different combination of RPM and throttle position. This process is carried out at a SCHENCK 230W dynamometer, giving the tuner a controlled environment to work in.

The target compounds were analyzed in the exhaust gas samples by the Perkin Elmer Photovac Voyager-mobile GC. For the separation of sample components, the Supelcowax10-Polyethylene glycol (PEG) column has been used. The target VOCs were identified by GC retention times in comparison with the authentic Messer Technogas standards. The sampling of exhaust gases was conducted on an experimental engine exhaust pipe in order to determine the concentration levels of BTEX compounds in the mixture of exhaust gases. The sampling process lasted for 20 seconds, and the analysis of each portion of the exhaust gas lasted 20 minutes.

The results of BTEX compound concentration measurements at different RPMs of the experimental engine under the conditions of low engine load and adjusted stoichiometric ratio in air-fuel mixture are shown in Figure 2. The results of the quantification of BTEX compounds in the exhaust gas stream point to the domination of toluene emissions at almost all operating points. The results obtained from the experimental measurements point to a trend of reduction in concentration levels of almost all compounds of the BTEX group with an increase in engine speed, except benzene. Namely, increasing the engine speed and therefore the piston speed increases the turbulence intensity of the flame during combustion. With higher RPM values, higher temperatures in the combustion chamber of IC engines are reached, which enables a more complete combustion of fuel under the conditions of sufficient amounts of oxygen, which is supplied by the wide lambda probe. The increase in concentration levels of benzene in the exhaust gas stream, together with a higher RPM, can be explained by the simultaneous attainment of optimal conditions for the hydro-dealkylation of toluene and xylene to benzene at higher temperatures.

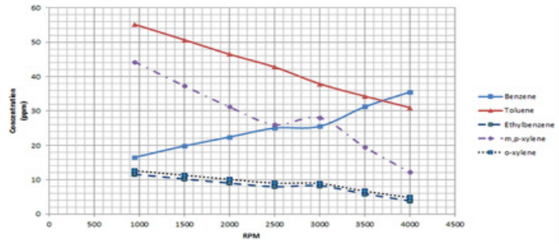

Fig. 2: The results of BTEX compound concentration level measurements at different RPMs

ACKNOWLEDGMENTS

This research has been supported by the Ministry of Education, Science and Technological Development through the project nº 451-03-68/2020-14/200156: "Innovative scientific and artistic research from the FTS (activity) domain".

REFERENCES

- Agarwal, A.K., Shukla, P.C., Gupta, J.G., Patel, C., Prasad, R.K., Sharma, N., 2015. Unregulated emissions from a gasohol (E5, E15, M5, and M15) fuelled spark ignition engine. Appl. Energy 154, 732–741. doi:10.1016/j.apenergy.2015.05.052Agudelo, A.F., García-Contreras, R., Agudelo, J.R., Armas, O., 2016. Potential for exhaust gas energy recovery in a diesel passenger car under European driving cycle. Appl. Energy 174, 201–212. doi:10.1016/j.apenergy.2016.04.092
- Barlow, T., Latham, S., Mccrae, I., Boulter, P., 2009. A reference book of driving cycles for use in the measurement of road vehicle emissions. TRL Publ. Proj. Rep. 280. doi:10.1108/WJSTSD-06-2014-0009

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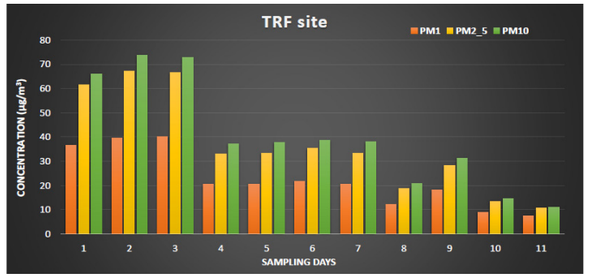
CONCENTRATION LEVELS OF THE ATMOSPHERIC PARTICLES PM10, PM2.5, & PM1

DURING THE WINTER SEASON ON THE TERRITORY OF NOVI SAD, SERBIA

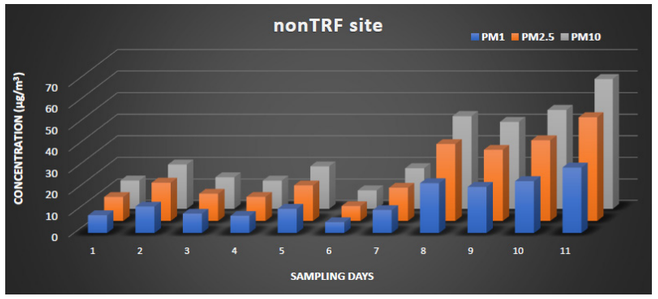
The analysis of ambient air quality in urban, industrial, and individual household areas was undertaken. Particulate matter concentrations (PM 10 PM 2.5 and PM 1) were monitored in order to enable further statistical modeling which could potentially lead to the development of a high resolution city-wide model for particle concentration levels on the territory of Novi Sad.

MEASUREMENTS

- Air sampling was conducted over a period of 10 days during February 2020 at 7 locations in the city, using the low-cost sensors (LCS).
- Measuring sites were carefully chosen to represent different scenarios of urban air pollution.
- Five locations were urban, and among them two were with high traffic density (TRF), while 3 measuring sites had smaller direct traffic impacts (non-TRF).
- Curing for 7 days in the respective type of water.
- The remaining two locations were individual households (IH), but the second one could also be categorized as industrial (IND), because it was situated at the very border of the Novi Sad industrial zone.

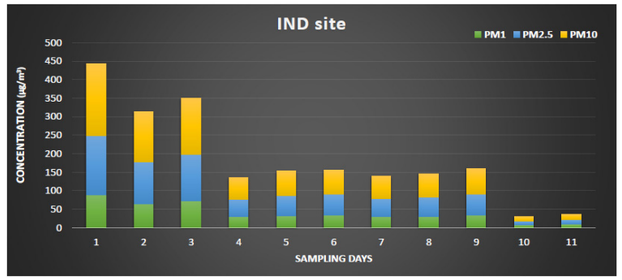


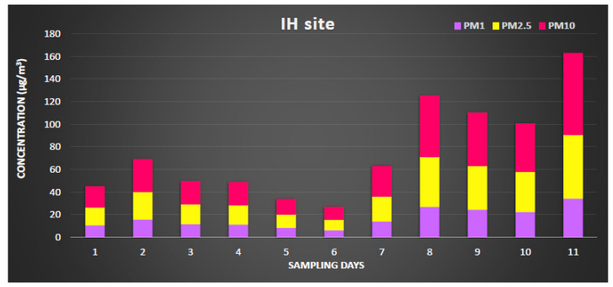
Measured concentration levels of PM1, PM2.5 and PM10 at the urban traffic site



Measured concentration levels of PM1, PM2.5 and PM10 at the urban non-traffic site

- The measured concentrations of PM1 at the TRF and non-TRFs sites were in the range from 7 – 40 µg/m³ and from 4 – 30 µg/m³, respectively. At the IND site, concentration levels ranged from 7 – 88 µg/m³, while at the IH site levels were within the range of 6 – 34 µg/m³.
- PM2.5 concentrations for TRF, non-TRF, IND and IH sites ranged between 10 – 67 µg/m³, 5 – 48 µg/m³, 10 – 160 µg/m³ and 9 – 56 µg/m³, respectively.





- Concentration levels of PM10 at TRF, non-TRF, IND and IH sites were within the range of 11 -73 µg/m³, 6 – 60 µg/m³, 11 – 194 µg/m³ and 11 – 72 µg/m³.
- Sensors were initially calibrated, but later colocation campaigns and recalibration strategies are beyond the scope of current work.
- These are a necessary part of the valid data quality assurance procedure for low-cost sensors.
- Sensors enable observations at high spatial resolution in near-real-time, but provide indicative measurements, so the measured coarse results can not be compared to Regulation on Monitoring Conditions and Air Quality Requirements. Official Gazette of the Republic of Serbia, No. 11/10 of 05/03/2010, 75/10 of 20/10/2010 and 63/13 of 19/07/2013.
- Results obtained by the research present the key and necessary step in the process of developing the model for PM2.5 particle concentration levels in Novi Sad.

ACKNOWLEDGMENTS

This research (paper) has been supported by the Ministry of Education, Science and Technological Development through the project nº 451-03-68/2020-14/200156: "Innovative scientific and artistic research from the FTS (activity) domain".

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HACKATHON

HACKATHON

Whoever would like to generate as many feasible ideas as possible in the shortest amount of time should take a closer look at the Hackathon format. Not only do start-up nerds benefit in many ways from this modern tool of innovation, but also others who have ideas.

The Hackathon concept helps participants to develop solutions for complex problems, products and services in a short period of time. Through the playful approach of experimental and creative problem solving techniques characterized by perseverance, innovative solutions are worked on together in a team.
Ideas planned in the shortest amount of time, successfully implemented!

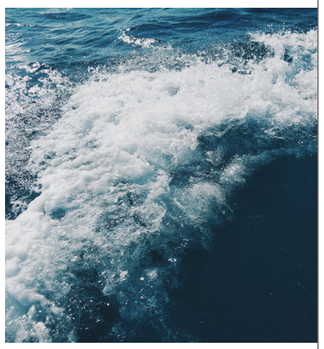
The Hackathon procedure is very much oriented towards the design thinking process and has the intention to develop solutions to real problems in the shortest amount of time. Small groups promote creative thinking to develop innovative ideas, concepts or prototypes.

The sequence of events for the 24-hour challenge includes the following steps:

Event Opening
(Rules and Procedures)

- Presentation of Tasks
- Setup of Teams
- Start of Activities
- Finding a Solution
- Submission of Results
- Presentation
- Award Ceremony

Successfully organized!



The respective responsible Challenge Owners responsible were briefed on the procedures beforehand.
Initially, appropriate challenges were discussed and agreed upon. Each challenge was organized independently, and the following steps were pointed out:

How to Hackathon
Pick a suitable challenge and meet the owner for a short discussion. Each group organizes itself and chooses its own communication channel. The associated pages provide an overview with the milestones and to-dos.

START

The Hackathon starts with direct instructions in the form of a keynote of approx. 10 minutes. The Challenge Owners play a central role supporting the participants in implementing their ideas and developing their skills.

BRAINSTORMING

Participants can only engage in the challenge after the brainstorming phase. Afterwards there is a discussion for about 20 minutes to draw up a plan for the Hackathon.

IMPLEMENTATION

The Challenge Owners only accompany the process, but this is designed by the participants themselves. The project is handed over to the participants step by step.

ITERATION

On the morning of the second day, interim results are presented, and work continues on the particular challenge.

PRESENTATION

Documentation and presentation, in the form of a PDF with a maximum of 7 pages, should begin no later than 2 hours before the end.
The PDF should contain the following content: problem description, target group, solution, concept including milestones and schedule, team presentation, vision and next steps. You are also welcome to include a prototype, graphics, mock-ups or the like.
In the Democratia Aqua Project we used the format of an online Hackathon to tackle five (5) different challenges in groups of 2 to 5 people. The tasks within the challenge groups were organized relatively loosely and with little uniformity. The creative and relaxed atmosphere, inspired by social media chat and blogs, served as the basis for the exchange of ideas.
Here is a brief explanation with the help of two examples.
The YouTube Challenge: videos are consumed four times more often than written texts. No other type of content is currently more popular than movies and animations. The challenge was used to create ideas, concepts or storyboards and prototypes for short YouTube videos. Together, a guide to create storyboards was developed.
The Gamification for Environment Challenge: how can we use mobile phones or PC games to raise environmental awareness? Together, ideas and approaches were created to develop games for environmental awareness.

REFERENCES

- Andreas Kohne, Volker Wehmeier (2019). Hackathons – Von der Idee zur erfolgreichen Umsetzung. Springer Fachmedien Wiesbaden GmbH
- Alvin Chia (2016). Hackathons Unboxed: A Field Guide to Ideating, Leading and Winning. Marshall Cavendish International (Asia) Private Limited
- Nicolai Krüger (2020). Are Hackathons the New e-Learning Environments? On the Outcome of the #WirVsVirus Hackathon From a Learning Outcome Perspective 06. January 2021 from https:// www.researchgate.net/publication/346714987_Are_Hackathons_the_New_e- Learning_Environments_On_the_Outcome_of_the_WirVsVirus_Hackathon_From_a_Learning_Outco me_Perspective
- Alexander Nolte, Irene-Angelica Chounta, James D. Herbsleb (2020). What Happens to All These Hackathon Projects? - Identifying Factors to Promote Hackathon Project Continuation 11.November 2020 from https://www.researchgate.net/publication/ 344747255_What_Happens_to_All_These_Hackathon_Projects_- _Identifying_Factors_to_Promote_Hackathon_Project_Continuation?_iepl%5BgeneralViewId%5D=3UbRit5xR742BQhHI5arPFkJ7G0OiGqOkbOD&_iepl%5Bcontexts%5D%5B0%5D=searchReact&_iepl%5BviewId%5D=6GhKxgxJGGVW9V0vGPJtepuEaqhW4QiO4LIv&_iepl%5BsearchType%5D=publication&_iepl%5Bdata%5D%5BcountLessEqual20%5D=1&_iepl%5Bdata%5D% 5BinteractedWithPosition15%5D=1&_iepl%5Bdata%5D%5BwithEnrichment%5D=1&_iepl%5Bposition%5D=15&_iepl%5BrgKey%5D=PB%3A344747255&_iepl%5BtargetEntityId%5D=PB%3A344747255&_iepl%5BinteractionType%5D=publicationTitle DOI: 10.1145/3415216
- Portal Wissenschaftskommunikation.de. Wissenschaft im Dialog 09. August 2020 from https:// www.wissenschaftskommunikation.de/format/hackday/
- Portal sciencehackday.org How to organize a Science Hack Day in your city 06. May 2020 from http:// sciencehackday.org/howto/

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WATER CONFLICTS AND LIMITING METHODS

The third challenge of the Democratia-Aqua-Technica was to analyse current global water conflicts, review and discuss available suggestions to resolve them and to summarize and implement our own suggestions, at the same time developing a future strategy with sustainable and innovative scenarios. This challenge was addressed by a group of twelve participants from all over the world; and the challenge owners were Prof. Dr. Ulrike Gayh and Ajeesh Nellikunnel Jose from SRH Hochschule Heidelberg in Germany. During the hackathon on 01-09-2020 and 02-09-2020, participants initially found no solution that fits all water conflicts, owing to the nature of, and underlying reasons for water conflicts. After the primary brainstorming session, it was decided to continue with a single conflict in order to study it carefully and also to suggest potential suggestions for the conflict resolution. From the several conflicts discussed, participants selected the Egypt-Suadan-Ethiopia conflict over the Nile river as a model project to find rational solutions to curb the conflict.

As soon as the decision was made, participants began working on their various sections, such as background and sources, environmental-social-political impacts and solutions, which were divided during the course of discussion. The bright side of the whole Corona pandemic was that it opened windows before us to communicate and work together with experts and enthusiasts, activities which otherwise would have confined to a small network.

The River Nile is basically shared by 11 riparian countries, among them Egypt, Sudan, and Ethiopia, who depend mostly on the river for their social and economic activities. Approximately 95% of water sources in Egypt originate from the Nile. Tension in the region began with Ethiopia's proposal for a mega-dam, the Grand Renaissance Dam, with a capacity of 74 billion m^3 intended for electricity generation in the river basin of the Blue Nile. This resulted in conflicts over the equal distribution of water, mainly between Egypt and Sudan.

Not only does this pose a greater concern in terms of water availability, but it also has major impacts on different aspects, such as the social, environmental, and political ones. One of the major social impacts is the displacement of human population. Furthermore, cultural ecosystem services including the use of the Blue Nile for recreational purposes, and provision ecosystem provision services, including the Blue Nile as a source of fish for Egypt and Sudan, will be negatively affected. However, the Grand Renaissance Dam is capable of helping grow the economies of Ethiopia, Egypt, and Sudan through reliable power generation. On the other hand, political impacts, such as riots and chaos in countries or even war between them due to the lack of water cannot be ignored either. Not limited to this, environmental impacts, such as an increase in the probability of a seismic event, negative impacts on local fish populations, flooding and the destruction of surrounding habitats and ecosystems etc. are also associated with the Grand Renaissance Dam project.

Deriving a solution while satisfying the concerns of all stakeholders at once is practically difficult to achieve. Nevertheless, we suggested a set of solutions arrived at through research and the individual impact assessment of each country with the help of the "Declaration of Principles" signed by Egypt, Sudan and Ethiopia in 2015. This is a set of ten principles committed to by the mentioned three countries mentioned in order to alleviate disputes over the Blue Nile. Based on the conflict and suggested solutions, a set of conclusions was also prepared by the participants.

AJEESH NELLIKUNNEL JOSE

SRH Hochschule Heidelberg, Germany

DIGITAL EXPLORATION RALLY

WASTE WATER TREATMENT

PROBLEM

The corona crisis has had a major impact on the event industry. Many events cannot take place as usual because the participants are not allowed to gather at the venue. However, the events industry is already developing digital concepts. The greatest challenge will be to make these concepts attractive, informative and motivating.

TARGET GROUP

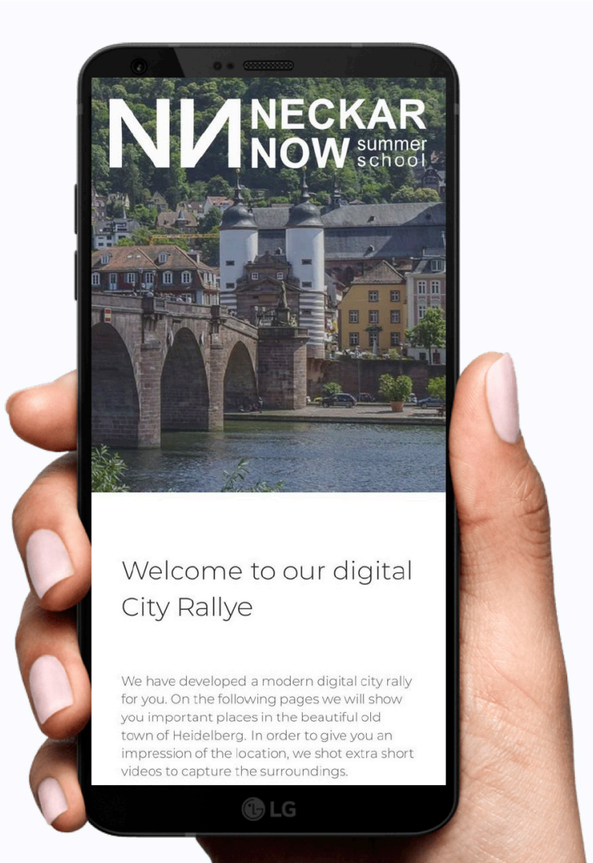
Students who study water technology

SOLUTION

Digital concepts have almost no barriers when it comes to participation compared to local events. However, digital events should be gamified in order to motivate and fascinate the participants. In order to convey the ecological topics of Democratia in an exciting and sustainable manner, a web-based rally is a suitable format for students to participate in, wherever they may be in the world.

MILESTONES

- Project meeting with the organizers of Democratia
- Evaluation of the Budget
- Content Research



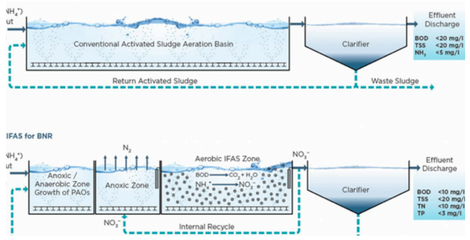
VISION

Our vision is to set up an immersive digital rally where the participants learn about different water projects all around the globe.
The narrative is “to be a world journey“ where all participants travel together at the same time to the next destination.

In addition to the various technological projects and institutions, cultural characteristics typical for the respective country should be conveyed. Therefore, every country will have its own ambassador/moderator.

POSSIBLE CONTENT

New Novi Sad Waste Water Treatment Plant



A modern digital city rally has been developed. The rally shows the important places in the beautiful old town of Heidelberg. In order to give an impression of the location, short videos to capture the surroundings have been shot. While discovering the city, the participants obtain more important information from the host and at the same time learn something about how water was transported and used in Heidelberg in the past.

OLIVER SCHLENKER

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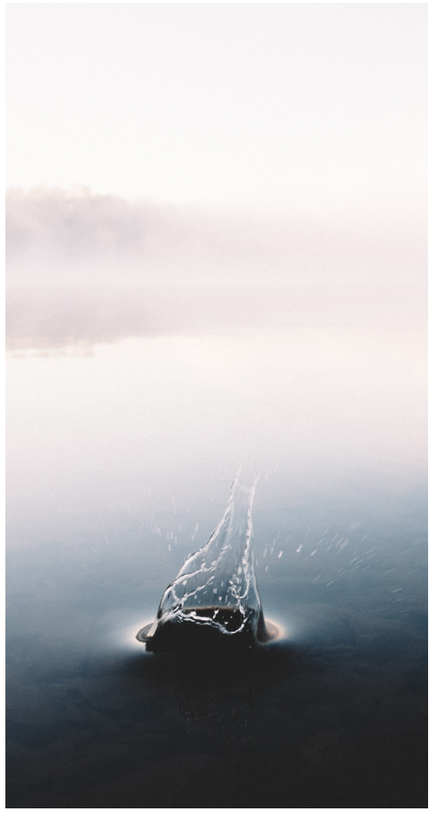
GAMIFICATION - A SHORT INTRODUCTION

The term “gamification” first appeared in 2002 (Burke, 2014, p. 17) and has developed into a much-discussed trend topic in the following years (Stieglitz, 2017, p. 3). The basic idea is to use the motivating factors of games to employ them in a non-game context (Sailer, Hense, Mandl & Klevers, 2017, p. 796). The objective is to take this knowledge and use it to influence the motivation and behavior of users (Hamari, Koivisto & Sarsa, 2014, p. 3028).

Today, you can find gamified applications being utilized in many areas of practice, such as in the health and education sector. The latter is even the most researched field of application of gamification. (Sailer, 2016, p. 57).

Gamification uses some basic characteristics of games and, in addition, takes advantage of the human playing instinct. The Dutch cultural historian Johan Huizinga even takes the view that playing is in the nature of man and is even older than the culture itself. He assumes that man created cultures only by playing. „Playing itself is older than both language and culture, but the recognition of a general term like “game” seems to be young“ (Huizinga, 1934, p. 24).



Games have always been an integral part of human history and has influenced our social and leisure life on a very large scale (Seaborn & Fels, 2015, p. 14). Oerter emphasizes that playing will become increasingly important and more diverse until adulthood and will not disappear even at an older age (cf. Oerter, 2007, p. 8). This is clearly demonstrated by the omnipresence of games in today’s everyday culture. With the exception of sports and board games, playing was considered childish until a few years ago but today it has a permanent place in society. This is due to the continuing success of the video game industry, which has developed rapidly since the 1970s. While video games were developed mainly for computers and game consoles until 2007, there has been a fundamental change with the introduction of the iPhone and the new era of the smartphone (cf. Castendyk & Müller-Lietzkow, 2017, p. 3-15). According to the German Games Industry 2018 Annual Report, the average age of a German video player is increasing. While the average age in 2013 was still 32 years old, by 2018 it had already risen to 36.1 years old. Meanwhile, 42 percent of the German population consumes video games at least occasionally (Game-Verband der deutschen Games-Branche e.V., 2019, S. 6-8).

This development seems to be the reason why gamified concepts are becoming more and more accepted in an entrepreneurial context. The term gamification itself is still very young and was only included in the Oxford Dictionary as Word of the Year in 2011 (cf. Deosthale & Ksiazka, 2014). Also in that year, the earliest and by far the most recited definition (Sailer, 2016, p. 9) is that of the user experience designer and computer game researcher Sebastian Deterding, who describes the term as follows: „‘Gamification‘ is the use of game design elements in non-game contexts (Deterding, Dixon, Khaled & Nacke, 2011, p. 10).
While the basic consensus is that gamification is about integrating playful elements into a non-playful context, further definitions have emerged in the following years depending on the application area. For example, Huotari and Hamari (2012, p. 19) created a definition from a marketing perspective which states: „Gamification refers to: a process of enhancing a service with affordances for gameful experiences in order to support user’s overall value creation“. According to their definition, gamification is the process of enriching a service with playful experiences to help the user create words.

Zichermann and Cunningham (2011, p. 5), on the other hand, define gamification in connection with applications and online uses as follows: „The use of game thinking and game mechanics to engage users and solve problems“. In this case, Deterding‘s very general definition is supplemented by the objective of user loyalty and the resolution of problems.

Another definition is used by Kapp (2012, p. 10), who placed gamification in a psychological reference. He describes gamification as follows: „Using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems“. From his point of view, gamification is about promoting user engagement and motivation, facilitating learning and enabling problems to be solved.

Although these definitions differ in their level of detail, what they all have in common is that the focus is on transferring playful elements into real environments, thereby promoting the motivation of users to participate in a wide range of areas.

In principle, when designing a gamified application, care should be taken to promote the intrinsic motivation of users (see Nicholson, 2012, p.9). This can be easily enabled if consideration is taken into account in the conception of the application to satisfy the basic psychological needs of the human being for the experience of competence, self-determination and social involvement (cf. Deci & Ryan, 1993, p. 229-231). When developing the game design, it is therefore important to focus on the users and their needs in order to design the application in a targeted manner in the respective application.

A categorization of the various application fields was made by Werbach and Hunter (2012, pp. 20-25), which relates to different contexts and their objectives. In their view, relevant categories are internal, external and behaviour influencing gamification. They show in this illustration how different categories relate to each other.

Illustration: Relationship between Different Gamification Categories (Werbach et al., 2012, p. 21)

Internal gamification, also known as Enterprise Gamification, serves the organizational benefit and has the employees of the respective company as a target group. The objective of such a gamified application is to promote the motivation, innovativeness and cohesion of employees in order to improve the productivity of the company (Werbach et al., 2012, p. 20-21).

The organisational benefits are also a priority when it comes to external gamification. In this case, however, the target group is either existing or future customers, who are to be more closely linked to the products or services, the brand and the company through gamified marketing measures (Werbach et al., 2012, p. 22-23).

As the name suggests, behavioral gamification aims to positively influence the behavior of individuals or a group of people. Most applications focus on behavioral influence in the learning context, traffic education and the maintenance or improvement of health. Such concepts are usually not used in companies, but are usually initiated and financed by non-profit organizations and governments (Werbach et al., 2012, p. 23-25). But companies in the fitness and sporting goods industry are also increasingly launching applications aimed at motivating their customers to play more sports (Stieglitz, 2017, p. 11).

In order for gamified concepts to be successful and for intended goals to be achieved, design must focus on the user(s) needs as already mentioned (Nicholson, 2012, p. 14). Zichermann et al. (2011, p. 76) emphasized that not every entrepreneurial problem can be solved by randomly using game design elements.

In addition, care must be taken to identify possible paradoxical effects during the conception. Paradoxical effects are when, instead of the intended target behaviour, either the opposite behaviour or a previously unanticipated negative side effect occurs (Diefenbach & Ullrich, 2018, p. 130). It is also essential to tailor the game elements to the player types. For example, if a gamified application uses rankings in a company when employees do not think and act competitively, this is unlikely to have a positive effect. Rewarding creative activities can even have a negative effect (Brell, 2017, p. 1265).

REFERENCES

- Brell, C. (2017). Gamification. WISU – Das Wirtschaftsstudium,17 (11), 1263-1269.
- Burke, B. (2014). Gamify – How Gamification motivates People to do extraordinary Things. Brookline, MA: Bibliomotion.
- Castendyk, O. & Müller-Lietzkow, J. (2017). Abschlussbericht: Studie zur Computer- und Videospielindustie in Deutschland. Hamburg: Media School. Zugriff am 4. September 2019 unter http://docs.dpaq.de/13008-abschlussbericht_games-studie_v1.0_2017-11-28.pdf
- Deci, E. L. & Ryan, R. M. (1993). Die Selbstbestimmungstheorie der Motivation und ihre Bedeutung für die Pädagogik. Zeitschrift für Pädagogik, 39 (2), 223-238. Zugriff am 22. Oktober 2019 unter https://www.pedocs.de/volltexte/2017/11173/pdf/ZfPaed_1993_2_Deci_Ryan_Die_Selbstbestimmungstheorie_der_Motivation.pdf
- Deosthale, D. & Ksiazka, M. (2014, November 5). Gamification and the generational divide: perspectives from AIEC 2014. Retrieved October 20, 2019 from https://www.eaie.org/blog/gamification.html
- Deterding, S., Dixon, D., Khaled, R. & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification". In Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments. New York: ACM. doi: 10.1145/2181037.2181040
- Diefenbach, S. & Ullrich, D. (2018). Paradoxe Effekte von Gamification: Spielerisch vorbei am Ziel. In S. Hess & H. Fischer (Hrsg.), Mensch und Computer 2018 – Usability Professionals. (S. 127-140). Bonn: Gesellschaft für Informatik e.V. und German UPA e.V. doi: 10.18420/muc2018-up-0143
- game-Verband der deutschen Games-Branche e.V. (Hrsg.) (2019). Jahresreport der deutschen Games-Branche 2018. Zugriff am 7. August 2019 unter https://www.game.de/wp-content/uploads/2018/08/Jahresreport-der-deutschen-Games-Branche-2018.pdf
- Hamari, J., Koivisto, J. & Sarsa, H. (2014). Does Gamification Work? – A Literature Rewiew of Empirical Studies on Gamification. In Proceedings of the 47th Hawaii International Conference on System Science. Washington, DC: IEEE Computer Society. doi: 10.1109/HICSS.2014.377
- Huizinga, J. (1934). Das Spielelement der Kultur (1934). In K. Ebeling (Hrsg.), Johann Huizinga: Das Spielelement der Kultur (4. Aufl.) (S. 18-45). Berlin: Matthes & Seitz.
- Huotari, K. & Hamari, J. (2012). Defining gamification – A service marketing perspective. In Proceedings of the 16th International Academic MindTrek Conference on Envisioning Future Media Environments. New York: ACM. doi: 10.1145/2393132.2393137
- Kapp, K. M. (2012). The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education. San Francisco: Pfeiffer.
- Nicholson, S. (2012). Strategies for Meaningful Gamification: Concepts behind Transformative Play and Participatory Museums. Paper presented at Meaningful Play 2012, Lansing, MI: Retrieved August 18, 2019 from http://scottnicholson.com/pubs/meaningfulstrategies.pdf
- Oerter, R. (2007). Zur Psychologie des Spiels. Psychologie und Gesellschaft, 31 (4), 7-32. Zugriff am 23. August 2019 unter https://www.ssoar.info/ssoar/bitstream/handle/document/29230/ssoar-psychges-2007-4-oerter-zur_psychologie_des_spiels.pdf?sequence=1
- Sailer, M. (2016). Die Wirkung von Gamification auf Motivation und Leistung – Empirische Studien im Kontext manueller Arbeitsprozesse. Wiesbaden: Springer.
- Sailer, M., Hense, J., Mandl, H. & Klevers, M. (2017). Fostering Development of Work Competencies and Motivation via Gamification. In M. Mulder (Ed.), Competence-based Vocational and Professional Education (1st ed.). (pp. 795-818). Berlin Springer.
- Seaborn, K. & Fels, D. I. (2015). Gamification in theory and action – A survey. International Journal of Human-Computer Studies, 74, 14-31. doi: 10.1016/j.ijhcs.2014.09.006
- Stieglitz, S. (2017). Enterprise Gamification – Vorgehen und Anwendungen. In S. Strahringer & C. Leyh (Hrsg.), Gamification und Serious Games – Grundlagen, Vorgehen und Anwendungen. (S. 3-14). Wiesbaden: Springer Nature.
- Werbach, K. & Hunter, D. (2012). FOR THE WIN – How GAME THINKING Can Revolutionize Your Business. Philadelphia: Wharton Digital Press.
- Zichermann, G. & Cunningham, C. (2011). Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps. Sebastopol: O'Reilly Media.

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The School of Engineering and Architecture of the SRH University Heidelberg and the Faculty of Technical Science of the University of Novi Sad organized the first Hackathon and the first digital conference within the framework of the Democratia-Aqua-Technica initiative.
Different areas of the initiative, such as the influence of water in the development of democracy, sustainable water resources management and water conflicts and conflict management have been covered.

This E-book provides an overview of our Democratia-Aqua-Technica activities and projects.

Thanks are due to all participants from all around the world who have contributed and made the project so exciting for everybody. We are very proud of having achieved to carry out the complete project in a digitally.

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We are looking forward to continuing with the Democratia-Aqua-Technica initiative in 2021.

PROF. DR. MAJA TURK-SEKULIĆ & PROF. DR. ULRIKE GAYH

PARTNER

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