Latvia University of Life Sciences and Technologies

LBTU Faculty of Forest and Environmental Sciences

EcoTech 2024

14th Annual International Scientific Conference on Establishment of Cooperation Between Companies and Institutions in the Baltic Sea region and the World

Book of Abstracts

19 – 20 November 2024

Grinfelde, I.; Pilecka-Ulcugaceva, J. (Editors)

Supported by **SIA ACO Nordic**

Jelgava 2024

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***Juris Burlakovs**, Conference Co-Chairperson*
***Rūta Ozola-Davidāne**, Conference Co-Chairperson*
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ABOUT THE CONFERENCE

Linnaeus Eco-Tech has been an academic tradition at Linnaeus University in Kalmar, Sweden, every second year since 1997. One of the conference's key objective is to encourage research and education collaboration among Baltic Sea region countries in order to achieve long-term sustainability. Environmental challenges have become increasingly visible as they have progressed from a local to a regional to a global concern.

For the first time, the 14th Annual International Scientific Conference EcoTech 2024 will be held outside Sweden, taking place in Latvia University of Life Sciences and Technologies (Jelgava, Latvia) from November 19–22, 2024.

It is with great delight that we welcome you to the 14th Annual International Scientific Conference "EcoTech 2024" here at the Latvia University of Life Sciences and Technologies. We believe that the conference will offer an excellent opportunity to exchange information and to discuss state-of-the-art trends between experienced and new researchers.

TOPICS

It is proposed to invite contributions in Knowledge-Intensive Bioeconomy research fields:

Agriculture and Food (Agroecology; Sustainable faming practice; Circular agriculture; Eco-friendly food production; Climate-smart agriculture; Food system resilience; Carbon-neutral farming; Circular food supply chains; Eco-innovations in agriculture; Sustainable fisheries and aquaculture)

Environmental Engineering, Sustainability, and Green Technology (Sustainable infrastructure; Circular design principles; Eco-friendly technologies; Green building materials; Climate-resilient infrastructure; Renewable energy systems; Circular economy solutions; Sustainable waste management; Green transportation systems; Resilient urban planning)

Forestry, Biodiversity and Conservation (Ecosystem restoration; Biodiversity preservation; Climate-resilient ecosystems; Eco-innovations in conservation; Habitat connectivity; Nature Based solutions; Sustainable land management; Circular marine conservation; Agroforestry)

Climate and Ecology (Ecosystem resilience; Nature-based solutions; Circular ecology; Carbon sequestration; Biodiversity conservation; Climate-smart ecosystems; Eco-innovations in climate resilience; Sustainable habitat management; Climate-neutral landscapes)

Energy and Climate Neutrality (Renewable energy; Energy efficiency; Circular energy systems; Clean energy technologies; Climate-neutral power generation; Eco-friendly energy production; Sustainable energy infrastructure; Energy transition; Resilient energy grids; Green hydrogen production)

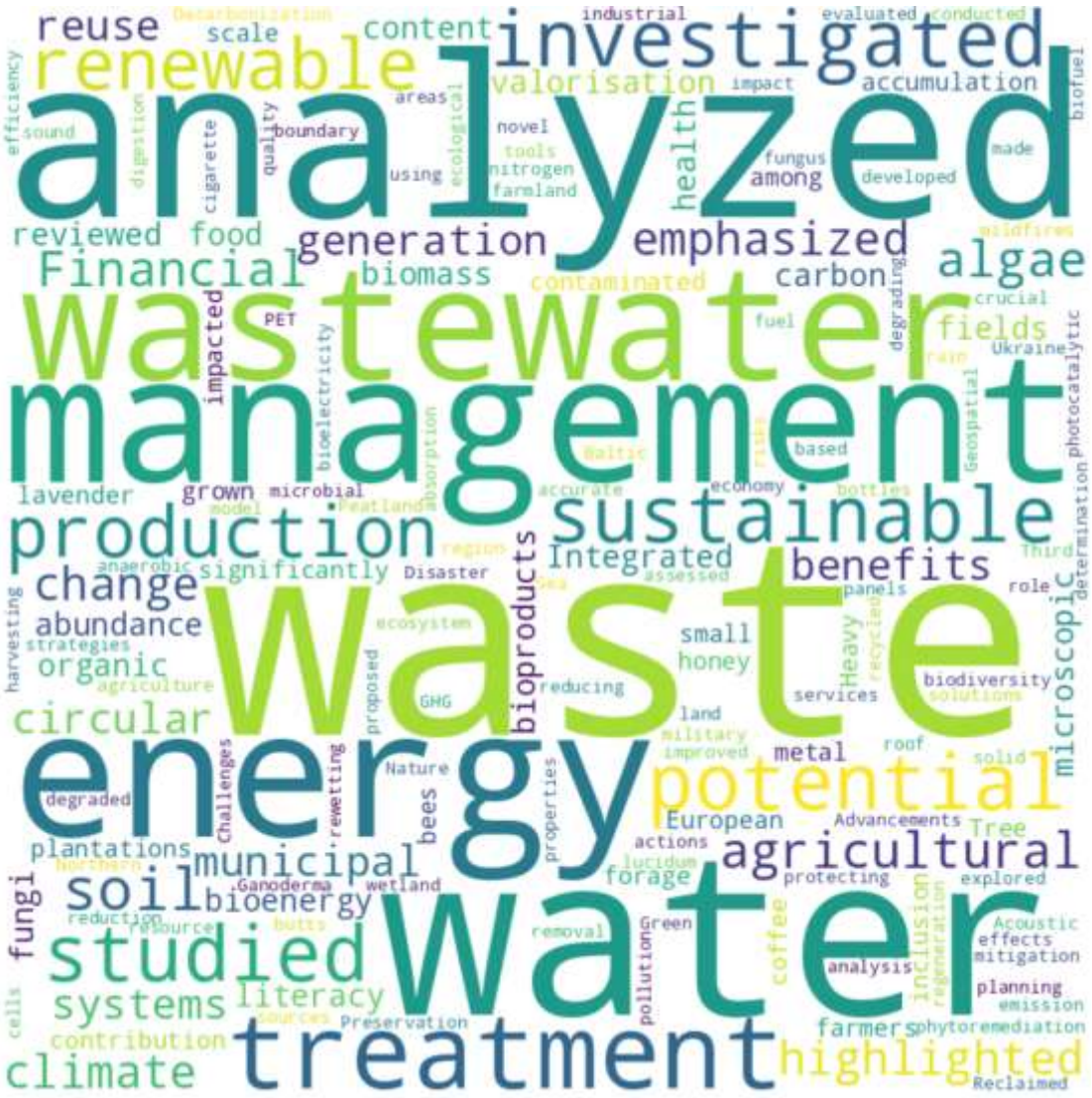
Geography, Geophysics, **Geochemistry and Geology** (Geospatial analysis; Climate-resilient landscapes; Circular geological resource management; Eco-friendly mining practices; Sustainable land use planning; Renewable energy geophysics; Green chemistry innovations; Circular resource extraction techniques; Geothermal energy exploration; Costal geomorphology resilience)

Infrastructure and Sustainability (Sustainable urban development; Circular infrastructure design; green building practices; Climate resilient infrastructure; Eco-friendly transportation; Renewable energy integration; Circular waste management systems; Resilient Water infrastructure; Low-carbon mobility solutions; Smart city initiatives)

Pollution (Pollution prevention; Circular pollution management; Eco-friendly waste disposal; Clean air initiatives; Water quality protection; Sustainable water treatment; Circular plastics management; Climate resilient pollution control; Green technologies for pollution reduction; Stakeholder engagement in pollution management)

Soil Science (Agro-ecological soil management; Soil conservation; Soil health assessment; Sustainable land use practice; Carbon sequestration in soil; Eco-friendly soil amendments; Climate resilient soil fertility; Circular nutrient cycling; Soil erosion control measures

Water and Hydrology (Water conservation; Circular water management; Eco-friendly water treatment; Climate resilient water infrastructure; Sustainable water resource allocations; Circular irrigation systems; Green storm water management; Resilient costal protection measures; Water quality monitoring; Stakeholder involvement in water governance)



Keyword Cloud 14th Annual International Scientific Conference on Establishment of Cooperation Between Companies and Institutions in the Baltic Sea region and the World EcoTech 2024

PROGRAMME

19.11.2024	**Akademijas street 11, Jelgava 5th floor hall, Join Zoom Meeting https://zoom.us/j/95069168117?pwd=XjNqgdVhxCQUaJZO3SKe3PskeUpQZd.1 Meeting ID: 950 6916 8117 Passcode: Ya1FbC5Ff**
09:00	Registration. Coffe
09:30	**OPENING CERMONY *(moderator Inga Grinfelde)***
09:30	Opening speach **Gatis Vītols** Vice-Rector of Science of Latvia University of Life Sciences and Technologies
09:40	Opening speach **Vivita Pukite** Dean of Faculty of Forest and Environmental Sciences, Latvia University of Life Sciences and Technologies
09:50	**CONFERENCE PHOTO SESSION**
10:00	Linnaeus Eco-tech/Kalmar Eco-tech since 1997, cooperation in the Baltic Sea Region and the world, by William Hoglande, Linnaeus University
11:00	A Retrospective on Linnaeus Eco-Tech: a forum on long-term interdisciplinary cooperation. **Jelena Lundström**, Linnaeus University, Sweden.
11:30	Sustainable Resource Management in the Context of Circular Economy, **Juris Burlakovs**, Riga Technical University, Latvia
12:00	LUNCH BREAK
	On site session *(moderator Juris Burlakovs)*
13:00	Groundwater level dynamics in extracted peatland: assessing potential for recultivation. **Normunds Stivrins, Janis Bikše, Sabīna Alta, Inga Grīnfelde**, Latvia University of Life Sciences and Technologies, Latvia.
13:15	How might the ongoing discussion about rewetting Swedish peatlands to reduce climate impact influence the problem of brownification? **Henric Djerf, Amelie Lindgren,** Kristianstad University, Sweden.
13:30	Arsenic and cadmium accumulated in lavender flowers grown in contaminated bottom sediment from the Baltic Sea (Malmfjärden). **Ulyana Muñoz Acuña, William Hogland and Johan Persson and Göran Andersson**, Department of Chemistry and Biomedical Sciences, Sweden.
13:45	DESTRUCTION OF THE NATURAL ENVIRONMENT CAUSED BY THE WAR IN UKRAINE: IMPACT ON LAND, WATER, AND FOREST ECOSYSTEMS. **Viktor Karamushka, Boychenko S.G., Khoriev M.Yu., Kozak O.M.,** National University of Kyiv-Mohyla Academy, Ukraine.
14:00	Phytoremediation with Salix: A Sustainable Approach to PFAS Remediation at Firefighting Training Sites. **Pille Kängsepp, Kängsepp Pille, Svensson Britt-Marie, Djerf Henric, Roos Simon,** Department of Environmental Science, Kristianstad University, Sweden.
14:15	Phytoremediation: a promising method for revegetation of heavy metal-polluted land, **Gintaras Šiaudinis, Danutė Karčauskienė, Regina Repšienė, Ieva Mockevičienė, Olga Anne,** Lithuanian research centre for agriculture and forestry
14:30	Towards Water Smart Cities!? **Henrik Aspegren, S**weden Water Research, Sweden
14:45	Medicinal plants and remediation. **Ulyana Munoz, Willian Hogland,** Department of Chemistry and Biomedicine, Linnaeus university, Sweden.
15:00 - 16:00	POSTER SESSION WITH COFEE & SNACKS

	Virtual presentations
19.11.2024	**Akademijas street 11, Jelgava 4th floor Room 46, Join Zoom Meeting https://zoom.us/j/94046449876?pwd=u9MSGmdLv4qaqH7CPIsb60RWoHxzfP.1 Meeting ID: 940 4644 9876 Passcode: nqi7z9guJ**
	Virtual session (Moderators Kristaps Siltumens and Liga Irbe Mikosa)
13:00	Oil spills resulted of military actions: environmental consequences and decontamination techniques. **Iryna Ablieieva, Iryna Sipko,** Linköping University; Sumy State University, Sweden; Ukraine.
13:15	Revealing the Invisible: Marine Plastic Waste and its Effects in Science-Inspired Visual Art. **Silvia Kurr,** Linnaeus University, Sweden.
13:30	Reuse and Recycling in the new wastewater treatment plant - Kalmarsundsverket. **Qing Zhao,** Kalmar Water, Sweden.
13:45	Challenges in communal water supply: the case of the Chitaría community aqueduct. **Sofía Picado Valverde, Braulio Umaña Quirós,** Tecnologico de Costa Rica, Costa Rica.
14:00	Adsorption activity of chemically modified waste from food industry. **Kamila Koronkiewicz,** Poland.
14:15	PFAS a gigantic hidden threat for environmental and human health-which technique able to solve it? **Yahya Jani,** Mälardalen University, Sweden
14:30	Tragedy of waste fires, **Asim Ibrahim,** Linnaeus University, Sweden
15:00 - 16:00	POSTER SESSION WITH COFEE & SNACKS

20.11.2024	**Akademijas street 11, Jelgava 5th floor hall, Join Zoom Meeting https://zoom.us/j/91438790728?pwd=Rp4fCHQChaccXHXUl1pCyqNXtJmlXB.1 Meeting ID: 914 3879 0728 Passcode: 88DRX6SJM**
08:30	Registration. Coffe
	Environmental engineering, sustainability, and green technology *(moderator Inga Grinfelde)*
09:00	The Vital Role of Agricultural Land: A Pillar of Sustainable Development and Resilience in a Changing World, **Kamil Zajaczkowski,** Sweden
09:30	Waste treatment technologies, **Ivar Zekker, Faysal Al Mamun, R.O. Davidane, J. Burlakovs, A.E. Krauklis, I Grinfelde, Z. V-Gaile, Koit Herodes, T.Tenno** University of Tartu, Chemistry Institute, Estonia
10:00	GEOSPATIAL DATA ANALYSIS OF DEGRADED AREAS OF VIDZEME AND LATGALE REGIONS. **Maris Virkavs, Armands Celms, Vivita Pukite,** Latvia University of Life Sciences and Technologies, Latvia.
10:15	Advancing Wastewater Treatment: The Role of Photocatalytic Microbial Fuel Cells **Mostafa Rahimnejad,** Babol Noshirvani University of Technology, Iran.
10:30	The Potential of Sand – Polonite Filters for Reducing Total Phosphorus Concentration in Subsurface Horizontal Flow Constructed Wetlands. **Dagnija Grabuža, Linda Grinberga, Didzis Lauva,** Latvia University of Life Sciences and Technologies, Latvia.
10:45	Waste Fires: Challenges and Opportunities for Environmental Impact Assessment. **Gintaras Denafas, Orinta Vaitkutė,** Kaunas University of Technology, Lithuania.
11:00	WATER SUPLY ECOSYSTEM SERVICE OF FORMER KAKHOVKA RESERVOIR . **Viktor Karamushka, Khoriev M. Huliaieva O. Kuns B.,** National University of Kyiv-Mohyla Academy, Ukraine.
11:15	Military Actions and Climate Change as Drivers of Wildfires in Northern Regions of Ukraine in 2022-2023. **Svitlana Boychenko, Viktor Karamushka** (National University of Kyiv–Mohyla Academy), Tetyana Kuchma (Institute of Agroecology and Environmental Management), **Olha Nazarova** National University of Kyiv–Mohyla Academy, Ukraine.
11:30	Advanced Monitoring for Enhanced Partial Nitritation/Anammox (PN/A) Performance. **Weronika Borowska, Monika Żubrowska-Sudoł, Nina Doskocz,** Warsaw University of Technology, Poland.
11:45	Analysis of possibilities for rain water harvesting from green roofs as a part of sustainable water management in Lithuania. **Vilda Grybauskiene, Gitana Vyciene,** LITHUANIAN UNIVERSITY OF APPLIED ENGINEERING SCIENCES, Lithuania.
12:00	LUNCH BREAK
	On site session *(moderator Juris Burlakovs)*
13:00	Energy-efficient wastewater treatment: the impact of hybrid technology and intermittent aeration. **Olga Zajac, Monika Zubrowska-Sudol,** Warsaw University of Technology, Poland.
13:15	Hybrid disintegration as a method for increasing energy recovery from sewage sludge – preliminary Study. **Katarzyna Sytek-Szmeichel, Justyna Walczak, Monika Żubrowska-Sudoł,** Warsaw University of Technology, Poland.
13:30	Mixed tree plantation as forage for European honey bees (Apis mellifera L.): a melissopalynological analysis. **Santa Celma, Dagnija Lazdiņa, Austra Zuševica,** Latvian State Forest Research Institute "Silava", Latvia.
13:45	Driving forces of difference in nitrous oxide and ammonia emission factors from soil management. **Olga Skiste, Laima Berzina, Kristine Valujeva, Jovita Pilecka-Ulcugaceva,** Latvia Univesity of Life Sciences and Tehnologies, Latvia.

20.11.2024	**Akademijas street 11, Jelgava 5th floor hall, Join Zoom Meeting** **https://zoom.us/j/91438790728?pwd=Rp4fCHQChaccXHXUl1pCyqNXtJmlXB.1** **Meeting ID: 914 3879 0728** **Passcode: 88DRX6SJM**
14:00	Effect of crop rotation on organic carbon and microscopic fungi abundance in maize (Zea mays L.) fields soil. **Nijolė Maršalkienė, Lina Skinulienė, Vaclovas Bogužas,** Vytautas Magnus University, Lithuania.
14:15	Natural decentralized system for the closed-loop regeneration and reuse of water. **Stanislaw Lazarek, Stanislaw Lazarek**, BeAquaAgain AB, Sweden.
14:30	Reduction of methane in landfills after post-closure period, **Mait Kriipsalu, Keshav Nagpal and Kaja Orupõld,** EMU, Estonia
14:45	POSTER SESSION WITH COFEE & SNACKS
15:15	POST-CATASTROPHIC ACTIONS – An introduction to remediation, **William Hogland,** Linnaeus University
15:30	DISASTERS AND RESORATION, **Gunnar Silferswärd,** Private
15:45	Detection and Removal of Contaminants of Emerging Concern (CECs) from Different Water Matrices: Have We Already Reached the Best Possible Results? **Marcia Marques, Marina M. G. Pastre, Rodrigo Coutinho, Amanda F. do Amaral, Bruna G. Pagliari, Henrique Y. Hoshima, Diogo Sabino, Vanda A. da Costa,** Rio de Janeiro State University (UERJ)
16:00	Reforestation in Guatemala, Central America, **Sven Kristensson, Lars Kristensson, Sven Kristensson,** SWE-CA, S.A.,
16:15	Hidden in Grains, **Kerstin Fredlund,** Sweden
16:30	Combined Sewer Overflow in a Historical Perspective, **William Hogland,** Linnaeus University
17:00	**SOCIAL ACTIVITY AND Conference Dinner**
18:00	**Liela str 2, 2nd floor, Jelgava**

	Virtual presentations
20.11.2024	**Akademijas street 11, Jelgava 4th floor Room 46, Join Zoom Meeting** **https://zoom.us/j/93979576912?pwd=mEfmP5dncKyZJTLSuXaSUCH9j8ZCT6.1** **Meeting ID: 939 7957 6912** **Passcode: w1pWsF45n**
	Virtual *(moderator Inga Grinfelde)*
13:00	Investigation of regeneration and spreading of black locust (Robinia pseudoacacia L.) in Lithuania. **Sinilga Černulienė,** Lithuanian College of Engineering│Higher Education Institution, Lithuania.
13:15	Analysis of the contaminant "microplastics" in marine and freshwater ecosystems in the World Heritage Site Cocos Island National Park, Costa Rica. **Maria Angelica Astorga Perez, Geiner Golfin Duarte, Andrea García Rojas, Fausto Arias Zumbado, Daniela Solís Adolio, Karol Ulate,** Instituto Tecnologico de Costa Rica, Costa Rica.
13:30	Degradation of cigarette butts using Ganoderma Lucidum fungus. **Sofia Arias, Lilliana Abarca**, Technological Institute of Costa Rica (TEC), Costa Rica.
13:45	Challenges for developing countries in the implementation of the London Protocol and the Marpol Convention for prevention of pollution of the marine environment. **Lilliana Abarca-Guerrero, Sunny Molina-Ramírez & Gabriela Arroyo-Rojas,** Instituto Tecnologico de Costa Rica, Costa Rica.
14:00	Enhancing Sustainable in municipal Solid waste management: A proposed anaerobic based scenario for Kaunas MBT. **Mohsin Abdullah, Gintaras Denafas,** Lithuanian Energy Institute, Lithuania, Lithuania.
14:15	The Influence of Financial Literacy on Financial Service Access and Financial Service Use among Small-Scale Coffee Farmers in South Ogan Komering Ulu District, South Sumatera. **Prio Nugroho, Anisah Firli,** School of Business and Economics, Telkom University, Indonesia.
14:45	POSTER SESSION WITH COFEE & SNACKS

21.11.2024	**Akademijas street 11, Jelgava 5th floor hall, Join Zoom Meeting** **https://zoom.us/j/95574388846?pwd=rI6gjylux7Udr1aGzeFeN2vabLDWUW.1** **Meeting ID: 955 7438 8846** **Passcode: LSq5GNDN0**
08:30	Registration. Coffe
	Pollution *(moderator Inga Grinfelde)*
09:00	Remediation of polluted environment using plants and microorganisms, **Piotr Rybarczyk,** Poland
09:15	Challenges in retrospective toxicological monitoring: current issues and a potential way forward, **Sebastian Lungu-Mitea**, Sweden
09:30	Serial Disasters in Post-Earthquake Bam: A Study of Environmental and Human Resilience, **Leila Papoli-Yazdi, Omran Garazhian,** Garbonomix AB
09:45	Natureculture Preserve Marhult – Contaminated sites as field, discourse and material for transdisciplinary processes between preservation, remediation and rewilding. **Timo Menke,** Alumn at Konstfack, Stockholm
10:15	Disaster and Restoration, **Gunnar Silfwersvärd,** Private senior lawyer
10:30	PHOTOCATALYSIS AS A POLISHING STEP FOR DEGRADING BISPHENOLS AFTER BIOLOGICAL TREATMENT, **Marina Pastre**, Brazil
10:45	REMOVAL AND IMPACT OF BISPHENOL-A IN MOVING BED BIOLOGICAL REACTORS (MBBR) WITH DIFFERENT CARRIERS. **Amanda do Amaral**, Brazil

21.11.2024	**Akademijas street 11, Jelgava 5th floor hall, Join Zoom Meeting** **https://zoom.us/j/95574388846?pwd=rI6gjylux7Udr1aGzeFeN2vabLDWUW.1** **Meeting ID: 955 7438 8846** **Passcode: LSq5GNDN0**
11:00	Reflections on Accident Management in Business. **Åke Erlandsson, William Hogland,** Kvalitet&MiljöUtveckling, Sweden.
11:15	Reclaimed Wastewater Reuse Topicality in Baltic Sea Area: Perspectives and Risks. **Oskars Purmalis, Maris Klavins,** University of Latvia, Latvia.
11:30	Problems of Determining Wetland Boundaries: The Case of Lithuania. **Edita Abalikstiene, Vilma Salkauskiene,** Lithuanian College of Engineering | Higher Education Institution, Lithuania.
11:45	The balance between freedom of speech, protection of religious feelings and environmental consciousness in the context of ECtHR practice. **Yurij Kozar, V Gogol, R Piasta, A Yatsyshyn,** Uzhhorod National University, Ukraine.
12:00	LUNCH BREAK
13:00	Hydrothermal humification of spruce greenery biomass as a tool for the production of synthetic humic substances. **Lauris Arbidans, Marcis Mezulis,** University of Latvia (Latvia)
13:15	Tox-free construction in the Baltic Sea region: an approach of NonHazCity-3 project. **Jolita Kruopiene, Edgaras Stunžėnas, Aušra Randė,** Institute of Environmental Engineering, Kaunas University of Technology (Lithuania)
13:30	Technology for Fagus sylvatica seedling production - a case study. **Dagnija Lagzdina, Kaspars Liepiņš, Viktorija Vendiņa, Celma Santa, Daugaviete Mudrīte, Dūmiņš Kārlis**, LSFRI Silava (Latvia)
13:45	Geotechnical opportunities for the construction of alternative energy production plants in the Baltic states. **Juris Burlakovs, Maris Krievans, Zane Vincevica-Gaile, Divya Pal, Martins Vilnitis,** Riga Technical University (Latvia).
14:00	Correlation of unconsolidated undrained shear strength of clay soils between uniaxial and triaxial test results. **Juris Burlakovs, Maris Krievans, Daira Krope, Ivar Zekker, Zane Vincevica-Gaile, Andrey Krauklis, Martins Vilnitis**, Riga Technical University (Latvia).
14:15	Sustainable landfill transformation integrating recovery of material, energy and land resources. **Juris Burlakovs, Maris Krievans, Inga Grinfelde, Ivar Zekker, Zane Vincevica-Gaile, Andrey Krauklis, Piotr Kunecki, Martins Vilnitis,** Riga Technical University (Latvia).
14:30	The Role of Silicon Fertilization in Enhancing Seedling Growth and Stress Resistance: A Review. **Mehrdad Zarafshar, Peyman Ashkavand, Mehrasa Zare,** Linnaeus university, Sweden.
14:45	Calling plants to the rescue for mitigating the detrimental effects of warfare, **Henrik Haller,** Natural Sciences, Sustainable Development and Design, Mid Sweden University, Sweden
15:00-17:00	POSTER SESSION WITH COFEE & SNACKS

22.11.2024	**Akademijas street 11, Jelgava 5th floor hall, Join Zoom Meeting** **https://zoom.us/j/91843295034?pwd=yRjoPHUuycBllr7q3t5jzaZlk1AIZ5.1** **Meeting ID: 918 4329 5034** **Passcode: xB6Kw6EPW**
08:30 - 09:00	POSTER SESSION WITH COFEE & SNACKS
	Virtual *(moderator Inga Grinfelde)*
09:00	The innovative environmental technologies: addressing the phosphorus challenge of this century, **Rūta Ozola-Davidāne**, Latvia University of Life Sciences and Technologies

22.11.2024	**Akademijas street 11, Jelgava 5th floor hall, Join Zoom Meeting https://zoom.us/j/91843295034?pwd=yRjoPHUuycBllr7q3t5jzaZlk1AIZ5.1 Meeting ID: 918 4329 5034 Passcode: xB6Kw6EPW**
09:15	Agri-food wastes and by-products as resources for water remediation and green synthesis of AuNPs, **Jennifer Gubitosa, Vito Rizzi, Anna Laurenzana, Cecilia Anceschi, Elena Andreucci, Paola Fini, Pinalysa Cosma,** Italy
09:30	Possibilities of Using Geospatial Data in Determining the Types of Land Use. **Jolanta Luksa, Vivita Pukite,** Latvia University of Life Sciences and Technologies, Institute of Land Management and Geodesy, Latvia.
09:45	Mapping the invisible – Flows of microplastics in a model city, **Emma Fältström**, Linköping University, **Heléne Österlund**, Luleå Technical University; **Alvise Vianello & Claudia Lorenz**, Aalborg University
10:00	Enhancing Emergency Response: Managing Post-Event Impacts Following Major Industrial Accident, **Diauddin Nammari, William Hogland,** Kalmar University Alumni,
10:15	Faith and Human Resiliance - Sustainable Recovery and Hope for the future. **Birgitta Åhlin**, Swedish church
10:30	ECO-FRIENDLY SOIL RECLAMATION IN POST-WAR UKRAINE, **Valeriy Mykhaylenk,** Kyiv, Medical University, **Mykola Blyzniuk,** Poltava V.G. Korolenko National Pedagogical Universit, Ukraine, **Ruslan Havryliuk** Institute of Geological Sciences of the National Academy of Sciences of Ukraine National Environmental Center of Ukraine
10:30	Microplastics in Human Tissues: Pathways of Exposure and Health Implications, **Divya Pal,** Stockholm University
10:45	Technology Transfer Possibilities for Phosphorus Recovery from Small and Medium-Sized Wastewater Treatment Plants Using CaFeOxide, **Solvita Kostjukova,** Latvia
11:00	SYNTHESIS OF Luffa cylindrica BIOMASS-BASED ADSORBENT FOR PFOA REMOVAL FROM AQUEOUS MATRICES, **Rodrigo Coutinho**, Brazil
11:15	The Impact of the Philosophy of the Dichotomy of Power and Society on Freedom of Religion in Ukraine: Legal and Environmental Aspects. **Vitalina Borovikova, V Derkach, A Chornenko, O Kaskiv**, Lviv State University of Internal Affairs, Ukraine.
11:30	Application of drone technology in providing geophysical processes. **Toms Lidumnieks, Armands Celms, Ivars Bergmanis,** LBTU, Latvia.
11:45	ECO-FRIENDLY SOIL RECLAMATION IN POST-WAR UKRAINE, **Valeriy Mykhaylenko**, Ukraine
12:00	**Inga Grinfelde**. Closing ceremony, Rewarding of best presentations and posters

	Poster presentations
	Posted from 19th to 22th of november Akademijas street 11, Jelgava 3rd floor hall
1	The nitrification process in soil: The identification of N2O sources. **Sindija Frienberga**, **Dace Butenaite - Ragele, Jovita Pilecka-Ulcugaceva, Inga Grinfelde** Latvijas biozinātņu un tehnoloģiju univetsitāte, Latvija.
2	Integrated Valorization of Algae Biomass and Food Waste: A Circular Approach to Sustainable Bioproducts. **Inese Skapste, Gunta Grinberga-Zalite,** Latvia University of Life Sciences and Technologies, Latvia.
3	Sustainable sorbents for phosphorus recovery and pathogen removal in wastewater treatment. **Līga Irbe Mikosa, Kamila Gruškeviča, Rūta Ozola-Davidāne, Jūlija Karasa, Juris Kostjukovs,** Latvijas Universitāte, Latvia.
4	DECARBONIZATION IN AGRICULTURE: DEVELOPING EFFECTIVE TOOLS FOR GHG EMISSION REDUCTION AND PROGRESS MONITORING. **Katrīna Muižniece, Jovita Pilecka-Uļčugačeva, Inga Grīnfelde,** Latvia University of Life Sciences and Technologies, Latvia.
5	Municipal Wastewater Reclamation – opportunities and challenges. **Monika Zubrowska-Sudol, Zubrowska-Sudol M., Knap-Baldyga A., Czajkowska J., Sytek-Szmeichel K., Borowska W., Zajac O.,** Warsaw University of Technology, Warsaw.
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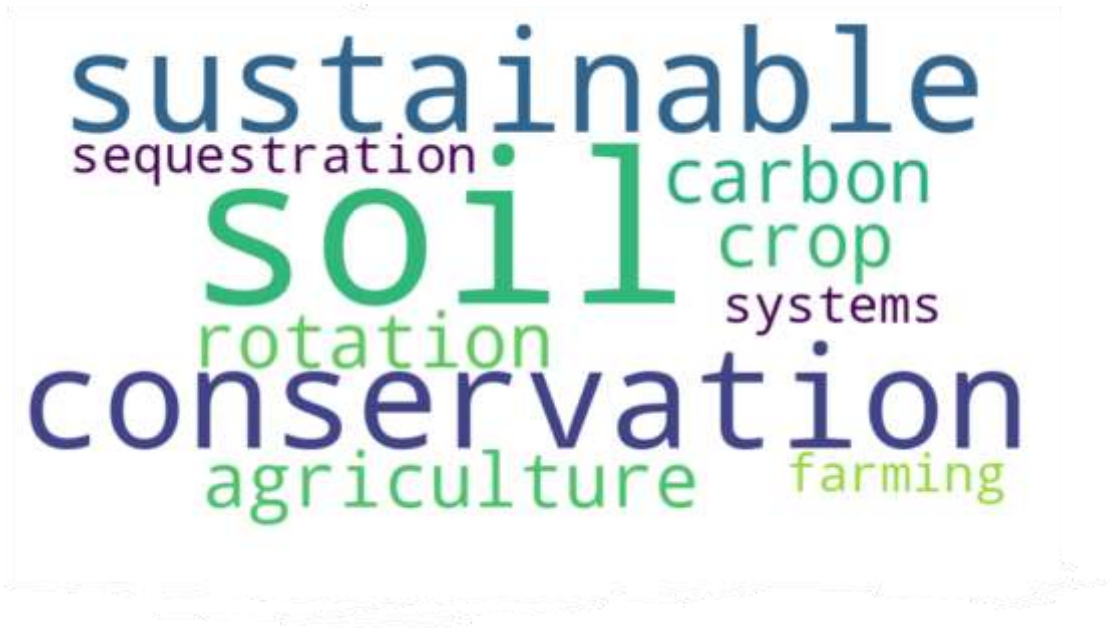

EFFECT OF CROP ROTATION ON ORGANIC CARBON AND MICROSCOPIC FUNGI ABUNDANCE IN MAIZE (*ZEA MAYS L.*) FIELDS SOIL

Nijolė Maršalkienė, Lina Skinulienė, Vaclovas Bogužas

Vytautas Magnus University

Abstract

The abundance of microscopic fungi was investigated in permanent black fallow, extensive mono crop (without fertilizer and herbicides), intensive mono crop (fertilizer+herbicide), pre-farm, fodder and intensive rotation maize crop fields soil at the beginning (BBCH 14) and the end of growing season (BBCH 89). Organic carbon (Corg) content was also determined.

Fungal abundance in the soil of the maize fields studied was higher at the end of the growing season than at the beginning, except for the extensive mono crop field soil. The most abundant fungi were found in the 0-5 cm and 6-10 cm soil layers at the beginning of the growing season and in the 0-5 cm and 11-20 cm layers at the end of the growing season. The most stable and abundant fungi were found in intensive rotation, where intercropping and green manure are used. The maize fields studied were arranged in the following order according to the highest average number of microscopic fungi in the soil: intensive > forage > pre-farmy > extensive mono crop > intensive mono crop > black fallow.

The highest number of Trichoderma fungi, which are the main decomposers of residues in agrocultural fields, were found in both mono-crop maize fields, and the lowest – in the pre-farm and intensive rotation fields soil. Trichodermas was almost absent in permanent black fallow soil.

The biggest content of Corg was in intensive and fodder rotations, probably due to use of legume-cereal mixtures and cumulative cultures as a pre-crop. The most significant Corg decreases of were caused by reseeding mono crop and the use of permanent black fallow. No statistically reliable relationship was found between Corg and the number of fungi in the rotations.

Keywords

Corn, soil, rotation, fungi, Trichoderma, Corg

INTEGRATED VALORIZATION OF ALGAE BIOMASS AND FOOD WASTE: A CIRCULAR APPROACH TO SUSTAINABLE BIOPRODUCTS

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Abstract

This review aims to evaluate and synthesise recent advances in the integrated valorisation of algal biomass and food waste, and to assess their combined potential as sustainable resources for bioproducts, bioenergy and environmental applications within a circular bioeconomy framework. The central hypothesis is that the synergistic use of algal biomass and food waste through integrated valorisation approaches can significantly improve resource efficiency, reduce environmental impacts and create new value streams in the bioeconomy.

To address this hypothesis, the review focuses on five main tasks: (1) analysing recent developments in co-processing techniques for algae biomass and food waste, (2) evaluating novel integrated valorisation strategies for the production of high-value bioproducts, (3) assessing the potential of combined algae-food waste systems for bioremediation and nutrient recycling, (4) identifying key challenges and opportunities for scaling up integrated algae-food waste biorefineries, and (5) exploring the circular economy implications of integrated valorisation approaches.

Recent developments in co-processing techniques have shown promising results. Co-digestion of Chlorella vulgaris with food waste increased biogas yields by 42% compared to mono-digestion, with a maximum methane yield of 0.38 L/g volatile solids at a 1:1 ratio (Zhang et al., 2022). Novel extraction methods using supercritical CO2 and green solvents have achieved high efficiencies in recovering valuable compounds from mixed biomass streams, with extraction efficiencies of 95% for lipids, 88% for proteins and 78% for polyphenols from a mixture of Spirulina platensis and fruit processing waste (Wang et al., 2021). In addition, hybrid systems combining microalgae cultivation with food waste fermentation have demonstrated effective nutrient recovery and wastewater treatment, achieving 92% nitrogen removal and 87% phosphorus removal, while producing valuable algal biomass and organic acids (Li et al., 2023).

The red alga Fucilaria lumbricalis offers interesting possibilities for integration into these valorisation strategies. Its high carrageenan content (up to 50% dry weight) makes it an attractive source of hydrocolloids for food and pharmaceutical applications (Smith, 2020). Co-processing F. lumbricalis with food waste could potentially enhance biogas production due to its high carbohydrate content. Furthermore, the ability of the seaweed to accumulate heavy metals suggests potential applications in bioremediation when combined with other waste streams (Johnson & Parker, 2018).

Key challenges for scaling up integrated algal/food waste biorefineries include optimising co-processing ratios, developing efficient separation technologies, and ensuring consistent biomass quality. However, the circular economy implications of these integrated approaches are significant, offering opportunities for waste reduction, resource recovery, and the creation of novel bio-based products (Kotler et al., 2021).

This review explores these recent advances, evaluates emerging valorisation strategies, and identifies critical research needs to further develop integrated algae-food waste biorefinery systems within a circular bioeconomy framework. The methodology involved a comprehensive literature review of peer-reviewed articles published in Q1 and Q2 journals within the last three years (2020-2023), focusing on key terms such as 'algae-food waste integration', 'circular biorefinery', 'integrated valorisation' and 'algae waste co-processing'.

Keywords

Algae biomass, Food waste, Integrated valorisation, Circular biorefinery

THE INFLUENCE OF FINANCIAL LITERACY ON FINANCIAL SERVICE ACCESS AND FINANCIAL SERVICE USE AMONG SMALL-SCALE COFFEE FARMERS IN SOUTH OGAN KOMERING ULU DISTRICT, SOUTH SUMATERA

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Abstract

This research examines the impact of financial literacy on access to and use of financial services among small-scale coffee farmers in Ogan Komering Ulu Selatan District, South Sumatra. Focused on enhancing farmers' financial management to address challenges such as coffee price fluctuations and dependence on loans from local middlemen, the research employs a quantitative approach using surveys for data collection. The research population comprises all small-scale coffee farming households across 19 sub-districts in Ogan Komering Ulu Selatan District. Cluster sampling is employed for selecting sub-districts, predominantly inhabited by coffee farmers, with random household sampling within each selected sub-district. Data analysis involves simple linear regression to explore the relationship between financial literacy, access to financial services, and their usage. This study aims to provide recommendations for improving farmers' welfare through enhanced financial literacy. The research results indicate that financial literacy has a significant impact on financial inclusion among small-scale coffee farmers in Ogan Komering Selatan District (the hypothesis is accepted). A simple linear regression analysis shows that financial literacy has a significant influence on financial inclusion. The regression coefficient of 0.561 with a very low significance level ($p < 0.05$) demonstrates a positive and significant relationship between financial literacy and financial inclusion. The recommendation from this research is small-scale coffee farmers should actively participate in financial literacy training to enhance financial management skills, diversify income sources to mitigate risks from coffee price fluctuations, and increase their access to formal financial products, while policymakers and financial institutions need to strengthen financial education programs, ensure market transparency, offer tailored financial products, and support research on financial inclusion and innovation to improve farmers' welfare and access to formal financial services.

Keywords

financial literacy, financial inclusion, access to financial services, use of financial services, small-holder coffee farmers

MIXED TREE PLANTATION AS FORAGE FOR EUROPEAN HONEY BEES (APIS MELLIFERA L.): A MELISSOPALYNOLOGICAL ANALYSIS

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Abstract

This study aimed to assess the contribution of a tree plantation – its woody species and its understory vegetation – as forage for pollinators through melissopalynological analysis. European honey bee (Apis mellifera L.) hives were located adjacent to a ten-year-old tree plantation consisting of blocks of aspen, willow, alder, birch, lime, maple and wild cherry. Pollen found in honey was analysed to determine the botanical origin of the honey. In total, 40 types of pollen were identified in the honey. In spring, predominant pollen originated from Salix spp. (willow), in summer – pollen of Brassicaceae (oilseed rape) dominated in the honey, but toward the late stage of summer multiflower honey was picked up. These findings confirm the importance of tree plantations as a foraging ground for bees in the beginning of vegetation season, with melliferous mass-flowering woody species serving as the primary source of the honey. This emphasizes the essential role these species play in sustaining continuous food resources for pollinators throughout the vegetation period within the landscape context. However, during the summer, the understory flora of the tree plantation was poorly utilised by honey bees. Even though 65 species of vascular plants were present in the understory, honey bees exhibited a preference for nearby mass-flowering crops of oilseed rape. It should be investigated further if this behaviour temporarily alleviates the competition with wild pollinators in surrounding ecosystems.

Keywords

Melissopalynology, pollen, mass-flowering crops, SRC, willow

ARSENIC AND CADMIUM ACCUMULATED IN LAVENDER FLOWERS GROWN IN CONTAMINATED BOTTOM SEDIMENT FROM THE BALTIC SEA (MALMFJÄRDEN)

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Abstract

Lavender (Lavandula angustifolia Mill.) is an ornamental and medicinal plant, used for human consumption. In this preliminary study the lavender plants were grown in a mixture of soil and contaminated bottom sediment. The objective of the study was to test if lavender plants grown in contaminated soil contain higher concentrations of heavy metals than permitted by WHO. The levels of heavy metals in lavender flowers were compared to inflorescence from plants grown in ordinary untreated soil. The levels of manganese, zinc, cobalt, nickel, lead, arsenic, chromium, cadmium and mercury were determined. High levels of lead, arsenic, cobalt and cadmium were accumulated in the lavender inflorescence of plants growing in contaminated soil. Cadmium and arsenic are harmful elements of great concern and have a negative impact on human health.

The concentration of arsenic was 0.16 mg/kg dry weight of lavender flowers growing in contaminated sediment. No arsenic was detected in the control flower. In addition, the levels of cadmium were higher in the flowers of lavender grown in contaminated soil in comparison with the inflorescences from plants grown in the untreated soil. A higher concentration of cadmium was detected in the flowers from plants that had grown in the contaminated mixture of soil than in the control, the concentration was 0,7 mg/ kg dry weight and 0,01 mg/ kg dry weight, respectively. Mercury was not detected in any of the tested inflorescence.

The results from this preliminary study suggested that lavender accumulates heavy metals from contaminated soil and may be used in the restoration of contaminated land by taking up toxic heavy metals. Further studies are needed to evaluate the efficiency of lavender as a phytoremediation plant.

Keywords

Lavandula angustifolia, phytoremediation, heavy metal, contaminated sediment

THE VITAL ROLE OF AGRICULTURAL LAND: A PILLAR OF SUSTAINABLE DEVELOPMENT AND RESILIENCE IN A CHANGING WORLD

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Acceleravia / LNU

Abstract

Agricultural land is a cornerstone of human survival, offering much more than food production. It is a critical resource that sustains economic stability, supports biodiversity, and provides essential ecosystem services like carbon sequestration and water regulation. Yet, with growing urbanization, agricultural land is increasingly being repurposed for housing developments, shopping centers, and industrial projects, often without considering the long-term implications. This presentation will address the importance of preserving agricultural land from multiple perspectives—ecological, economic, social, and even as a safeguard for post-catastrophe remediation.

From an ecological standpoint, the role of agricultural land in maintaining biodiversity and mitigating climate change is crucial. When we lose arable land to construction and development, we reduce the capacity of landscapes to buffer extreme weather events, such as floods and heavy rains. This becomes especially critical in the context of climate change, where agricultural land can act as a natural sponge, absorbing excess water and preventing flood-related damage in both rural and urban areas. Post-catastrophe, agricultural land can facilitate recovery by acting as a resource for food production and soil regeneration, which are essential to restoring communities and ecosystems.

Economically, agricultural land serves as a foundation for rural economies and food systems, contributing to job creation, trade, and local resilience. Converting this land for other uses often leads to increased food insecurity, price volatility, and greater dependency on external food sources, weakening the fabric of local communities. Last but not least, socially and culturally, agricultural land carries historical and societal value, preserving traditional knowledge and practices that are deeply rooted in local identities. As societies grow, the challenge lies in balancing development needs with the imperative to protect this essential resource.

Given this framework, it is of utmost importance to advocate for sustainable urban planning and land-use policies that prioritize the preservation of agricultural land. Future societies must explore innovative approaches to integrating urban growth with agricultural sustainability, ensuring that future generations inherit a landscape that can continue to provide food, ecosystem services, and resilience in the face of global challenges.

Keywords

Agriculture, land usage, exploitation, catastrophe mitigation

HIDDEN IN GRAINS

Kerstin Fredlund

Med Dr

Abstract

How to promote health and well-being by agriculture and food? Interdisciplinary collaboration between biomedicine and environmental sciences.

The biology of humans must take the lead over food industry if health and well-being shall be possible. What food do humans need to remain healthy during life? Is it possible to produce such food combined with environmental needs?

EAT-Lancet report 2019 was a full scientific review of what constitutes a healthy diet from a sustainable food system. A rise in consumption of whole grains and legumes was proposed as a big part in the global transformation of the food system that is urgently needed.

Currently wheat, rice and maize stand for 80% of the production of grains globally. Wheat and rice are mainly consumed refined, not as whole grains. Wheat requires many inputs and accumulates cadmium. Rice takes water resources, releases methane and accumulates arsenic. Maize is a monoculture and the cultivation is not favorable for the soil and biodiversity.

Today environmental disasters and military conflicts are added to reasons for polluted soils and contaminations of crops with for example heavy metals. Questions must be raised: Are other grains than wheat, rice and maize more appropriate for human health and environmental considerations? Can we expect an acceptance by consumers to replace rice with millet and barley? Might grains like primitive wheats and rye that don´t accumulate cadmium be cultivated to a greater extent and used for bread baking? Can heterogenous grains with large gene pool better resist climate changes? How to make tasty and attractive products from sorghum and millet that are drought resistant grains? Can wheat that accumulate cadmium be used for remediation?

The future perspective for food consumption is not linear from today patterns. There must urgent be big changes to prevent food related diseases and protect environmental concerns.

Keywords

Promote health, whole grains, replace wheat and rice, environmental concerns

DECARBONIZATION IN AGRICULTURE: DEVELOPING EFFECTIVE TOOLS FOR GHG EMISSION REDUCTION AND PROGRESS MONITORING

Katrīna Muižniece, Jovita Pilecka-Uļčugačeva, Inga Grīnfelde

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Abstract

The agricultural sector has historically been a significant source of greenhouse gases (GHG) on a global and European scale. In order to achieve the objectives set out in the Paris Agreement, which is to limit the temperature rise, it is required to implement a comprehensive decarbonization strategy across the entire economy, including the agricultural sector, as well as within individual agricultural companies. Decarbonization planning tools play a vital role in assisting companies to gain insights into their existing GHG emissions, explore abatement measures, and prioritize decarbonization actions for implementation. While several decarbonization planning tools exist, the unique complexities of agriculture—such as carbon sequestration in soils and livestock management—render general tools insufficient. The analysis of existing studies highlights the key functionalities that an agriculture-specific decarbonization tool should have. These include data input fields for data specific to the farm, GHG emission calculations and tracking by source, an assessment of soil health, and the prioritization of abatement measures based on decarbonization potential. Additionally, the tool must enable farmers to monitor year-on-year progress to ensure effective decarbonization. Challenges may arise from user experience, suggesting further research is needed on integrating artificial intelligence or other Agriculture 4.0 technologies into decarbonization planning tools for the sector of agriculture.

Keywords

Decarbonization planning, agriculture decarbonization, greenhouse gas emissions

HOW MIGHT THE ONGOING DISCUSSION ABOUT REWETTING SWEDISH PEATLANDS TO REDUCE CLIMATE IMPACT INFLUENCE THE PROBLEM OF BROWNIFICATION?

Henric Djerf, Amelie Lindgren

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Abstract

The role of peatlands in climate mitigation and their impact on water quality is a crucial area of study. In Sweden, drained peatlands contribute significantly to CO2 emissions, comparable to national vehicle emissions. However, drained peatlands are used for forestry and agriculture, making rewetting economically costly and potentially reducing the production of biomaterials needed for a future climate-neutral society. Additionally, rewetting can enhance methane emissions, potentially worsening the climate impact in the short term. Consequently, research and discussions are ongoing about how and where to rewet to reduce risks and optimize gains.

Brownification, a term used to describe the increase in organic matter, primarily dissolved organic carbon (DOC), in water bodies, has become a growing concern. This phenomenon results in water turning a brownish color and can affect water quality by altering light penetration, affecting aquatic ecosystems, and making water treatment more challenging.

Rewetting can also have positive effects on water quality, especially to regulate flow throughout the year. Current research is assessing the potential of rewetting to mitigate climate change through reduced CO2 emissions while exploring its overall benefits to water quality. Swedish peatlands offer a promising approach to reduce CO2 emissions and improve water quality. However, careful consideration and planning are required to balance these benefits against the risks of methane emissions. Further research is needed to optimize rewetting practices for both climate and water quality benefits.

Keywords

Brownification, Rewetting, Water Quality, Methane emission

MILITARY ACTIONS AND CLIMATE CHANGE AS DRIVERS OF WILDFIRES IN NORTHERN REGIONS OF UKRAINE IN 2022-2023

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National University of Kyiv–Mohyla Academy

Institute of Agroecology and Environmental Management

Abstract

The large-scale Russian military aggression has led to a number of serious and dangerous consequences for the environment and the population of Ukraine. Our research focuses on the impact of military actions on the natural ecosystems of Ukrainian Polissia. The most common consequences of this impact in 2022-2023 were fires. Almost 70% of forest fires in this region were caused by active combat, missile strikes, mine explosions, artillery shells, etc. While the majority of fires in Ukrainian Polissia during these years were triggered by war, their spread was influenced by many other factors. These include regional climate change and weather patterns, the topographical features of the region (slope steepness and aspect, elevation above sea level), the types and properties of natural components that served as fuel (grass, grass-shrub, shrub, timber-understory, timber litter, slash-blowdown), settlement density in the Wildland-Urban Interface zone, wood damage by pests and diseases, and the presence of non-native invasive plants, which added complexity to forest and grassland fire behavior.

The last decade has been the warmest in the past 100-120 years in Ukraine. Warm, low-snow winters, along with dry and abnormally warm spring and summer seasons, are the current climate realities. Abnormally high temperatures and periods without rainfall create favorable conditions for fire spread. In the spring of 2022 and 2023, a slight increase in the climate norm for near-surface temperatures was recorded. At the same time, a deficit of atmospheric precipitation was observed in March and May, with only 70% of the typical rainfall. In contrast, April saw 30-50% more precipitation than usual. The weather conditions in the spring of 2022 and 2023 were less dry compared to 2020. However, due to active military operations in 2022 and missile strikes in 2023, large parts of the Kyiv, Chernihiv, Zhytomyr, and Sumy regions were affected by fires. The number and spread of fires in Ukrainian Polissia in 2022-2023, established based on satellite monitoring data from the FIRMS, correlate with weather conditions and climate trends.

The fires caused gas-aerosol pollution of the atmosphere over these regions. Daily variations in the aerosol absorption index (AAI) in the vertical air column over Zhytomyr and Chernihiv regions, as well as the Chornobyl Exclusion Zone in the spring of 2022 and 2023, were recorded based on data from the Sentinel-5P satellite and used in this research.

Keywords

military actions, climate change, forest fires, satellite observations

INVESTIGATION OF REGENERATION AND SPREADING OF BLACK LOCUST (*ROBINIA PSEUDOACACIA L.*) IN LITHUANIA

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Abstract

Black locust (Robinia pseudoacacia L.), a North American species, naturalized in Europe many years ago, falls into the category of alien species with insufficient and controversial information. In Lithuania this species is mostly found in farmsteads. It is frequently cultivated along roadsides. However, it is relatively rare in forests. Robinia pseudoacacia found new habitats during the rapid globalization period due to intentional human activity or random factors. In Lithuania, black locust, as an invasive species spreads in certain ecotops relatively such as Curonian Spit. The black locust does not behave uniformly across different ecotopes and climate zones. Thus, to successfully manage the species abundance, scientific investigations are essential.

The aim of these studies was to evaluate the black locust (Robinia pseudoacacia L.) spreading in open areas and adjacent stands. Investigations were carried out in the Jonava and Kretinga Regional Divisions of State Forest Enterprises (SFE) allocated temporary sample plots, where species composition contained black locust. The recovery of black locust under tree crowns was small and exceed only about 122 units / ha. The black locust spread into open spaces from the maternal plant at the distance of 8-32 meters in average. Prevailed the saplings in 1 and 2 hight groups and their relative share increase moving away from biogroups (coppice). Of all the records on the saplings 96.6% was formed from the root suckers and only 3.4% - regenerated from seeds.

After conducting a seed germination study under natural conditions, it was determined that the germination rate was low, at about 2.5%. The seeds germinated only in the mineral firebreak when sown on the surface and in mineral soil on the surface.

Keywords

black locust, spreading, germination, root sprouts (sucker)

DISASTER WASTE AND PROTECTION OF WATER SOURCES AND FARMLAND

Dinesh Raj Manandhar, Bijay Thapa, Ajay Kumar

Independent Consultant on WASH

Abstract

This paper explores the critical intersection of disaster waste management and the protection of water sources and farmland in the aftermath of natural disasters. With increasing frequency and intensity of such events due to climate change, the effective management of disaster-generated waste has become imperative to safeguard environmental and public health. We examine the challenges posed by debris, hazardous materials, and organic waste, emphasizing the importance of waste segregation, recycling, and safe disposal methods. Furthermore, we assess the impact of disaster waste on water quality and soil health, highlighting strategies for monitoring and remediation to prevent contamination of vital resources. Through case studies and best practices, this paper advocates for integrated land use planning and community engagement to enhance resilience and recovery. By fostering collaboration among stakeholders, we aim to promote sustainable practices that protect water sources and farmland, ensuring a healthier ecosystem for future generations.

Keywords

Disaster waste, protection of water sources, farmland, land use, sustainability

ALGAE AS POTENTIAL SOURCE FOR THIRD GENERATION OF BIOFUEL

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Babol Noshirvani University of Technology

Abstract

Algae can absorb and fix carbon dioxide during photosynthesis, potentially reducing greenhouse gas emissions when used as a fuel source. This characteristic positions algae not only as a renewable energy source but also as a tool for climate change mitigation. While third-generation biofuels from algae present significant potential to contribute to global energy needs sustainably, further research is essential to overcome existing technological and economic barriers. By addressing these challenges through innovative cultivation techniques and biorefinery concepts, algae could play a pivotal role in the transition towards renewable energy sources. The future of energy may well depends on harnessing the remarkable capabilities of microalgae in quest for sustainabilityCO2 biofixation through microalgae represents a sustainable method for capturing carbon dioxide. In this study, CO2 was supplied directly from the flue gas of the Neka thermal power plant. The growth performance of microalgal species, including Spirulina sp., Chlorella vulgaris, and Scenedesmus obliquus, was evaluated for their capacity for the biofixation of CO2 and accumulate lipids at CO2 concentrations of 0.03%, 2%, and 5%. The results indicated a comparative analysis of the growth rates among the three strains under identical conditions. For C. vulgaris, the maximum growth rate, biomass productivity (PB), CO2 consumption rate (P CO2), and lipid content at a CO2 concentration of 5% were recorded as 0.44 d^{-1}, 169.75 mg L^{-1} d^{-1}, 319 mg L^{-1} d^{-1}, and 32.8%, respectively.

Keywords

Biofuel, biorefinery, Microalgae, CO2 fixation, Third generation, Photo bioreactor

ADVANCING WASTEWATER TREATMENT: THE ROLE OF PHOTOCATALYTIC MICROBIAL FUEL CELLS

Mostafa Rahimnejad

Babol Noshirvani University of Technology

Abstract

The increasing reliance on fossil fuels has led to significant environmental challenges, including pollution and habitat degradation. To address these issues, microbial fuel cells (MFCs) offer a promising alternative by converting organic waste into bioelectricity while simultaneously treating wastewater. This study explores the integration of photocatalytic materials within a microbial fuel cell framework, aiming to enhance its overall performance.

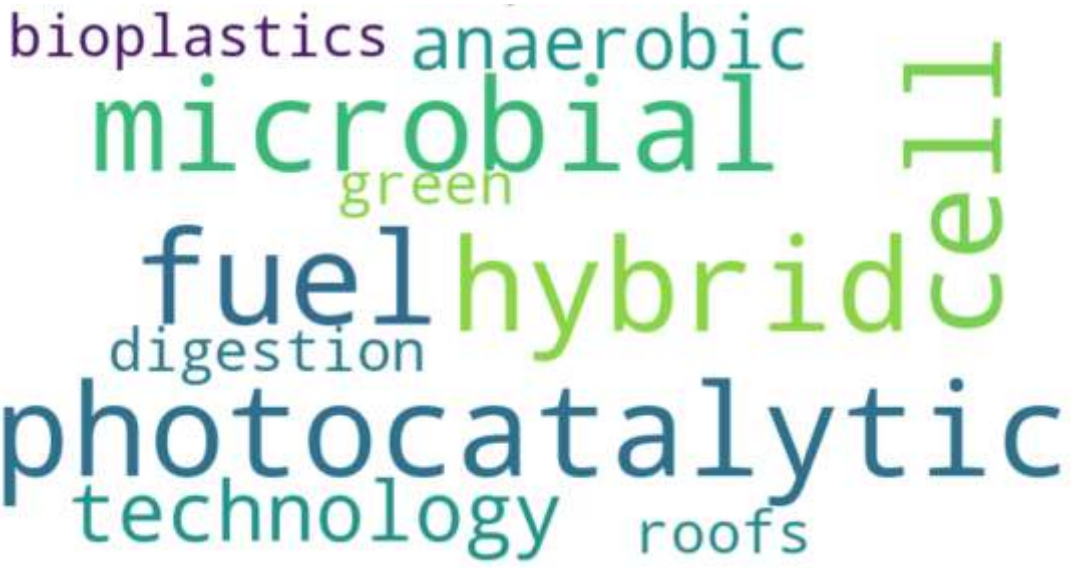
We employed a dual-chambered MFC with a photosynthetic cathode featuring novel photocatalytic surfaces designed to maximize light absorption and promote enhanced microbial activity. Experiments were conducted under various light exposure conditions, including continuous illumination and alternating light/dark phases, to evaluate their effects on power generation and wastewater treatment efficiency. Preliminary findings indicate a substantial increase in maximum power density—up to 30% greater than traditional MFC configurations—attributable to improved oxygen generation facilitated by the photocatalytic processes.

Furthermore, the study examines the impact of integrating specific algal strains as biocomponents within the MFC architecture. Results demonstrate that the presence of these microorganisms not only optimizes energy output but also contributes to a significant reduction of chemical oxygen demand (COD) in treated effluents. The findings underscore the potential for innovative photocatalytic strategies to enhance the viability and sustainability of MFC technology, paving the way for cleaner energy solutions and effective waste management practices.

Keywords

Photocatalytic microbial fuel cell; bioelectricity; wastewater treatment; renewable energy; sustainable technology

II.ENVIRONMENTAL ENGINEERING, SUSTAINABILITY, AND GREEN TECHNOLOGY



THE SUSTAINABILITY CHALLENGES OF WASTE PROCESSING PLANTS INDUSTRY: CASE STUDY

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Abstract

The sustainable management of waste processing plants is a critical environmental and socio-economic challenge. This study investigates the effectiveness of various remediation techniques, including bioremediation, phytoremediation, and chemical treatments, for mitigating contamination in soils, water, and air around waste processing facilities. The aim is to assess baseline contamination levels, monitor remediation progress, and evaluate the impact of treatments on environmental health.

Sampling was conducted at designated sites to establish initial contamination levels. Experimental plots were treated with selected remediation techniques, while untreated plots served as controls. Contaminant levels, soil health, and water quality indicators were monitored at regular intervals, with chemical analyses and statistical tools employed to evaluate changes over time. Data analysis compared the reduction of contaminants and the environmental impact of each remediation method.

Special attention was given to the role of halotolerant plant growth-promoting rhizobacteria (PGPR) in enhancing phytoremediation under saline conditions. These bacteria improve plant resilience to stress by increasing the K^+/Na^+ ratio, reducing toxic Na^+ translocation, boosting antioxidative systems, and producing phytohormones and osmoprotectants. The production of exopolysaccharides by PGPR aids in soil aggregation, water and nutrient uptake, and the mitigation of salinity stress. Key findings include the following: Significant reductions in contaminant levels were observed with bioremediation and phytoremediation, proving their effectiveness compared to chemical treatments. Environmental health was improved through PGPR-enhanced phytoremediation, which positively impacted soil structure, nutrient dynamics, and plant growth in contaminated areas. The integration of biological methods with waste management practices demonstrated strong potential for sustainable remediation of industrial pollution. These results highlight the feasibility of eco-friendly remediation strategies for addressing environmental contamination. The study highlights the importance of adopting eco-friendly remediation strategies in waste processing plant management. Future research should focus on optimizing the use of PGPR and other biological approaches to ensure sustainable industrial practices while mitigating environmental risks.

Keywords

Waste management, bioremediation, phytoremediation, halotolerant bacteria, sustainability, environmental remediation, industrial pollution, soil health

INFORMAL SECTOR BUSINESSES AND TAX COMPLIANCE IN GHANA: A CASE STUDY OF BOTTLED/SACHET WATER PRODUCERS IN GOASO MUNICIPALITY

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Abstract

The study investigated the informal sector and tax compliance within the Goaso Municipality. The study focused on four core objectives: to explore the characteristics of economic activities of the informal sector operators, determine the drivers of tax non-compliance, analyze the extent to which features of the informal sector influence tax compliance and explore strategies the Ghana Revenue Authority (GRA) uses to ensure tax compliance and challenges it faces in collecting taxes from the informal sector. The study employed purposive and convenience sampling techniques to select 42 Ghana Revenue Authority team and 78 business operators respectively. For data collection, it blended questionnaire with structured interview. Data analysis was done using the Statistical Package for Social Sciences (SPSS) software. The Pearson Chi-Square result showed that the business and informal sector characteristics such as business type, business registration status, having Tax Identification Number (TIN), kind of tax and how often they issue VAT invoices were statistically significant. This implies that, business type, business registration, having Tax Identification Number (TIN), kind of tax and how often they issue VAT invoices influence the informal sector tax compliance. The study also found that majority of the businesses representing 53.8% does not pay their tax. The major challenge GRA faces in collecting tax includes lack of record keeping which makes assessment difficult. It is therefore that recommended that the GRA should improve customer service, simplify the returns forms and bringing tax offices to the homes or convenience of tax payers through online transactions.

Keywords

Informal sector, VAT, tax compliance and tax non-compliance

RECLAIMED WASTEWATER REUSE TOPICALITY IN BALTIC SEA AREA: PERSPECTIVES AND RISKS

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Abstract

Increased water consumption, industrialisation and climate change are creating growing water consumption and thus stress on water resource availability and quality. A solution to reduce water resource consumption is reuse of reclaimed wastewaters. Such approaches are widely used in southern countries, where water shortages are everyday problems, but in Baltic Sea Regions (BSR) still are not common. To demonstrate feasibility of water reuse potential several case studies in the BSR has been started as well as studies on risks related with water reuse and potential. The risks of reclaimed water reuse are related to presence of microorganisms, viruses as well as persistent pollutants, however significance of risk factors are related to sizing of wastewater treatment facility and possible sources of risk factors. European Union regulations requires risk analysis as key process to support water reuse. Several case studies (pilot projects) within the Interreg project Renutriwater have convincingly demonstrated benefits of reclaimed water reuse, tools to mitigate risks. Besides to already functioning technologies a search for approaches is going on to simplify process realisation as well as achieve risk reduction aims.

Acknowledgments: The study was elaborated as part of the ReNutriWater project

Keywords

Reclaimed water, water reuse, risk analysis, innovative wastewater reuse

ANALYSIS OF POSSIBILITIES FOR RAIN WATER HARVESTING FROM GREEN ROOFS AS A PART OF SUSTAINABLE WATER MANAGEMENT IN LITHUANIA

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Abstract

Europe faces extreme climate change; these changes are fixed as longer drought periods, not just in springs or the middle of summer but all over the vegetation period. Long droughts mean water shortages in rural areas, reduced river water flows, and limited opportunities to use this water for irrigation. Attention should be paid to different rational water management technologies and systems with particular emphasis on rainwater harvesting. Sustainable development goals targeted for the water sector in Lithuania can be reached underwater by harvesting from roof systems using water tanks or harvesting rainwater in green roof systems. One method meets farmers' requirements, another - sustainable development goals. Lithuania is in a zone of excess moisture, and by accumulating this water, it is possible to compensate for the lack of water reserves in topsoil in the dry season.

This study aims to compare two technologies, water storage in green roof structures and water storage in rain tanks. The comparison is based on a field experiment study, when the dynamics of rainwater runoff from an experimental green and bituminous roof was recorded in 2022-2023 two 1 m2 stands were affected by open field climatic conditions. One stand was covered with traditional bituminous tiles and the other was covered with a "green roof" coating. Meteorological data were obtained from the Kaunas City meteorological station.

The study confirms that a green roof can reduce the load on rainwater systems and retain precipitation in the roof layers. During the first months of observation, it recorded the tendency that rainwater runoff is slow in the case of a green roof, but it continues even after the intense rain has ended. This confirms the claims of foreign authors that the green roof accumulates, retains rainwater, and thus reduces the runoff peak during rain. This means that the water from the roof system accumulates in rain tanks giving the possibility to reuse it for the future and bigger agglomeration.

Keywords

Green roofs, rain harvesting, precipitation, sustainable development

ENHANCING SUSTAINABLE IN MUNICIPAL SOLID WASTE MANAGEMENT: A PROPOSED ANAEROBIC BASED SCENARIO FOR KAUNAS MBT

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Abstract

The Mechanical-Biological Treatment (MBT) facility plays a vital role in the management of municipal solid waste (MSW). A Life Cycle Assessment of the current operations at the Kaunas MBT reveals that the facility's processes have a negative environmental impact. This impact can be minimized by reducing the carbon footprint. This study presents the activities of the MBT in the Kaunas Region, Lithuania, and proposes a scenario to reduce the carbon footprint of the Kaunas MBT. The Kaunas MBT processes waste collected from six different municipalities in the Kaunas region. The facility also has two landfill sites for non-hazardous waste. The facility shreds and sorts waste into fractions such as paper, plastics, metals, and biodegradable waste. Biodegradable waste is composted using an aerobic technique inside composting tunnels, and afterward, the composted material is used in landscaping and agriculture as fertilizer. Refuse-Derived Fuel (RDF) produced by the MBT is transferred to the Kaunas incineration plant for energy production. This article proposes a scenario to replace the aerobic composting of biodegradable waste at the MBT with anaerobic digestion to produce biogas. This biogas can be used to generate electricity, meeting the energy demands of the MBT facility. As a result, the Kaunas MBT could be considered a Green MBT. The MBT facility in Kaunas region requires a load of 1.9MW to operate smoothly, consuming 16.12 million kWh annually. If the MBT is modified according to aforementioned proposed scenario, 72240 tons per year of biodegradable material can generate 28.94 million kWh.

Keywords

Anaerobic, Biodegradable waste, Mechanical-Biological Treatment.

PROBLEMS OF DETERMINING WETLAND BOUNDARIES: THE CASE OF LITHUANIA

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Abstract

Precise identification of wetland boundaries has become increasingly important as society's view of ecology changes. With climate change, various environmental issues significantly impact public discourse. One of these "uncomfortable" questions is the establishment of protection regimes in wetland areas. To achieve this, the accuracy and correctness of determining wetland boundaries is essential. This is relevant for land users because vegetation in areas becomes protected if it grows in wetlands or water protection zones. The exact wetland boundary is determined by a surveyor in time of measurements. However, such measurements often lead to errors, and subjective boundary determination by the surveyor can play a significant role, along with factors like the moisture level at the time of measurement. As a result, deviations can occur, and the boundary of the wetland can shift in one direction or another. Determining accurate and correct wetland boundaries ensures the proper implementation of environmental requirements, as well as optimal land use for various economic activities. During the research measurements of wetland boundaries were conducted at different water levels of the wetland. The measurements were carried out in accordance with legal regulations and criteria for determining wetland boundaries. The measurement data were analyzed, discrepancies between the determined wetland boundaries were presented, and the reasons for measurement inconsistencies were provided.

Keywords

Wetland boundary, wetland measurement, measurement accuracy

ADVANCED MONITORING FOR ENHANCED PARTIAL NITRITATION/ANAMMOX (PN/A) PERFORMANCE

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Abstract

The Partial Nitritation/Anammox (PN/A) process is a promising solution for efficient nitrogen removal in wastewater treatment, combining low energy requirements with reduced carbon footprint. Despite its potential, the successful and stable operation of PN/A systems remains challenging due to the complex interactions within the microbial communities responsible for nitrogen transformation. This study addresses these challenges by integrating batch test monitoring with microbial community analysis to optimize and stabilize the PN/A process.

A combination of batch assays and next-generation sequencing analysis was employed to systematically investigate the influence of different oxygen concentrations and ammonia influent concentrations on PN/A performance. Batch assays were conducted after introducing various operational conditions in a Moving Bed Sequencing Batch Biofilm Reactor (MBSBBR), allowing for the precise measurement of nitrogen removal rates and identification of key metabolic pathways within the system. Simultaneously, microbial community dynamics were monitored to assess how specific operational strategies affect the composition and function of ammonia-oxidizing bacteria (AOB) and anammox bacteria, as well as their competitors, nitrite-oxidizing bacteria (NOB).

The integration of these methodologies provided valuable insights into the critical parameters that drive process efficiency and stability. The findings highlight the importance of microbial community structure in determining the overall performance of PN/A systems. The nitrogen removal efficiency of the system was enhanced by identifying and promoting beneficial microbial populations through targeted operational strategies.

Keywords

Partial Nitritation/Anammox; Batch Test; Microbial Community; Wastewater Treatment; Nitrogen Removal

ENERGY-EFFICIENT WASTEWATER TREATMENT: THE IMPACT OF HYBRID TECHNOLOGY AND INTERMITTENT AERATION

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Abstract

Many researchers highlight the potential for increasing the efficiency of activated sludge-based methods by incorporating moving carriers into the reactor, creating a hybrid system. However, there is a lack of in-depth studies on the improvements in biofilm-based systems via development of activated sludge.

In addition to the most efficient removal of pollutants from wastewater, wastewater treatment plants (WWTPs) have also recently focused on the challenge of reducing their negative environmental impact and minimizing the costs of treatment. One of the ways to minimize the costs incurred by WWTP while positively impacting the environment and our planet is to reduce their demand for electricity. Energy consumption in wastewater treatment plants, particularly in aeration processes, remains one of the most significant operational costs, often constituting 50-75% of the total energy demand. It is therefore important to carefully select the operational parameters and employ appropriate technologies to achieve both high-quality treatment and a reduction of electricity use.

This paper explores cutting-edge hybrid approaches that focus on reducing energy use in aeration by integrating optimized oxygen transfer systems, adaptive control mechanisms, and novel membrane technologies that enhance oxygen solubility.

Key findings suggest that these hybrid systems can reduce energy consumption by as much as 30%, offering both economic and environmental benefits. By optimizing the aeration process and incorporating energy-saving innovations, treatment plants can achieve substantial improvements in operational efficiency. This study underscores the potential of hybrid technologies to reshape the future of wastewater treatment through energy-conscious design and operation.

Keywords

Moving bed; hybrid technology; energy use for aeration; intermittent aeration

HYBRID DISINTEGRATION AS A METHOD FOR INCREASING ENERGY RECOVERY FROM SEWAGE SLUDGE – PRELIMINARY STUDY

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Abstract

The disintegration process can be a tool for improving the efficiency of the methane fermentation process at wastewater treatment plants, thereby contributing to increased energy recovery from sewage sludge. In the research project being conducted, we are analyzing two different methods of sewage sludge disintegration: hydrodynamic and chemical disintegration, as well as exploring the possibility of combining both methods in a hybrid process, aiming to achieve promising results without the need for large doses of chemical agents and with moderate electricity consumption due to the synergistic effect of both methods. In preliminary studies involving batch tests, we aimed to determine the appropriate doses of the chemical agent (NaOH) and the energy density in the hydrodynamic disintegration process, which could be used in the hybrid disintegration of sewage sludge directed to the fermentation chambers. The influence of these technological parameters on the release of organic compounds (COD and VFAs), as well as nitrogen and phosphorus compounds into the sludge liquid, was analyzed. The effect of the disintegration process on the methane potential of sewage sludge was also examined in Biochemical Methane Potential (BMP) tests. The results of the preliminary studies will be used to determine the parameters under which research will be conducted on the impact of hybrid disintegration on the efficiency of the methane fermentation process in continuous culture mode, where it will be possible to assess both the impact on biogas production, the degree of sludge digestion, as well as the dewatering and rheological properties of the sludge.

Keywords

Anaerobic digestion, sewage sludge disintegration, hybrid disintegration, energy recovery from sewage sludge

THE BALANCE BETWEEN FREEDOM OF SPEECH, PROTECTION OF RELIGIOUS FEELINGS AND ENVIRONMENTAL CONSCIOUSNESS IN THE CONTEXT OF ECTHR PRACTICE

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Abstract

This research is highly relevant as it addresses the contemporary legal challenges arising from the intersection of human rights, religious sensitivities, and environmental responsibilities. By examining ECtHR case law, it offers insights into how legal systems can evolve to address conflicts between these critical areas in modern democratic societies. Moreover, the study emphasizes the need for integrating ecological considerations into legal frameworks, reflecting the increasing importance of environmental sustainability in both policy-making and human rights protection. This study explores the intricate balance between freedom of speech, the protection of religious feelings, and environmental consciousness within the framework of European Court of Human Rights (ECtHR) practice. The research underscores the complexity of reconciling freedom of expression with the need to protect religious beliefs and emerging environmental responsibilities. The ECtHR applies a proportionality test and principles of necessity, ensuring that any restrictions on freedom of expression serve legitimate aims within a democratic society. By analyzing the Court's case law, the study highlights the intersection of legal standards and environmental concerns, emphasizing that freedom of speech must be balanced against the protection of religious sentiments and environmental awareness. The integration of ecological aspects into the Court's considerations reflects growing societal values regarding the preservation of the environment. As religious communities increasingly engage with environmental issues, the alignment of freedom of speech, religious feelings, and environmental protection becomes crucial for maintaining justice and societal harmony. The findings call for national legal systems to adapt ECtHR standards to ensure a balanced coexistence of these essential rights and interests.

Keywords

Freedom of Speech, Religious Feelings, Environmental Consciousness, ECtHR, Proportionality Principle, Human Rights, Legal Framework

THE IMPACT OF THE PHILOSOPHY OF THE DICHOTOMY OF POWER AND SOCIETY ON FREEDOM OF RELIGION IN UKRAINE: LEGAL AND ENVIRONMENTAL ASPECTS

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Abstract

The article "The Impact of the Philosophy of the Dichotomy of Power and Society on Freedom of Religion in Ukraine: Legal and Environmental Aspects" explores the complex relationship between philosophical concepts of state, society, and religion, particularly how these ideas influence the legislative regulation of religious freedom in Ukraine. It also highlights the growing involvement of religious organizations in addressing environmental challenges.

The study reviews the philosophical approaches of thinkers such as Hobbes, Locke, Rousseau, and Hegel, analyzing their impact on legal systems and their relevance to contemporary discussions about ecology. Although these philosophers did not directly address environmental issues, their ideas on the state's role in maintaining order, the social contract, and individual rights offer valuable insights into modern environmental governance.

Religious institutions are seen as potential agents for promoting ecological responsibility through moral and ethical teachings. The research suggests that integrating religious principles into state environmental strategies could enhance legislative efforts in Ukraine. However, challenges such as inadequate legal support and insufficient monitoring of religious organizations' environmental initiatives remain.

Ultimately, the article offers scientifically based recommendations for improving Ukraine's legislation on freedom of religion and ecology, emphasizing the need to harmonize national laws with European standards while acknowledging the country's historical, cultural, and religious particularities.

Keywords

Freedom of Religion, Environmental Responsibility, Dichotomy of Power and Society, Ukrainian Legislation, Philosophical Concepts, Religious Organizations, Legal Regulation

MUNICIPAL WASTEWATER RECLAMATION – OPPORTUNITIES AND CHALLENGES

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Abstract

Water scarcity is a global phenomenon severely impacting numerous communities worldwide. In 2022 alone, over 2 billion people lacked access to safely managed water. Furthermore, the problem of water shortages is projected to be intensified by the climate change-related rise of global temperatures, growing population, and increasing water demand. Undoubtedly, there is a growing need for solutions addressing the issue of freshwater shortages and providing both sustainable and accessible water supply in the future. Such solutions include municipal wastewater reclamation, which is tapping into the potential of turning hazardous waste into a valuable resource.

Water recovery technologies are very different; several processes are usually combined and selected for a specific purpose of water use. When choosing a technology, it is essential to consider three main aspects: 1) ecological, 2) economical, 3) regulatory. Well-selected technology removes various pollutants, including micropollutants (heavy metals, pharmaceuticals, pesticides, biocides, perfluoroalkyl substances, and microplastics). It also allows for the destruction of living and spore forms of pathogenic organisms and prevents their secondary development. Simultaneous recycling of water and nutrients is also possible, i.e. selecting the amounts and chemical forms of nitrogen, phosphorus, and potassium.

Recovering water from wastewater is a concept that is becoming interesting for urban WWTPs operators. Most operators close internal circuits or use treated wastewater in the technological processes of plants. However, external use, e.g., washing streets or watering public green areas, is still unpopular. The potential is most significant here due to saving resources (drinking water). In the ReNutriWater project, the possibility of using reclaimed water is assessed depending on the local conditions of a given WWTP. This issue will be the topic of the proposed poster.

Acknowledgments: Paper was prepared as a part of project “Closing local water circuits by recirculation nutrients and water and using them in nature” (ReNutriWater) financed by European Regional Development Fund (ERDF), project no. #C016.

Keywords

Water scarcity, micropollutants, reclaimed water

CHALLENGES FOR DEVELOPING COUNTRIES IN THE IMPLEMENTATION OF THE LONDON PROTOCOL AND THE MARPOL CONVENTION FOR PREVENTION OF POLLUTION OF THE MARINE ENVIRONMENT

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Abstract

Marine litter is a growing problem with serious environmental, economic, and human health implications. The marine environment is polluted by the intentional or accidental disposal of waste by individuals or businesses, as well as by wind, rainwater, or sewage. It is estimated that more than 6.4 million tons of waste enter the marine ecosystem annually, with 80% coming from land sources and the remaining 20% from marine sources.

Different organizations have developed international treaties of global application to protect the marine environment from pollution. There are two important conventions that aim to protect the marine environment. They are:

1. The "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972", the "London Convention" for short and the "London Protocol"
2. The "International Convention for the Prevention of Pollution from Ships (MARPOL)"

Both treaties aim to prevent pollution. The London Protocol restricts the dumping of Dredged material; Sewage sludge; Industrial fish processing; Vessels and offshore platforms or other man-made structures at sea; Inert, inorganic geological material; Organic material of natural origin and Bulky items including iron, steel, concrete and similar non-injurious materials where physical impact is a concern, and only in those circumstances where such wastes occur in locations, such as small islands with isolated communities, where there is no practical access to disposal options other than landfilling. MARPOL addresses pollution from ships caused by operational or accidental factors through its six annexes regulating pollution by: I. Oil; II. Noxious Liquid Substances in Bulk; III. Harmful Substances Carried by Sea in Packaged Form; IV. Sewage from Ships; V. Garbage from Ships and VI. Air Pollution from Ships.

This article reports a research conducted to assess the implications for Costa Rica of adhering to or not to these conventions. The conclusion is that while signing the treaties is relatively straightforward, implementing the directives and guidelines provided by the International Maritime Organization (IMO) presents challenges. Barriers to compliance include lack of accurate information existing in the country, inconsistent regulations, and local institutions not taking responsibility due to limited knowledge, resources, and other factors.

Keywords

London Protocol of 1996, Dredged material, Marpol Convention, Marine litter

THE POTENTIAL OF SAND – POLONITE FILTERS FOR REDUCING TOTAL PHOSPHORUS CONCENTRATION IN SUBSURFACE HORIZONTAL FLOW CONSTRUCTED WETLANDS

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Abstract

The aim of this research is to develop an effective sand-polonite filter mixture for individual treatment plants to reduce the total phosphorus concentration in wastewater. The hypothesis is that the appropriate proportions of sand and polonite in the filter mixture will effectively reduce the total phosphorus concentration in wastewater. In the study, nine different sand-polonite mixtures with various material proportions were developed. A phosphorus-containing solution ($C_p$tot ~17 mg/L) was prepared to assess the effectiveness of these mixtures in reducing total phosphorus concentration by filtering the water through them. Total phosphorus concentrations were measured using a spectrophotometer before and after filtration.

Based on laboratory trials, the use of a sand-polonite mixture for reducing total phosphorus in subsurface flow constructed wetlands shows the good potential. The mixtures with varying proportions of sand and polonite demonstrated effective phosphorus removal, achieving reduction efficiencies greater than 90%. In mixtures with low (10-30%) Polonite content, the influencing factor on phosphorus reduction efficiency was the retention time: the longer the phosphorus-containing solution remained in the filter, the greater the reduction in total phosphorus concentration. In mixtures with moderate (40-60%) Polonite content, the key factor for phosphorus reduction efficiency was the proportion of Polonite in the mixture.

Employing sand-polonite materials in constructed wetlands can mitigate seasonal variations in wastewater treatment efficiency, particularly by enhancing phosphorus reduction during non-vegetative periods. To ensure optimal performance, it is crucial to maintain continuous water flow to prevent chemical clogging, and it is recommended to separate the mixture from fine particles (smaller than 2 mm). This research highlights the potential of sand-polonite mixtures as a viable method for enhancing phosphorus removal in wastewater treatment systems.

Keywords

Phosphorous removal, wastewater treatment, adsorption, constructed wetlands, filter material

NATURAL DECENTRALIZED SYSTEM FOR THE CLOSED-LOOP REGENERATION AND REUSE OF WATER

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Abstract

BeAquaAgain designs and implements natural decentralized systems for regeneration and reuse of water. These small scale expandable systems imitate structures and processes in undisturbed aquatic ecosystems. Presented system solutions demonstrate a closed-loop, waste-free approach to on-site treatment of sewage and contaminated water. By applying principles of microbial food-webs and natural materials such as biochar and zeolites, we engineer resilient systems for regeneration of healthy water in any climatic and social economic conditions. At the same time, phosphorus accumulating bacteria are applied for quantitative recovery of phosphorus and its reuse on land - a patent-pending technology. We demonstrate how such decentralized systems bring transformative and regenerative changes to communities and ecosystems by increasing water - food security and environmental resilience.

Keywords

Nature-based systems, ecosystem services, microbial food-webs, regeneration, reuse

DEGRADATION OF CIGARETTE BUTTS USING GANODERMA LUCIDUM FUNGUS

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Abstract

Cigarette butts, despite their small size, pose a significant environmental problem. Their chemical composition, rich in toxic substances, makes them a dangerous contaminant for soils and water. As they seep into the soil and are washed away by rain, they pollute aquatic ecosystems and endanger the health of various species. Tobacco production and consumption have a significant global environmental impact. From cultivation, which involves excessive pesticide use and deforestation, to the final disposal of cigarette butts, tobacco leaves a destructive footprint. Additionally, the tobacco industry is linked to public health problems, child labor, and gender inequality in producing countries. The lack of proper cigarette butt management has led to the search for innovative solutions. Bioremediation, a process that uses living organisms to break down contaminants, presents a promising alternative. Fungi such as Ganoderma lucidum have the ability to decompose the toxic components of cigarette butts, transforming them into less harmful substances. The issue of cigarette butts aligns with several Sustainable Development Goals (SDGs). Proper management of this waste contributes to ensuring healthy lives, protecting marine ecosystems, and promoting sustainable forest management. This study focuses on evaluating the potential of the fungus Ganoderma lucidum to degrade cigarette butts. The objective is to develop an effective and accessible bioremediation technology to address this environmental problem.

Keywords

Cigarette butts, Tobacco, Tobacco industry, Bioremediation

GEOSPATIAL DATA ANALYSIS OF DEGRADED AREAS OF VIDZEME AND LATGALE REGIONS

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Abstract

The use of degraded areas reduces the burden on the use of agricultural land for industrial purposes. After the restoration of the country's independence in 1991, the area of agricultural land in Latvia has decreased by 21.7%. Taking into account climate change and the current geopolitical situation, it is necessary to look for suitable territories for the production of electricity with renewable energy sources in order to ensure the country's energy independence. In the study, 158 pcs.geospatial analysis of land units containing contaminated or potentially contaminated territory. The goal was to find out which of the land units, on which the municipal waste collection and storage sites of rural areas were historically located, would be suitable for the possible construction of solar and wind power plants. Measurements were made from the geometric center of the land unit to electrical networks, settlements, access roads, nature protection objects. It was determined that the state and the municipality own 71% of the land units with degraded territory. Of the land units included in the study, up to 10% have potential for electricity generation with renewable energy resources.

Keywords

Degraded area, renewable energy, geospatial analysis

THE INNOVATIVE ENVIRONMENTAL TECHNOLOGIES: ADDRESSING THE PHOSPHORUS CHALLENGE OF THIS CENTURY

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Abstract

Phosphorus, a vital nutrient for global food production, faces significant environmental and resource challenges, including eutrophication and depletion. Urbanization, industrialization, and intensive agriculture have elevated phosphorus levels in aquatic systems, degrading water quality and biodiversity. Eutrophication, driven by excess phosphorus, promotes algal blooms and oxygen depletion, endangering ecosystems, fisheries, and recreational waters. This study investigates innovative technologies for phosphorus removal and recovery from municipal wastewater, emphasizing the use of natural sorbent materials such as calcium- and iron-rich composites, Polonite, and other minerals. These sorbents achieve high removal efficiency while minimizing chemical use, reducing sludge production, and enabling recovery. Compared to conventional methods like chemical precipitation and enhanced biological phosphorus removal (EBPR), they offer greater simplicity, environmental benefits, and adaptability to diverse wastewater conditions. By integrating these sustainable approaches, wastewater treatment systems can align with circular economy principles and support agricultural resilience through phosphorus recovery. This not only mitigates environmental challenges but also reduces dependence on finite phosphorus reserves, fostering sustainable resource management.

Keywords

phosphorus, environmental technologies, resource recovery, circular economy

CHALLENGES IN COMMUNAL WATER SUPPLY: THE CASE OF THE CHITARÍA COMMUNITY AQUEDUCT

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Abstract

Drinking water supply is essential for both domestic and industrial development. Effective management requires a comprehensive understanding of the system, including infrastructure, resources, and users. It is crucial to establish adequate governance of water resources, encompassing all necessary processes to make informed decisions and execute actions that ensure the effective management and provision of services to the community, in compliance with legal, social, environmental, and economic regulations (Centro de Derecho Ambiental y Recursos Naturales, 2013).

In Costa Rica, approximately 95% of the urban population has access to good-quality water; however, deficiencies in supply persist in rural areas. While large distributors possess the necessary resources and technology, the challenges are more pronounced in these rural regions (Soto, Gaviria & Pino, 2016).

A key recommendation is to conduct studies aimed at developing a system of indicators and monitoring tools to evaluate the performance of communal organizations. This would facilitate the identification of gaps and enable the quantification of the effectiveness of the measures adopted, assisting decision-makers in setting verifiable goals and enhancing accountability (Gentes, 2009).

A detailed diagnosis is crucial for identifying areas of improvement in the operation and management of the system (United Nations Water, 2021). This analysis, which includes the creation of cadastres for networks and users, is fundamental for optimizing the operation of aqueducts (Ziegler et al., 2011; Muñoz Martos & Rueda Rincón, 2017). Hydraulic parameter tests, combined with the cadastre, allow for hydraulic modeling that reflects the system's behavior. Additionally, data regarding the operational and administrative management of the aqueduct is collected and analyzed, involving both users and collaborators from the provider.

The diagnosis conducted for the Chitaría community aqueduct included a topographic survey using GNSS technology, the creation of a Geographic Information System (GIS), and measurements of flow and pressure. EPANET modeling identified critical areas with low pressure, highlighting the need for infrastructure improvements such as the installation of hydrants and regulating valves. Regarding administrative management, processes that have not been fully complied with were identified, which are priorities for enhancing service quality. An important challenge is the culture and involvement of users, leading to illegal connections and unreported situations, influenced by the Municipality's oversight of the aqueduct.

In conclusion, the aqueduct faces challenges in multiple areas, from administrative issues to inadequate infrastructure and a lack of metering equipment, all of which negatively impact water supply. A comprehensive strategy that includes the reconstruction of the aqueduct is recommended.

Keywords

Water supply, community management, rural aqueduct

ACOUSTIC PERFORMANCE OF PANELS MADE FROM RECYCLED POLYESTER FIBER DERIVED FROM PET BOTTLES

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Abstract

The global issue of PET bottles lies in their contribution to plastic pollution, as millions of bottles are discarded daily, often ending up in landfills or oceans. This non-biodegradable waste poses a significant threat to wildlife and ecosystems, while also contributing to the growing plastic waste crisis. This study investigates the acoustic performance of panels made in the laboratory from recycled polyester fibre extracted from post-consumer PET bottles, addressing the growing environmental challenges of plastic waste. The key objective of this research is to evaluate the sound absorption properties of these panels and explore their potential for application in noise control solutions. The acoustic performance of the panels was tested across a range of frequencies. Testing followed standard procedures for determining sound absorption characteristics in accordance with ISO 10534-2 using the impedance tube method. Results indicate that the panel exhibit significant sound absorption, particularly in the mid-frequency range, making them suitable for use in spaces such as offices, classrooms, and auditoriums. In addition to their acoustic properties, the panels offer environmental benefits by reducing PET waste and minimizing reliance on non-renewable resources commonly used in acoustic treatments. This research highlights the potential of recycled polyester fiber panels as an effective and sustainable solution for sound absorption in various architectural applications. Further studies are recommended to explore their long-term durability and performance under different environmental conditions, as well as their cost-effectiveness compared to conventional acoustic materials.

Keywords

PET Bottles, Acoustic Performance, Recycled Polyester, Sustainable Acoustic Solutions,

REUSE AND RECYCLING IN THE NEW WASTEWATER TREATMENT PLANT - KALMARSUNDSVERKET

Qing Zhao

Kalmar Water

Abstract

Kalmarsundsverket is a new wastewater treatment plant that is currently in the building phase. The plant will be taken into commissioning in the end of 2026. It is one of the biggest investment projects in Kalmar municipality. The new treatment plant will meet the future more stringent discharge limit. It will decrease the nutrient discharge load to the Baltic Sea about 30 % even though the future influent load will be increasing. It is prepared for the future investment for removal of pharmaceutical residues. And it is built for water reuse, production of electricity and heat by biogas and reuse of certified sludge in the agriculture.

Keywords

Wastewater treatment, water reuse, nutrient recycling

THE NITRIFICATION PROCESS IN SOIL: THE IDENTIFICATION OF N_2O SOURCES

Sindija Frienberga, Dace Butenaite-Ragele, Inga Grīnfelde, Jovita Pilecka-Uļčugačeva

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Abstract

Nitrous oxide (N_2O) is a potent greenhouse gas contributing to global warming and ozone layer depletion. Its atmospheric concentrations have significantly increased over the past two decades, emphasizing the need for research into its sources and mitigation strategies. Denitrification and nitrification are the primary biological processes generating N_2O emissions in soil, influenced by soil moisture and aeration. Denitrification occurs under wet and anaerobic conditions, while nitrification dominates in aerobic environments. Understanding the contributions of these processes is essential for improving nitrogen cycle models and forecasting N_2O emissions under varying environmental conditions. This study employed isotopic analysis to differentiate N_2O sources under aerobic and anaerobic soil conditions. Mixed soil samples (n=26) were collected in June 2019 from test fields at the "Pēterlauki" holding, Latvia University of Life Sciences and Technologies. Samples were subjected to controlled moistening regimes (150 ml and 300 ml of water) every three days to simulate wet aerobic and anaerobic conditions. Isotopic measurements ($\delta^{15}N\alpha$, $\delta^{15}N\beta$, $\delta^{18}O$) were performed using Picarro G5131-i, with each sample measured three times over six sessions. Key findings include the following: Aerobic conditions were observed to produce higher proportions of $\delta^{15}N\alpha$ and $\delta^{15}N\beta$ isotopes compared to anaerobic conditions. The $\delta^{18}O$ isotopic proportions remained consistent across both conditions, indicating stability in this parameter. The results corroborate previous studies, confirming that soil aeration plays a critical role in influencing N_2O formation via nitrification and denitrification processes. Variations in isotopic signatures further suggest that factors such as soil chemical properties, plant influence, and treatment methods have significant impacts on N_2O emission pathways. These findings provide valuable insights into the complex mechanisms governing N_2O emissions in soils. This study underscores the necessity of detailed analyses of N_2O complexes, considering soil type, moisture, plant influence, and treatment methods. These findings provide valuable insights for refining nitrogen budget models and developing mitigation strategies to reduce N_2O emissions from soils.

Keywords

N_2O emissions, nitrification, denitrification, isotopic analysis, $\delta^{15}N\alpha$, $\delta^{15}N\beta$, $\delta^{18}O$, soil moisture, greenhouse gases, nitrogen cycle

FROM WASTEWATER TO RENEWABLE ENERGY: A CIRCULAR ECONOMY MODEL FOR REDUCING URBAN POLLUTION

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Abstract

The European Green Deal and Circular Economy Action Plan emphasize the importance of reducing waste volumes and adopting circular patterns in reactive nitrogen management. This includes a bioeconomy strategy that integrates terrestrial and marine ecosystems while adhering to sustainability and resource circularity principles. Household wastewater treatment is traditionally energy-intensive and reliant on fossil fuels, with limited opportunities for nitrogen recirculation. This study proposes a novel circular economy model using phytoremediation with willow in underground stream wetlands as a sustainable alternative for household wastewater treatment. This approach leverages natural processes to reduce pollution, recycle nitrogen, and produce biomass for energy generation. The research aimed to develop and validate this circular economy model through a pilot study in Nākotne village, Latvia, with 738 inhabitants. The study tested the hypothesis that willow-based phytoremediation in underground stream wetlands adheres to circular economy principles. Key calculations included determining the required area for wetlands (0.5166 m^2 per inhabitant) and evaluating costs and benefits, such as energy production, CO_2 sequestration, and oxygen generation. Additionally, pollutant accumulation was quantified, with 48.96 tons of nitrogen and 12.96 tons of phosphorus estimated over a 24-year period. The proposed model incorporates wastewater treatment, biomass generation, and renewable energy production, creating a closed-loop system that optimizes resource efficiency and promotes sustainability. Over a 24-year period, it was estimated that the system would process 969,732 m^3 of domestic wastewater from Nākotne village. Significant nitrogen and phosphorus uptake was demonstrated by willow, effectively reducing pollution levels in the treated effluent water. Biomass generated from willow plantations was found to be convertible into renewable energy, contributing to carbon neutrality and reducing reliance on fossil fuels. These findings highlight the sustainability and effectiveness of willow-based phytoremediation systems in wastewater management and resource recovery. The study confirms the feasibility of willow-based phytoremediation as a sustainable wastewater treatment method that aligns with circular economy principles. This model not only treats wastewater but also generates renewable energy, enhances biodiversity, and supports climate change mitigation efforts.

Keywords

Phytoremediation, circular economy, wastewater treatment, willow wetlands, nitrogen management, renewable energy, urban pollution, bioeconomy

FORECASTS OF WASTE VOLUME AND FLOW DYNAMICS IN LATVIA IN THE CONTEXT OF EU WASTE MANAGEMENT POLICY

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Abstract:
The rising waste production globally and in Latvia presents significant challenges for sustainable waste management. To address these challenges, the European Union (EU) has set ambitious waste reduction goals, including reducing landfill waste to 10% of total waste by 2035. Latvia is aligning its policies with these objectives by focusing on waste prevention, reuse, recycling, and minimizing environmental impacts. This research aims to analyse waste volume and flow dynamics in Latvia, assess current trends, and project future developments to support compliance with EU policies. The study utilized historical data from publicly available databases and the waste management company SIA "AAS Piejūra" covering waste volumes and flows from 2018 to 2023. Key data categories included glass, cardboard, mechanical waste processing, PET, and used tires. Analytical methods focused on identifying trends, fluctuations, and efficiency improvements in waste collection, recycling, and processing activities. Over the study period, total waste volumes were found to increase significantly, rising from 3,439.260 tons in 2018 to 11,877.354 tons in 2023, indicating improvements in waste collection and processing systems. A notable spike was observed in 2020, with waste volumes tripling compared to 2019. Recycling efforts showed marked success, with peak quantities achieved in 2023 for glass and in 2020 for cardboard, while mechanical waste processing (191212) remained the largest category, reaching 7,223.440 tons in 2023. However, fluctuations in categories such as PET and used tires highlighted challenges associated with demand, collection efficiency, and infrastructure limitations. The study underscores the importance of sustained investment in waste management infrastructure, improved sorting systems, and increased public awareness to enhance recycling efficiency and support sustainable waste practices. Latvia has demonstrated progress in waste management practices, particularly in expanding recycling efforts and improving processing capacity. This study provides a comprehensive evaluation of waste management dynamics, offering valuable insights for future strategic planning. By focusing on recycling efficiency, adapting infrastructure, and aligning with EU environmental policies, Latvia is well-positioned to achieve its sustainability goals and transition to a circular economy.

Keywords:
Waste management, circular economy, EU waste policy, recycling, waste flow dynamics, Latvia, sustainability, environmental targets

HYDROTHERMAL HUMIFICATION OF SPRUCE GREENERY BIOMASS AS A TOOL FOR THE PRODUCTION OF SYNTHETIC HUMIC SUBSTANCES

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Abstract

The evident need to replace fossil resources with renewable ones is essential not only to reduce the depletion of non-renewable or slow-renewing resources but also to combat climate change. One solution to limiting fossil resources is the development of a bioeconomy based on biomass waste, which can be considered a sustainable approach. The European Green Deal (EGD) aims to reduce greenhouse gas (GHG) emissions by at least 55% by 2030 compared to 1990 levels and for Europe to become the first climate-neutral continent by 2050. It also calls for a significant reduction in peat extraction for low-value products such as fuel and soil improvers, pushing for alternative sources. Currently, peat is the main raw material for soil improvers, but it is a slow-renewing fossil resource, and its extraction produces substantial GHG emissions (mostly CO_2 and CH_4). According to the Latvian State Forest Research Institute "Silava" 70% of peat GHG emissions come from agricultural peat, 16% from degraded areas, 9% from open peat extraction fields, and 5% from renaturalized areas, with total emissions reaching 1709 kt CO_2 equivalent annually. A potential alternative for soil improvers could be spruce green waste (a mix of fine branches and needles), left in forests after logging. This unused portion of the tree can account for up to 50% of the tree's dry mass (needles 27.9–32.3%; branches 13.1–20.0%). In 2021, Latvia harvested 13.56 million m^3 of wood, of which conifers accounted for about 8.03 million m^3. This biomass can be used for extracting various substances, leaving behind primarily lignin, cellulose, and hemicellulose, which can be thermochemically converted into synthetic humic substances using hydrothermal humification. This valorisation of biomass waste promotes a circular economy, reduces GHG emissions from biomass decomposition, and limits the depletion of slowly renewable resources while providing soil improvers.

Keywords

Peat, Conifers, Humic substances, hydrothermal humification, biomass

TECHNOLOGY TRANSFER POSSIBILITIES FOR PHOSPHORUS RECOVERY FROM SMALL AND MEDIUM-SIZED WASTEWATER TREATMENT PLANTS USING CAFEOXIDE

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Abstract

The sustainable recovery of phosphorus (P) from wastewater is a key challenge for modern wastewater treatment, particularly in small and medium-sized plants. This paper explores the use of calcium-iron oxide (CaFeOxide) as an effective sorbent for phosphorus removal, offering a solution that aligns with circular economy principles. Thermally treated CaFeOxide demonstrates a high adsorption capacity, exceeding 60 mg P/g, outperforming alternative recycled materials such as Ca/Fe-rich industrial by-products and waste materials. The saturated sorbent can be repurposed as a soil amender including fertilisation and pH regulation (e.g., struvite or calcium phosphate), contributing both environmental and economic value. By integrating phosphorus recovery into wastewater treatment systems, this approach addresses two critical issues: the growing scarcity of phosphorus resources and the environmental threat of eutrophication caused by excess phosphorus discharge. This study also examines the potential for technology transfer and scale-up to small and medium-sized wastewater treatment plants, emphasizing the economic viability of phosphorus recovery for agricultural reuse.

Keywords

Phosphorus recovery, Wastewater treatment, Eutrophication, Circular economy, Technology transfer

KAKHOVKA RESERVOIR – PROSPECTS OF RESTORATION

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Abstract

Based on the analysis of the lessons learned from the creation and operation of the Kakhovka Reservoir in the pre-war period and the disaster that occurred at the Kakhovka Hydroelectric Power Station in 2023 as a result of the explosion of its hydraulic structures by the Russian occupation forces, an alternative approach to the restoration of the lost hydropower potential and water resources of the Lower Dnipro within the former reservoir is proposed. The proposed approach is based on the idea of working out compromises when implementing the principles of integrated water resources management, risk diversification, and the use of nature-based solutions. As an alternative to the restoration of the Kakhovka Reservoir and the Kakhovka Hydroelectric Power Plant, a scheme of several reservoirs and several hydroelectric power plants within the former reservoir and a certain number (if necessary) of bulk reservoirs on the banks of the Dnipro, and within the Konske and Bazavlutske floodplains – the creation of artificial channels with a combination of culverts and fish passage channels.

Keywords

Risk diversification; Kakhovka Reservoir; trade-offs; nature-based solutions

ADSORPTION ACTIVITY OF CHEMICALLY MODIFIED WASTE FROM FOOD INDUSTRY

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Abstract

Due to the increase in industrialization, the contamination of water and wastewater with heavy metal ions is still growing. Conventional metal ion removal technologies are inefficient and commercially available sorbents are increasingly expensive. As literature data indicates, raw natural sorbents, i.e. fruit pomace have excellent adsorption capacity, biodegradability and non-toxicity in comparison with synthetic sorbents and is also cheaper.

There is a great chance of efficient use of apple pomace, which is produced on a large scale all over the world (it has been estimated that the global production of apple pomace was about 5 million in 2023), for designing new biosorbents for heavy and toxic metals removal from water and wastewater. The storage of waste from the agro-food industry carries the risk of mainly microbiological contamination. At the same time, due to the increase in industrialization, the contamination of water and wastewater with heavy metals is growing. Therefore, both problems, which are generally associated with the increase in civilization and human population growth in the world, are a great challenge for modern science.

Within the framework of the present study, sorption studies of apple pomace, raw and modified by joint synthesis of hydroxyapatite on its surface were performed. The sorption studies included the effects of contact time, weighting, pH and copper(II) ion concentration. The results confirmed an effective increase in adsorption capacity of the adsorbent due to their chemical modification.

Keywords

Apple pomace; adsorption; heavy metals; hydroxyapatite

L-ARGININE SALTS AS A POTENTIAL SUSTAINABLE FLAME RETARDANT FOR UNSATURATED POLYESTER RESIN

Adriana Dowbysz, Mariola Samsonowicz, Bożena Kukfisz

Bialystok University of Technology

Abstract

Continuous growth in the production of plastics, as well as an increase in plastic waste, which may be a source of environmental pollution, are of great importance for modern science.

Nowadays, composites containing unsaturated polyester resin (UPR) are widely used in the shipbuilding, rail, aerospace, automotive, and construction industries due to their high mechanical properties and chemical resistance. However, their high flammability and toxic smoke emission during fires pose a serious threat not only to human health and property but also to the environment.

A proper level of fire safety can be achieved by the use of flame retardants (FRs). Although limitations on FRs have been imposed, 39% of their global production accounts for FRs that pose a threat to human health and the environment. For this reason, in recent years, the replacement of halogenated and organophosphorus FRs, and others has led to the development of more sustainable FRs of natural origin. Moreover, it is advisable to look for other sources of non-toxic and effective FRs, along with their economic availability.

The aim of the study is to analyze the influence of L-arginine salts with high nitrogen content on the thermal degradation and emission of gaseous combustion products of UPR. Based on the conducted research and the analysis of volatile products changes in the degradation process of modified UPR are discussed and the most promising and efficient compounds in terms of enhancement of flame retardancy of UPR are proposed.

Keywords

L-arginine; thermal analysis; flammability; volatile products; unsaturated polyester resin

REMOVAL AND IMPACT OF BISPHENOL-A IN MOVING BED BIOLOGICAL REACTORS (MBBR) WITH DIFFERENT CARRIERS

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Abstract

Bisphenol A (BPA) is a widely produced plasticizer extensively used by different industries, resulting in continuous release into water bodies. BPA is classified as xenoestrogen (substance that causes endocrine disruption, among other impacts) in aquatic environment. Even after treatment in wastewater treatment plants (WWTPs), significant amounts of BPA remain in treated effluents discharged in receiving water bodies, often exceeding safe levels. The Moving Bed Biological Reactor (MBBR) is a promising biological treatment strategy for BPA removal. It promotes biomass growth on suspended carriers, which serve as platforms for microbiota growth, distinct from microbiota found in the water column. These carriers, which can have different characteristics, play a crucial role in the process, influencing biomass thickness, mass transfer, microbial composition, and pollutant removal efficiency. In the present investigation, three continuous flow bench-scale aerobic MBBR reactors, filled with carriers formed by different materials – polyethylene, polyurethane, and natural sponge (Luffa cylindrica) – received synthetic wastewater, initially without BPA (control conditions) and later on, with BPA added. The objective was to assess removal efficiency and the impact of different carriers on the removal efficiency. The reactors showed stable BPA removal efficiencies, with average rates of 92.1 ± 1.7% (MBBR1), 91.9 ± 1.7% (MBBR2), and 93.0 ± 1.0% (MBBR3), with no statistically significant differences between them (p-value = 0.22). The microbial communities in all reactors adapted well to a BPA concentration of approx. 100 µg L^{-1} after two weeks of acclimatization, maintaining their efficiency in removing organic matter and ammonium nitrogen.

Keywords

MBBR, Xenoestrogens, Bisphenol A, Carrier, Biological Treatment, Wastewater

PHOTOCATALYSIS AS A POLISHING STEP FOR DEGRADING BISPHENOLS AFTER BIOLOGICAL TREATMENT

Marina Pastre, Amanda F. do Amaral, Bruna Pagliari, Marcia Marques

Rio de Janeiro State University

Abstract

The presence of bisphenols among other contaminants in water and wastewater is a serious environmental issue of emerging interest globally. The ubiquitous occurrence of bisphenols in the environment is a result of their high production, extensive use, and subsequent release, as they do not naturally occur in the environment. The complete removal of bisphenols with a single treatment step is, however, challenging because of their widely varying characteristics, and such a goal requires innovative integration of treatment processes. One strategy to achieve the complete removal of bisphenols from wastewater is the application of a two-stage treatment process. Advanced oxidation processes (AOPs) can be used either as pretreatment or post-treatment of a biological treatment stage. Coupling AOPs with the biological process for wastewater treatment can reduce the concentration of compounds below the threshold value, minimizing the costs, and reducing the overall treatment time. In this study, photocatalytic oxidation process using simulated solar light irradiation was applied as a post-treatment step for degrading bisphenol A (BPA), bisphenol S (BPS) and bisphenol F (BPF) in synthetic wastewater after biological treatment in a moving biofilm reactor (MBBR) in bench scale. First, titanium dioxide (TiO2) was coated on borosilicate glass spheres (5 mm diameter) following the dip-coating method. A control sample without glass spheres was labeled TiO2-S, while the immobilized TiO2 was labeled TiO2-I. The effluent of the MBBR was collected in a tank, centrifuged and analyzed before passing through the photocatalytic reactor via peristaltic pump. The effluent of the photocatalytic reactor was collected at 15, 30, 60, 120, 180 and 240 min to evaluate the removal efficiency of the system. The BPA, BPS and BPF concentrations in the influent of the photocatalytic reactor were 14, 35 and 39 µg L-1, respectively. Batch studies indicated that at the immobilized system (TiO2-I), removal efficiencies of BPA, BPS and BPF were 94.9 ± 1.8%, 96.3 ± 2.5%, and 99.9 ± 0.2%, respectively. As for the suspended TiO2-S system, the BPA, BPS, BPF and BPAF removal after 4 h of simulated solar light exposure was 89.3 ± 11.1%, 64.9 ± 5.8%, and 96.1 ± 6.6%, respectively. The immobilized TiO2 combined high removal performance and energy efficiency, proving to be an appropriate and sustainable alternative to solar photocatalysis as a tertiary wastewater treatment.

Keywords

Tertiary treatment; Immobilized TiO2; BPA and analogs; wastewater

SYNTHESIS OF LUFFA CYLINDRICA BIOMASS-BASED ADSORBENT FOR PFOA REMOVAL FROM AQUEOUS MATRICES

Rodrigo Coutinho, Henrique Y. Hoshima, Beatriz Rocha, Marcia Marques

Rio de Janeiro State University

Abstract

Global concern about perfluoroalkyl substances (PFAS) has increased due to their very high environmental stability, recalcitrance to conventional water and wastewater treatment technologies and adverse effects on aquatic ecosystems, as well as potential risks to human health. These factors underscore the need for control measures and development of efficient and sustainable technologies to remove these persistent organic pollutants, especially from aqueous matrices. Among various PFAS, perfluorooctanoic acid (PFOA) is one of the most detected compounds in different environmental matrices such as water, air, soil, sediments and biota. Despite the restrictions and controls proposed by the European Commission (Stockholm Convention) and the US Environmental Protection Agency (EPA), PFOA continues to be widely used by the polymer and surfactant industries in many countries. Polishing techniques, such as oxidative processes, membrane filtration, and biological reactors, have been investigated for PFOA removal. However, many of these technologies involve high implementation costs, operational complexity, and, in some cases, the result is the partial degradation of PFOA, generating even more stable and toxic by-products. In this context, adsorption processes stand out as a feasible and efficient alternative, especially if low-cost biomass-based adsorbent materials is applied, offering a sustainable and cost-effective solution. This study aims to evaluate the optimal synthesis conditions for the preparation of an adsorbent material derived from Luffa cylindrica (plant sponge) for the removal of PFOA in aqueous matrices. To find the best synthesis conditions, thermochemical modifications of the biomass were tested using a Central Composite Design (CCD) with three independent variables: (i) temperature; (ii) residence time in the furnace; and (iii) type of activation. Removal efficiencies were evaluated at 30, 60, 120 and 180 min of contact time. Temperature and furnace residence time were identified as the most significant variables, with a 90% confidence level. The design of experiment (DoE) showed that setting the temperature at 400°C, residence time of 20 min and acid activation resulted in the removal of 87.7 ± 6.5% of PFOA in water at an initial concentration of 5 mg L-1. This approach offers a sustainable and promising alternative for the synthesis of biomass-based biosorbents capable of efficiently removing PFOA, thereby minimizing potential environmental and public health impacts. Future experiments with focus on the performance of such adsorbent in removing other contaminants of the PFAS group from water is recommended.

Keywords

Design of experiments; PFAS; adsorption process; biomass

ENHANCING EMERGENCY RESPONSE: MANAGING POST-EVENT IMPACTS FOLLOWING MAJOR INDUSTRIAL ACCIDENT

Diauddin Nammari, William Hogland

Kalmar University Alumni

Abstract

Fire, explosions, and uncontrolled emissions to air, water, and soil can cause significant disruptions to communities surrounding petrochemical and waste management sites. As industries have advanced, the risk of such uncontrolled events has diminished, but their potential severity has increased. Legislative improvements have enhanced public and environmental protection, mandating stricter controls and safety measures. However, gaps persist in emergency response planning, particularly in managing the aftermath of major accidents.

While facilities are typically designed to handle major accident hazards, many overlook the importance of an after-event emergency response plan. These plans are critical for managing residual hazards that can continue to threaten populations and the environment long after the initial event has passed. Emergency planning needs to evolve to not only prevent accidents but also to effectively mitigate the post-event impacts on both human health and ecological systems.

To bridge this gap, after-event emergency response planning should become an integral part of the safety case submissions for industrial facilities. These plans must detail specific measures to manage the consequences of major accidents, focusing on minimizing long-term environmental degradation and protecting nearby communities. Developing robust, site-specific strategies for post-event management will ensure that industries can better respond to both immediate and delayed effects, providing valuable lessons and improving resilience across the sector. Additionally, emergency response scenarios must account for the ongoing environmental impact, requiring continued assessment and mitigation efforts in the aftermath of a major incident.

Keywords

Emissions, Major accidents, Emergency response

DETECTION AND REMOVAL OF CONTAMINANTS OF EMERGING CONCERN (CECS) FROM DIFFERENT WATER MATRICES: HAVE WE ALREADY REACHED THE BEST POSSIBLE RESULTS?

Marcia Marques, Marina M. G. Pastre, Rodrigo Coutinho, Amanda F. do Amaral, Bruna G. Pagliari, Henrique Y. Hoshima, Diogo Sabino, Vanda A. da Costa

Rio de Janeiro State University (UERJ)

Abstract

The presence, concentration, toxicity on different species including humans, and technological options for removing contaminants of emerging concern (CECs) from different environmental matrices have been intensively investigated during the last decade. The results obtained through all these investigations so far have shown it is possible to significantly increase the percentage of removal or destruction of most CECs, particularly from water matrices using: (i) advanced biological treatment that promote microbiota diversity in the same reactor or in different reactors placed in sequence at wastewater treatment plants; (ii) non-destructive techniques, such as adsorption with commercial activated carbon or non-conventional adsorbents produced from different materials, such as plant biomass or advanced filtration; (iii) destructive techniques, such as advanced oxidation processes, including ozonation, Fenton/photo-Fenton, and heterogeneous photocatalysis; (iv) train-treatment approach, when different treatment steps are combined; (iv) development of new materials that bring together different properties (i.e. adsorption and photocatalysis) to create composites that promote CECs removal by more than one process. Over the last years, our research group has conducted experimental research with a focus on CECs detection and removal from aqueous media, including: (i) environmental monitoring of rivers with the highest relevance from the water supply viewpoint and urban lagoons with the highest ecological relevance, followed by health risk and ecological risk assessment respectively; (ii) treatability studies using Design of Experiments (DoE) for process optimization to remove 22 different CECs from water and wastewater applying advanced biological, sorptive and photocatalytic processes isolated or in combination with the use of composites formed by nanoparticles of the semiconductor titanium dioxide (TiO2) and different adsorbent materials; (iii) ecotoxicological assays to evaluate the remaining toxicity (particularly estrogenicity) in treated water and effluents. The efficiency achieved by different treatment techniques for different groups of CECs will be presented and discussed.

Keywords

Adsorption, Photocatalysis, MBBR, Estrogenicity, Desing of Experiments

CALLING PLANTS TO THE RESCUE FOR MITIGATING THE DETRIMENTAL EFFECTS OF WARFARE

Henrik Haller

Natural Sciences, Sustainable Development and Design, Mid Sweden University

Abstract

Armed conflicts imply devastating loss of civilian life, human suffering and infrastructural damage, but military activities also cause numerous environmental impacts. Plants play an essential role in the functioning of life on Earth. In addition to providing ecosystem services such as food, fresh water and fuel they may also help remediating disturbed environments. The objective of this study was to assesses some plant-based approaches for mitigation or prevention of some of the detrimental effects associated with armed conflicts. A scoping review of the potential for different plant-based approaches was conducted. The following three approaches were highlighted: (i) post-war phytoremediation, (ii) Urban agriculture for food security in ongoing conflicts, and (iii) meaning-making through urban gardening in the midst of conflicts. Examples from different conflict zones show that plant-based approaches may successfully be integrated in general strategies that aim to mitigate and prevent the detrimental effects of warfare.

Keywords

Warfare, environmental impact, phytoremediation, urban agriculture, meaning-making,

TOWARDS WATER SMART CITIES!?

Henrik Aspegren

Sweden Water Research

Abstract

Drivers for a shift towards a circular water system are climate adaptation, increased demands for water and wastewater treatment and new demands from customers Implementing a circular water system has numerous benefits, but it also faces several significant barriers e.g.:

- Complex Regulations and Permits
- Public Perception and Acceptance.
- Technological and Infrastructure Challenges
- Uncertain Economic Incentives
- Lack of Public and Political Support

In addition to environmental concerns, we have to plan and invest with robustness and resilience in mind. This may also be a driver for circular water systems.

Keywords

Circular water system, Water wise cities

REDUCTION OF METHANE IN LANDFILLS AFTER POST-CLOSURE PERIOD

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Estonian University of Life Sciences

Abstract

Closure of landfills does not stop decomposition of biodegradables, resulting in continuous production of leachate and landfill gas. The EU landfill directive mandates to monitor and manage the landfills for at least 30 years post-closing the landfills. However, how to manage methane emission after this monitoring period ends? Biological degradation of gas offer attractive alternative to reduce methane emission. There are three major challenges where scientific community could help the landfill owners and regulatory body: the design of such system; the selection of substrate, and the monitoring system, to ensure that the whole system remains operational. The materials used in biofilters such as biowaste compost, wood chips, etc. supports the growth of methanotrophic bacteria, which biologically degrade methane into carbon dioxide and water. The project becomes circular, if the material for biofilters were waste-based.

In Tallinn, Estonia, the Pääsküla landfill has passed the after-care period, where gas-to-energy was feasible. The decision was made to replace the active gas collection system with biofilters. In 2024, six biofilters were built. Selection of materials and monitoring of the filters was a duty of Estonian University of Life Sciences. After several lab experiments, a composition of 70% scarp yard compost and 30% mineral soil was selected. Preliminary results from the ongoing stage will be shown in the current presentation.

In Baltic countries, there are approximately 1400 closed landfills that require monitoring. Given the fact that Baltic countries have almost similar climate conditions, but also financial and cultural background, our work on reducing residual methane emissions in closed landfills would be beneficial and worth following for all the Baltic countries.

Keywords

Methane degradation, biofilter, biocover, GHG

TRAGEDY OF WASTE FIRES

Asim Ibrahim

Linnaeus University

Abstract

Waste fires has emerged as an important environmental and societal problem in the past two decades. Waste fires is a multifaceted issue and has several root causes including, poor understanding of the risk, poor waste collection infrastructure, improper sorting and waste diversity, lack of administrative control, lack of understanding on fire initiation and propagation, limitation in detection of waste fires etc. In this conference an overview of the problem of waste fires is presented and summary of recent work done on prevention and mitigation of waste fires is shared.

Keywords

Waste fires, Waste Management, Smouldering fire

III.FORESTRY, BIODIVERSITY AND CONSERVATION

NATURE-BASED SOLUTIONS AND BIODIVERSITY IN HIGHER EDUCATION: LIVING LABS APPROACH

Vitas Marozas, Anželika Dautartė, Vitas Marozas, Jolanta Stankevičiūtė, Gedimimas Brazaitis

Agriculture Academy Vytautas Magnus University

Abstract

Prioritizing environmental sustainability partnerships and capacity building with an emphasis on biodiversity and Nature-based Solutions (NBS) education is imperative today. A network that fosters transdisciplinary conversation and incorporates NBS ideas into professional and vocational education, academia, and society may prove beneficial in a resource-constrained world.

In order to improve biodiversity conservation, the Living Labs project "Education and Nature-Based Solutions: enable society to bend the curve for biodiversity" (eNaBlS) uses multiple viewpoints and skills to be integrated into TVET and higher education curricula. Through collaboration and institutionalization, this endeavor seeks to improve learning and capacity-building with an emphasis on relational, systems-oriented, and useful approaches.

It is crucial to collaborate across various fields and viewpoints, restructure education, and continuously improve one's skills. In order to promote a Nature Positive society, eNaBlS advocates radical modifications to lifestyles, corporate practices, and communities. In line with the EU's 2030 biodiversity policy and climate adaption plan, it seeks to improve climate conditions and biodiversity.

Keywords

Biodiversity, Education, Nature based solutions

ECO-FRIENDLY SEED CONTAINERS: A PARADIGM SHIFT IN ADDRESSING POLYTHENE SEEDBAGS USE IN RWANDA'S AGRICULTURAL SECTOR

Liliane Musabwa

LEARN WORK DEVELOP (LWD)

Abstract

Plastic pollution is increasingly recognized as the top global waste management impediment. Since the 1950s, plastic production and use have heightened, with an estimated 300 million tonnes of plastic waste produced annually. According to the United Nations Environmental Program (2022), only 9% of the produced plastic is recyclable, with the remaining being deposited as waste in natural environments and landfills. Despite plastic pollution being directly addressed by Sustainable Development Goal target 14.1, little is done to control single-use plastics in the agricultural sector. In the struggle to curtail plastic use, Rwanda seems to be at the forefront of battling plastic pollution, earning the title "the cleanest country in Africa". With more than 70% of Rwandans engaged in the Agricultural sector (FAO, 2022), the sector is the most significant contributor to plastic pollution. This paper analyses the current knowledge on the environmental impacts of plastic and assesses the potential of eco-friendly seed containers as replacers of polythene bags in Rwanda's agricultural sector. Using primary data and literature from peer-reviewed articles, journals, websites, reports, and dissertations, this paper suggests a sustainable agrarian solution with the potential to address plastic use in Rwanda's agricultural sector. Through qualitative data analysis through software such as Nvivo, the paper raises key insights around plastic use and its impact on Kigali's agricultural spaces. The paper critically evaluates banana barks as potential seed container vessels to replace polyethylene bags in agricultural spaces. Despite growing efforts to address plastic, little is written on plastic use in Rwanda, making it onerous to quantify plastic's past and current environmental impact on Rwanda's agricultural sector.

Keywords

Plasticulture, Eco-friendly, Pollution, Conservation, Seed Containers, Agrarian, Greenhouse Gases

THE ROLE OF SILICON FERTILIZATION IN ENHANCING SEEDLING GROWTH AND STRESS RESISTANCE: A REVIEW

Mehrdad Zarafshar, Peyman Ashkavand, Mehrasa Zare

Linnaeus university

Abstract

Silicon (Si) is increasingly recognized as a beneficial element in agriculture and forestry, particularly in enhancing seedling growth and improving resistance to various stresses. This review explores the role of silicon fertilization in seedling production, focusing on its physiological, biochemical, and morphological impacts. Silicon plays a critical role in alleviating both biotic and abiotic stresses, such as drought, salinity, heavy metal toxicity, and pathogen attacks, by enhancing the mechanical strength of plant tissues, improving water-use efficiency, and regulating stress-related gene expression. Additionally, silicon contributes to the improved uptake of essential nutrients and the stabilization of soil structure, fostering optimal conditions for root growth. The review synthesizes recent research findings on silicon fertilization in various seedling production systems, including forestry and agricultural crops, and highlights the potential for its broader application as a sustainable tool to boost plant resilience and productivity. The implications of silicon fertilization for seedling health under climate change-induced stresses are also discussed, along with future research directions and practical considerations for its use in nursery practices.

Keywords

Silicon fertilization, Plant stress tolerance, Soil-plant interactions, Forest nurseries

TECHNOLOGY FOR *FAGUS SYLVATICA* SEEDLING PRODUCTION – A CASE STUDY

Dagnija Lazdina, Kaspars Liepiņš, Viktorija Vendiņa, Santa Celma, Mudrīte Daugaviete, Kārlis Dūmiņš

LSFRI Silava

Abstract

Starting the cultivation of beech stands in Latvia is a solution for improving the adaptability of Latvia forests, and the offer of valuable roundwood assortments in our country will also diversify the opportunities of forest industry companies. In order to achieve these goals, it is necessary to adapt beech restoration methods that would be successfully applied in Latvia conditions. In order to be able to start growing beech in Latvia on a significant scale, it is necessary to create a planting material production technology that will allow to provide high-quality reproductive material suitable for local conditions. Anticipating that the future climate in Latvia will be suitable for the growth of beech stands, early planting of genetically high-quality seedlings obtained from mother trees selected in the selection process will increase the value of future stands and reduce the long-term risks associated with climate change in the selection of renewable/planted species.

Keywords

Fagus sylvatica, seedlings propagation, nursery

REFORESTATION IN GUATEMALA, CENTRAL AMERICA

Sven Kristensson, Lars Kristensson

SWE-CA, S.A.

Abstract

SWE-CA, S.A. is a company with more than 25 years of experience in the agroforestry branch. We specialize in the comprehensive management of the agroforestry cycle, from
the sale of seeds to the forestry harvesting machinery. We offer technical elevated cultivation nurseries with Ecofore® rigid agroforestry tray and/or with Ellepot® biodegradable paper. Technical nurseries have a cleaner production process, since contaminants such as plastic bags and agrochemicals are eliminated; it is also efficient with natural resources. Raised cultivation is commonly used to produce conifers and broadleaf trees, but they are also used for coffee, cardamom, sugar cane, African palm, banana, vegetables, citrus, fruit trees and ornamentals.

One of SWE-CA objectives is aimed at offering products for cleaner production and with that desire we organized together with the University of Linneus EcoTech 2019, Guatemala.

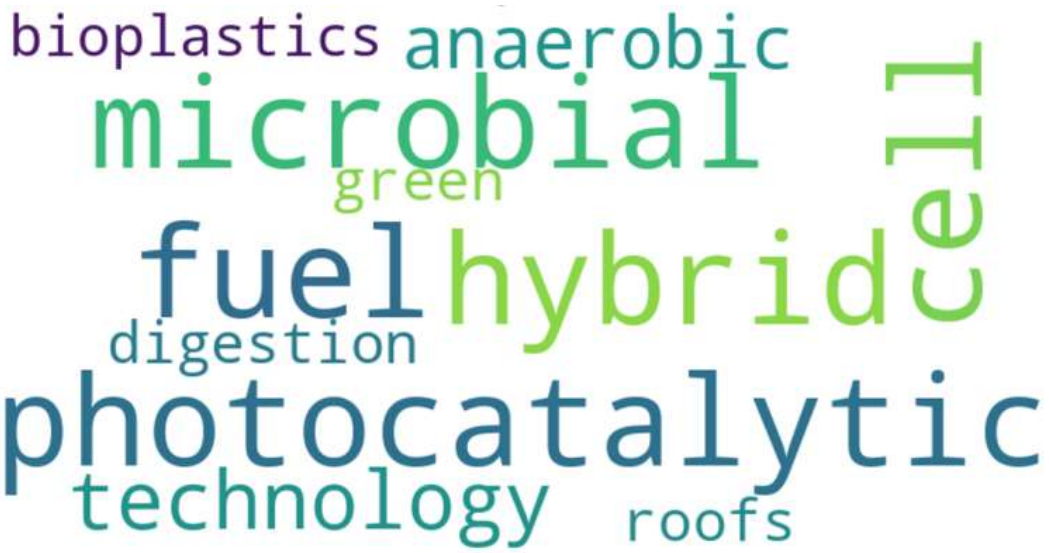
Mainly the aim was to share the options to mitigate climate change with reforestation and the use of green technology. The event also brought the participation of schools increasing awareness of climate change.

SWE-CA, S.A. has directly and indirectly reforested 62,295,000 trees in the Republic of Guatemala, Central America. We believe that collaboration and knowledge exchange are crucial in addressing the pressing environmental challenges we face today. As pioneers of elevated technology, we believe it is even more important to act on the matter of climate change and become leaders and agents of change in the market.

Keywords

Nursery, Reforestation, Guatemala, climate change

IV.GEOGRAPHY, GEOPHYSICS, GEOCHEMISTRY AND GEOLOGY



GEOTECHNICAL AND ENVIRONMENTAL OPTIONS IN THE BALTIC STATES' REGION FOR SMALL MODULAR REACTOR (SMR) CONSTRUCTION

Juris Burlakovs, Maris Krievans, Zane Vincevica-Gaile, Divya Pal, Martins Vilnitis

Riga Technical University

Abstract

Small modular reactors (SMR) are of growing interest, the regional geological situation determines whether such objects can be safely situated in any specific area. The dynamic progress of climate change in boreal regions, such as the Baltic States, may endanger the structural integrity of SMR. Soil shear strength and stiffness during warmer winters and more often freeze-thaw cycles, increasing moisture, might significantly influence the instability due to overconsolidation in some parts under the structure, activation of possible sliding planes between various layers (especially varved clays), resulting in the risk of structural settlement and instability, also higher corrosivity. Studies must include all kind of risk assessment regards geotechnics, environment and logistics.

Keywords

Geotechnical testing, nuclear energy, seismic studies

CORRELATION OF UNCONSOLIDATED UNDRAINED SHEAR STRENGTH OF CLAY SOILS BETWEEN UNIAXIAL AND TRIAXIAL TEST RESULTS

Juris Burlakovs, Maris Krievans, Daira Krope, Ivar Zekker, Zane Vincevica-Gaile, Andrey Krauklis, Martins Vilnitis

Riga Technical University

Abstract

The instability and potential threats for accidents in the foundation of prospective areas of energy infrastructure exist due to the complicated mechanical properties of soft soil in marine and glacial deposit regions. Before the construction of energy infrastructure, such as the installation of wind generators, solar panels, or power lines, it is desirable to carry out a geotechnical study, including field and laboratory tests to determine the mechanical properties of soil, including testing of the unconfined shear strength or compressive strength. Due to naturally large pore diameter and high porosity, the rapid permeability increase may destroy loose cementation. However, clay minerals' geotechnical properties change in triaxial confinement conditions, meaning the moisture increases followed by permeability fluctuations. In planning infrastructure works, these properties must be considered as properties influenced dramatically by dynamic conditions. Inaccurately obtained results on the mechanical parameters of the soil may have wrong results on the capacity of load and compressive strength determined in the laboratory, which may differ significantly in nature. It is essential to scale the factors when it would be advisable to perform an unconsolidated undrained triaxial test instead of a uniaxial test to obtain more accurate results. The triaxial test provides more accurate results using the pressure within the soil sample.

Keywords

Dynamic stress, uniaxial test, triaxial test, compressive strength

RESIDUAL FINE FRACTION OF WASTE XRD AND SEM STUDY RESULTS FOR POTENTIAL BIOCOVER CONSTRUCTION IN LANDFILLS

Juris Burlakovs, Maris Krievans, Inga Grinfelde, Ivar Zekker, Zane Vincevica-Gaile, Andrey Krauklis, Piotr Kunecki, Martins Vilnitis

Riga Technical University

Abstract

Waste is concern globally and reducing it through sustainable practices is wishful. This study provides the insight to the approach, methodology and investigation of waste deposits recognized as an inert mass and extracted at abandoned landfill site. Geotechnical and geochemical parameters of rejected inert waste fine fraction were performed, specifically through visualization through SEM imaging and mineral phases study with XRD. The gained results show that inert fraction of waste fine fraction might be reused in construction of cover material in landfills thus reducing environmental footprint reducing the use of raw material.

Keywords

Waste reject material, biocover, geotechnical properties

V.INFRASTRUCTURE AND SUSTAINABILITY

TOX-FREE CONSTRUCTION IN THE BALTIC SEA REGION: AN APPROACH OF NONHAZCITY-3 PROJECT

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Institute of Environmental Engineering, Kaunas University of Technology

Abstract

Green building practices aim at minimization of the environmental impact of buildings. Interreg Baltic Sea Region Programme project "Reducing hazardous substances in construction to safeguard the aquatic environment, protect human health and achieve more sustainable buildings" (NonHazCity-3) intends to contribute to green building practices in the Baltic Sea region countries by the developed and implemented strategic and practical solutions, addressing municipalities as well as private constructions and renovations.

The targeted pollutant screening was performed in five different matrices (construction materials, stormwater, indoor dust and air, and residential wastewater) to investigate whether construction sector contributes to outdoor and indoor environment. A broad array of pollutants, including biocides, organosphophate esters, metals, and PFAS, was quantified in storm water, suggesting that it acts as a conduit between the built environment and natural environment. Dust samples contained organic pollutants (plasticizers, PFAS, chlorinated paraffins). All this highlights the importance of better material choices to reduce health and environmental risks from the buildings. The mentioned strategic and technical solutions are intended to be helpful when making chemical smart choices. The Building material catalogue was compiled, which offers an overview on non-toxic, climate-neutral, and circular construction materials. Framework for the implementation of strategic planning phase in sustainable construction at municipalities was developed, including green public procurement (GPP) criteria, benchmarking the existing building certification systems with regard to the explicit coverage of hazardous substance aspects, guidelines for proper supply chain communication, and a market dialogue strategy for communication with the construction stakeholders. Practical solutions include Step-by-step guide for the process management of toxfree construction at municipalities; English language adaptation of the Swedish Byggvarubedömningen® database (BVB); the NHC3 series of fact sheets ; do-it-yourself (DIY) guide "Toxfree, circular and climate-friendly renovation of my home"; and the “Check(ED)” (ED – endocrine disruptors) consumer app.

Keywords

Building materials, tox-free building materials, green building practices, NonHazCity

FAITH AND HUMAN RESILIENCE – SUSTAINABLE RECOVERY AND HOPE FOR THE FUTURE.

Birgitta Åhlin

Swedish church

Abstract

"Faith and Human Resilience - Sustainable Recovery and Hope for the Future. Birgitta Åhlin, priest in the Swedish church. Southern Öland parish.

Emphasizes the importance of methods in post-disaster recovery. Highlighting human adaptability and the necessity for community support, it underscores faith as a source of trust, purpose, and direction. Through collective resilience and hope, the initiative advocates for rebuilding our environment and lives, ensuring sustainable recovery for humanity.

Keywords

Faith, Human resilience, Hope

NATURECULTURE PRESERVE MARHULT – CONTAMINATED SITES AS FIELD, DISCOURSE AND MATERIAL FOR TRANSDISCIPLINARY PROCESSES BETWEEN PRESERVATION, REMEDIATION AND REWILDING.

Timo Menke

Alumn at Konstfack, Stockholm

Abstract

The illegal landfill at Marhult (in rural Småland, Sweden) poses the kind of multi-complex environmental risk typically associated with socio-economic conditions in the global South. Dumped and scattered over the 30-hectare postindustrial sawmill ALEX since 2015 by a number of criminal networks, ca 35,000 tonnes of hazardous waste consisting of "fluff" (ground car parts), demolition debris, slaughterhouse waste and various microplastics have transformed both site and community into a toxic terra incognita.

The Marhult dump consists of a critical mass of archaeological, ecological and cultural agency ripe with deeply entangled relationships between what we call nature and culture, human and inhuman, or artifact and ecofact. Rather than zooming in on an environmental disaster to clean up, can the dump hold other valuable natural and cultural heritage significance to paradoxically “protect”? Could waste constitute future natural-cultural heritage? Waste as a world heritage? How can artistic processes and interdisciplinary methods investigate, rethink and transform the unknown potential of waste as Natureculture?

In the summer of 2023 I launched the project NatureCulture Reserve Marhult as part of the Småland Triennal, inviting participants and collaborators from the Arts and Humanities for interdisciplinary site-specific and process-based investigations of the landfill. My presentation of the project will give insight on challenging and renegotiating the binary concepts of natural and cultural heritage by considering waste as field, discourse and material for artistic processes.

Keywords

Process-based, garbology, nature-culture, Art, artifact-ecofact

SERIAL DISASTERS IN POST-EARTHQUAKE BAM: A STUDY OF ENVIRONMENTAL AND HUMAN RESILIENCE

Leila Papoli-Yazdi, Omran Garazhian

Garbonomix AB

Abstract

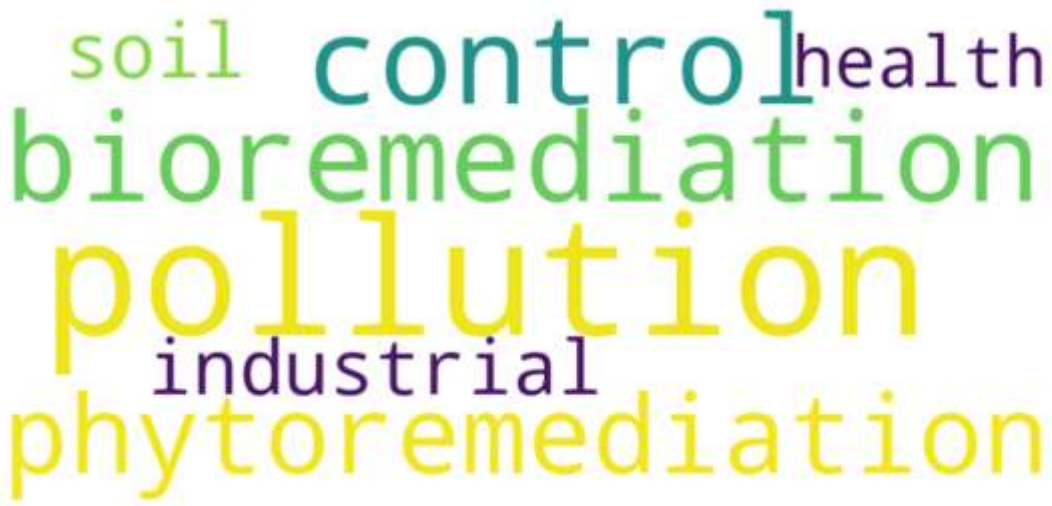
On December 26, 2003, a devastating earthquake struck the city of Bam in southeastern Iran, resulting in over 40,000 fatalities and the destruction of more than 80% of the city's residential infrastructure. Initially, governmental and international relief efforts focused on the urban area. However, subsequent investigations revealed that the earthquake triggered a cascade of environmental disasters. Bam is situated on the edge of the Lut Desert and is known as one of the region's largest oases. But, the villages in the county experienced severe water scarcity when survivors, displaced from the city, resettled in nearby villages, causing a significant population increase.

This study, conducted from 2003 to 2010, is part of the Ethnoarchaeology and Contemporary Archaeology of Post-Earthquake Bam project. It examines the patterns and impact of successive disasters that unfolded in this environment following the earthquake. This presentation will explore these interconnected events, shedding light on the broader implications for disaster management and environmental resilience.

Keywords

Disaster, environment, resilience, Bam city

VI.POLLUTION



THE CONCENTRATIONS OF HEAVY METALS IN SNOW WATER

Paula Miezāka, Jovita Pilecka-Uļčugačeva, Inga Grīnfelde

Latvia University of Life Sciences and Technologies, Faculty of Forest and Environmental Sciences, Latvia

Abstract:
Snow provides an effective medium for assessing air pollution due to its capacity to absorb organic and inorganic contaminants during deposition. This study investigates the impact of anthropogenic activities on air quality in Jelgava, Latvia, using snow samples as short-term pollution indicators. The aim is to evaluate the influence of transportation and other pollution sources by analyzing snow samples exposed for seven days. A total of 180 snow samples were collected across various city zones on December 15, 2020, and analyzed for heavy metal concentrations using inductively coupled plasma atomic emission spectrometry (ICP-OES). Results indicate that transportation is the predominant source of air pollution in Jelgava, contributing significantly to the concentrations of heavy metals such as lead (Pb), copper (Cu), zinc (Zn), and iron (Fe). Additional sources, including residential heating and industrial activities, were identified, particularly for pollutants like aluminum (Al) and copper (Cu). GIS-based mapping using the Inverse Distance Weighted (IDW) method revealed spatial variability in pollution levels, categorizing the city into areas of low, moderate, and high pollution. Notable hotspots include main streets like Dobeles šoseja and Satiksmes Street, which demonstrated the highest levels of Cu and Fe due to intense traffic and industrial emissions. The distribution of heavy metals in snow was observed to vary significantly across the studied area, influenced by anthropogenic activities. Zinc (Zn) concentrations were found to range from 4.63 to 1,000.43 µg/L, with the highest levels detected near industrial zones. Lead (Pb) levels, ranging from 0.35 to 51.12 µg/L, were identified as being elevated at major intersections. Copper (Cu) was measured within the range of 1.40 to 825.27 µg/L, with peaks recorded near main roads and residential areas where waste burning was practiced. Iron (Fe) concentrations, ranging from 0.05 to 34.91 mg/L, were predominantly associated with traffic-dense regions, highlighting the impact of vehicular emissions on urban snow pollution.The findings underscore the need for long-term air quality monitoring to complement short-term assessments and inform sustainable urban planning. Future studies should focus on longitudinal sampling and the integration of wind direction data to further understand pollution dynamics in urban settings.

Keywords:
Snow sampling, air pollution, heavy metals, ICP-OES, GIS mapping, transportation, urban planning, Jelgava, Latvia

ECO-FRIENDLY SOIL RECLAMATION IN POST-WAR UKRAINE

Valeriy Mykhaylenko* Mykola Blyzniuk* Ruslan Havryliuk*

Kyiv Medical University, Polish Campus, Ukraine

Poltava V.G. Korolenko National Pedagogical Universit, Ukraine

Institute of Geological Sciences of the National Academy of Sciences of Ukraine

*National Environmental Center of Ukraine**

The protracted war in Ukraine has opened up the problem of the spread of persistent organic pollutants (POPs) that have contaminated agricultural landscapes and open water bodies with highly toxic precipitation. These compounds are among the most dangerous unintentionally produced products that can migrate through food chains. Ukraine is one of the world's largest exporters of grains and oilseeds. The experience of recent wars demonstrates the danger of the spread of POPs in Afghanistan, Serbia, Bosnia, Georgia and Lebanon. Ukraine's war zones and destroyed energy infrastructure pose the highest risk and are recommended for UN protection. Unfortunately, Ukrainian society has little awareness of the dangers of a 'creeping' disaster, the consequences of which will be felt by both producers and consumers of agricultural products. Chemical contamination of soils threatens the sustainable development of Ukraine and endangers vulnerable populations that export food to Europe, Africa and Asia. According to economic analysts, the market and non-market cost of inaction could reach 10 per cent of global gross domestic product. The Carpathian School is a volunteer educational project dedicated to building information channels to inform the scientific community, students, farmers and other stakeholder groups about existing technologies for cleaning contaminated soils based on phytoremediation and biofiltration. Such methods are successfully used in the EU. Their advantage is accessibility, low cost and the ability to cover large areas. The organisers are planning a series of events to raise awareness among young people about this extremely complex and challenging issue, guided by the provisions of the Stockholm Convention on POPs, to which Ukraine is a party. This path is guided by influential international institutions focused on the implementation of the Global Framework for a Chemical and Waste-Free World (GFC) and the Bonn Declaration on Chemicals Management (Bonn, 2023).

Keywords: Aftermath of war; Hazard emission; Land reclamation; Phytoremediation; Education for Sustainable Development.

DESTRUCTION OF THE NATURAL ENVIRONMENT CAUSED BY THE WAR IN UKRAINE: IMPACT ON LAND, WATER, AND FOREST ECOSYSTEMS

Viktor Karamushka, Boychenko S.G., Khoriev M.Yu., Kozak O.M.

National University of Kyiv-Mohyla Academy

Abstract

The most powerful destructive factor affecting the settlements, infrastructure and natural environment of Ukraine is the full-scale invasion of the armed forces of the RF, which began on February 24, 2022. From the first months of this tragic period in the history of Ukraine, we focused our attention on registration and assessment of the impact of military activity on the natural environment, which in some cases had catastrophic consequences. The purpose of this study is to determine the specifics of the impact of military operations on the land surface, vegetation and water bodies of the affected territories based on the field research, remote monitoring and analysis of available published data. Examination of affected areas and analysis of available information makes it possible to identify at least three main forms of damage to the natural environment. These are the following.

Pollution and clogging of the atmosphere, lithosphere, hydrosphere and biosphere. Polluting substances - products formed as a result of ammunition explosions, damage to industrial and infrastructure facilities, maintenance and operation of military equipment, etc. As a rule, each recorded incident had an impact on several components of the environment. At the same time, atmospheric air pollution has a temporary, dynamic nature, while soil pollution, in particular, by oil products, has long-term consequences. A special form of littering a large part of the territory where hostilities took place, as well as the occupied territories, is their mining.

Physical destruction of natural and anthropogenic landscapes. Explosives of munitions on agricultural lands cause the formation of deep craters and destruction of the soil cover with long-term recovery. In addition to this impact, fires occurred in forest ecosystems, which caused emissions of significant amounts of combustion products into the atmosphere and complete or partial destruction of biotopes. Only in the Drevliansky National Park, fires destroyed more than 2,000 hectares of protected forests. The destruction of natural ecosystems also occurred as a result of their flooding or dehydration after the destruction of water resources management infrastructure.

Indirect (remote) consequences. This is a special form of influence associated with the synergistic impact of a number of factors. An illustrative example is the decrease of groundwater in the region of the Kakhovka Reservoir after its dewatering as a result of the detonation of the dam.

Paper describes case studies of the incidents and demonstrates specifics of the assessment of different forms of environmental damages.

Keywords

Military impact on the environment; pollution of air, soil and water resources; fires in ecosystems; landscapes destruction

OIL SPILLS RESULTED OF MILITARY ACTIONS: ENVIRONMENTAL CONSEQUENCES AND DECONTAMINATION TECHNIQUES

Iryna Ablieieva, Iryna Sipko

Linköping University; Sumy State University

Abstract

Oil spills resulting from military actions present significant environmental challenges and demand effective decontamination strategies. These incidents, often stemming from warfare-related damage to infrastructure such as pipelines, refineries, and storage facilities, can lead to widespread ecological damage. The environmental consequences include severe contamination of soil, waterways, and marine ecosystems, adversely affecting biodiversity, water quality, and public health. The consequence of soil pollution of the petroleum hydrocarbons remains their hydrophobicity, the occurrence of anaerobic conditions, increased erosion, and loss of soil fertility.

The impacts are exacerbated in conflict zones where response and remediation efforts are hindered by ongoing hostilities. Addressing these challenges requires a comprehensive approach encompassing immediate containment, clean-up, and long-term restoration efforts. Based on studies of toxicokinetic and toxicodynamic oil for certain groups of microorganisms, approaches to the use of bioremediation as an effective set of measures aimed at soil purification using biological objects have been developed. Bioaugmentation and biostimulation are two main techniques within bioremediation improving natural processes of petroleum hydrocarbon degradation with an appropriate microorganisms and nutrients needed for their metabolism. For this purpose, taxonomic classification and review of the metabolic pathways of the transformation of petroleum compounds were carried out using the electronic databases KEGG (Kyoto Encyclopedia of Genes and Genomes), MetaCyc, BacDive and the EzTaxon database and visualized using the IslandViewer 4 web server. Application of anaerobic digestate (by-product of biogas production) during biostimulation is currently under investigation due to content of nutrients, anaerobic bacteria and organic matter stimulating the process of oil compounds transformation.

Thus, military actions have a catastrophic effect on the environment by oil spills that require the development of specific techniques, particularly, soil bioremediation.

Keywords

bioremediation, digestate, electronic database, soil pollution, petroleum hydrocarbons

REVEALING THE INVISIBLE: MARINE PLASTIC WASTE AND ITS EFFECTS IN SCIENCE-INSPIRED VISUAL ART

Silvia Kurr

Linnaeus University

Abstract

Humans produce over 350 million tons of plastic waste annually, and this number is expected to triple by 2060. This means that the increasing amount of plastic waste persists, often creating harmful effects. In particular, marine plastic waste chokes turtles and birds that mistake it for food. Microplastics escape sewage treatment plants, enter the marine food chain, and accumulate in bodily tissues, causing health harm. Micro- and nanoplastics have been found in human organs, placentas, and unborn children. Plastic waste is not passive but capable of acting back upon human and nonhuman bodies. It thereby exhibits destructive agency.

The paper explores how science-inspired visual artworks can foreground the agency of marine plastic waste, challenging the perception of discarded plastic things as inert objects. In my analysis, I rely on the framework of intermedial ecocriticism and new materialist thought. New materialisms aim to challenge the anthropocentric view of the material world as a passive object and emphasize the human body as enmeshed in the environment.

Furthermore, the paper discusses two related issues: first, the invisibility of microplastics waste to the human eye; second, the sense of distance between everyday terrestrial practices and plastic in aquatic ecosystems. Empirical studies of public perceptions of plastic pollution have demonstrated that many people think of plastic waste as "a 'far away' problem" (Henderson and Green 2020: 4). This paper shows that the artistic visualizations of scientific knowledge about plastic waste behavior in the media of photography, sculpture, and installation can reveal the hidden connections between the materiality of plastic and the human body.

Keywords

Plastic waste, visual art, ecocriticism, intermediality, new materialisms

DESTRUCTION OF THE NATURAL ENVIRONMENT CAUSED BY THE WAR IN UKRAINE: IMPACT ON ATMOSPHERE, LAND, AND WATER ECOSYSTEMS

Viktor Karamushka, Karamushka V.I., Boychenko S.G., Khoriev M.Y., Kozak O.M.

National University of Kyiv-Mohyla Academy

Abstract

The most powerful destructive factor affecting the settlements, infrastructure and natural environment of Ukraine is the full-scale invasion of the armed forces of the RF, which began on February 24, 2022. From the first months of this tragic period in the history of Ukraine, we focused our attention on registration and assessment of the impact of military activity on the natural environment, which in some cases had catastrophic consequences. The purpose of this study is to determine the specifics of the impact of military operations on the land surface, water bodies, and vegetation of the affected territories based on the field research, remote monitoring and analysis of available published data. This paper describes results of the examination of affected areas after explosions of the missiles in forest zone (Buda-Babynetska case study) and deterioration of oil depots (Kalynivka case study).

Pollution and clogging of the atmosphere air and land surface were observed in all cases. Polluting substances were products formed as a result of ammunition explosions and burning of target materials. Our estimates show that the shock release of combustion products into the atmosphere after damage to the Kalynivka oil depot amounted to more than 40,000 tons of pollutants. Monitoring of the consequences of this case showed pollution of the soils and underground water by oil derivatives. The concentration of pollutants in affected land areas exceeded background concentrations by 28 or more times. The migration of polluted underground water ended up loading into surface water bodies. As a result, the average concentration of oil product in the affected pond was 40 times more than the maximum allowable concentration six months after the incident. This pollution had a detrimental effect on the coastal vegetation of the pond. We recorded pioneer species in this area a few months after registering the pollution load. In this case, atmospheric air pollution had a temporary, dynamic nature, while soil and water pollution, in particular, by oil products, has the long-term consequences.

Physical destruction of natural and anthropogenic landscapes was registered near Buda-Babynetska and Moshchun Villages, Kyiv Region. Explosion of missiles, bombs, shells in forest and agricultural areas caused the formation of deep craters, destruction of the soil cover, flora and fauna species with long-term recovery. In addition to this impact, fires in forest ecosystems caused emissions of significant amounts of combustion products into the atmosphere and complete or partial destruction of biotopes.

Paper describes the case studies of the incidents, demonstrates specifics of the assessment of different forms of environmental damages, and discusses the possible approaches to restoration of the disturbed environment.

Keywords

Military impact on the environment; pollution of air, soil and water; fires in ecosystems; landscapes destruction

ANALYSIS OF THE CONTAMINANT "MICROPLASTICS" IN MARINE AND FRESHWATER ECOSYSTEMS IN THE WORLD HERITAGE SITE COCOS ISLAND NATIONAL PARK, COSTA RICA

Maria Angelica Astorga Perez, Geiner Golfin Duarte, Andrea García Rojas, Fausto Arias Zumbado, Daniela Solís Adolio, Karol Ulate

Instituto Tecnologico de Costa Rica

Abstract

Microplastics (MPs) defined as 'small' pieces of plastic < 5 mm have been found everywhere scientists have looked: in deep oceans; in Arctic snow and Antarctic ice; in shellfish, table salt, drinking water and honey; and drifting in the air or falling with rain over mountains and cities. Nevertheless, considering that oceanic insular environments such as Coco´s Island, are even more vulnerable to plastic pollution because they could retain plastics from the adjacent ocean currents by different meteoceanographic mechanisms; ecologically, they are unique ecosystems in terms of biodiversity and endemism, and, the limited human activity and its remoteness from the mainland, the question arises about the status of contamination in Cocos Island National Park. The purpose of the project was to analyze the presence of MPs in the marine and freshwater ecosystem by comparing samples of biota, sediments and water. Two phases have been carried out; in 2018 the first phase was carried out and the presence of the contaminant in both ecosystems was analyzed. The detection of MPs in the marine ecosystem samples was expected due to exposure by marine currents, tourism activities, and discarded fishing gear from illegal fishing activities; however, the presence in the freshwater ecosystem were not expected and the sources of contamination were unclear, also the first phase only focused the survey close to the human activity. In the second phase developed in 2022, an analysis was conducted around the island, with the intention of compare the areas with human presence and areas without human presence to determine if the presence of ranger parks was a significant source of contamination in the freshwater ecosystem and also to determine if the distribution of MPs is consistent around the island or if there are accumulation sites in the two ecosystems. The results obtained indicate that the distribution of MPs in the marine and freshwater ecosystem was consistent around the island; therefore, human activity by staff is not a significant source of MPs. These results prove that issue most be viewed as a planetary boundary threat, therefore, governance strategies must be implemented. Also, a Global Plastic Waste Partnership must be established to determine the path to move forward.

Keywords

plastic microparticles, remote, oceanic island, deposition, long-range transport, source, distribution

SUSTAINABLE SORBENTS FOR PHOSPHORUS RECOVERY AND PATHOGEN REMOVAL IN WASTEWATER TREATMENT

Līga Irbe Mikosa[1,2], Kamila Gruškeviča[1], Rūta Ozola-Davidāne[2,3], Jūlija Karasa[2], Juris Kostjukovs[2]

[1]Riga Technical university [2]University of Latvia 3Latvia University of Life Sciences and Technologies

Abstract

The growing need for sustainable technologies in environmental management has driven research into effective resource recovery methods. One significant challenge is addressing the contamination of water bodies by pathogens (Escherichia coli, Salmonella, and cyanobacteria) and excessive nutrient loads, particularly phosphorus, which contribute to eutrophication and environmental degradation. The aim of this work is to evaluate the effectiveness of calcium and iron oxide composites (CaFeOxide) in removing pathogens and recovering phosphorus from wastewater, with the goal of reducing environmental pollution and enabling the reuse of spent sorbents. The study employed coagulation tests, zeta potential measurements, and microbiological analysis to investigate the sorbent's performance.

The experimental results demonstrated that CaFeOxide composites significantly reduced phosphorus levels in wastewater. Using 2 g/L of the composite, phosphorus concentrations were reduced from 27.4 mg/L to 3.74 mg/L, achieving an 84% reduction. At a higher dosage of 10 g/L, phosphorus removal reached 96%, although the 2 g/L dosage was deemed more economical for practical applications. Additionally, CaFeOxide reduced Bacillus subtilis spores in wastewater by 36.88%, further validating its pathogen reduction capability.

The experiments also included soil treatment using the recovered sorbent, which demonstrated its ability to modify soil pH and sustain microbial populations. For instance, at 25 mg of CaFeOxide per kilogram of soil, the pH increased from 8.86 to 9.33, while at 250 mg, the pH rose significantly to 12.08. Despite these pH changes, the microbial population in the soil remained stable, with no statistically significant difference ($p > 0.05$) observed between the control and treated samples. This indicates that CaFeOxide does not negatively impact soil microbial activity.

The findings suggest that CaFeOxide is a viable material for both phosphorus recovery and pathogen reduction in wastewater, with the added benefit of soil amendment potential. Future research should explore the long-term effects of CaFeOxide on soil ecosystems and its performance in removing other pollutants, such as heavy metals and organic contaminants. Additionally, DNA-based microbial analysis could provide further insights into the sorbent's influence on microbial communities.
This research is funded by Fundamental and applied research projects of the Latvian Council of Science "Unused Latvia's natural mineral resources for the development of innovative composite materials for phosphorus recovery from small municipal and industrial wastewater treatment plants to implement the principles of circular economy (CircleP, No. lzp-2021/1-0090)".

Keywords

Calcium and iron oxide composites, phosphorus removal, resource recovery, wastewater treatment, pathogen reduction

REFLECTIONS ON ACCIDENT MANAGEMENT IN BUSINESS

Åke Erlandsson, William Hogland

Kvalitet&MiljöUtveckling

Abstract

Since the early 80s has Åke Erlandsson worked with environmental issues in Swedish business. As Environmental Manager in a wood industry company for 20 years I have gained knowledge of environmental issues within the industry. The aim of this presentation is to discuss and present experience of decades of industrial environmental development in the wood industry. The manager experiences and reflections on how the business community can and should handle accidents are given. Three points are found crucial for a company's actions:

1) Strategy and preparedness for avoiding and managing accidents

2) Assessment of costs and other financial consequences

3) Assessment of the impact of external and internal goodwill

The open question for future is what a company make thorough risk assessments and taken into account the prevention of accidents.

Keywords

risk assessment

REMEDIATION OF POLLUTED ENVIRONMENT USING PLANTS AND MICROORGANISMS

Piotr Rybarczyk

Gdańsk University of Technology

Abstract

Environment pollution, beside continuous development of clean production technologies and novel remediation methods, is still an urgent global problem. In the perspective of sustainable development and circular economy perspectives, increasing interest for bio-based solutions for environment cleaning has been recently observed. The lecture focuses on to bio-based solutions i.e. phytoremediation for treating polluted soils and biofiltration for treating waste gases. Mechanisms how plants allow for the removal of heavy metals from soils and the microorganisms may be used for air treatment will be discussed. Research results of pilot studies on combined soil and air treatment will be preseted, including the strategies for enhancing phytoremediation and biofiltration performances.

Keywords

pollution; phytoremdiation; heavy metals; biotrickling filtration; volatile organic compounds

CHALLENGES IN RETROSPECTIVE TOXICOLOGICAL MONITORING: CURRENT ISSUES AND A POTENTIAL WAY FORWARD

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LNU - BOM

Abstract

Water quality management in the European Union is governed by the Water Framework Directive (WFD), which has a synergistic overlap with the Marine Strategy Framework Directive (MSFD) and the Drinking Water Directive (DWD). The WFD mandates achieving a "good chemical and ecological status" for surface, groundwater, and coastal waters, primarily through retrospective in situ biomonitoring and targeted chemical analysis of 45 priority pollutants.

However, this approach has faced criticism in environmental toxicology. Targeted chemical analysis is inherently limited to preselected substances, overlooking a myriad of other micropollutants present in the environment - often referred to as the "iceberg scenario." Additionally, while in situ biomonitoring assesses aggregate adverse effects on biota, analysis is only conducted a posteriori, detecting issues only after harmful impacts have occurred - potentially too late to mitigate damage to higher trophic levels of biological hierarchy.

Instead, bioassays (in vitro bioanalytical tools) have been proposed as a crucial supplement to current practices. They can be applied as stand-alone methods for assessing toxic effects, such as monitoring influent and effluent waters at wastewater treatment plants in a high-throughput manner. Alternatively, bioassays can complement chemical analysis and in situ monitoring in what is known as the TRIAD approach, offering a more comprehensive assessment. This strategy not only enhances environmental safety evaluations but also facilitates the detection of emerging pollutants that might evade prospective regulatory testing.

In this contribution, we will discuss the current challenges of retrospective toxicological monitoring and explore how novel in vitro test methods can address these issues. Additionally, we will highlight ongoing research at Linnaeus University that contributes to these advancements.

Keywords

Biomonitoring, in vitro bioassays, Water Framework Directive

COMBINED SEWER OVERFLOW IN A HISTORICAL PERSPECTIVE

William Hogland

Linnaeus University

Abstract

The municipal sewage networks were originally built to divert the untreated wastewater and stormwater directly to the nearest recipient. When, at the beginning of the 1950s, wastewater treatment in Sweden began in a rational way, cut-off lines were often built parallel to the receiver to collect the wastewater. For economic and practical reasons, these cut-off lines were only dimensioned for a certain flow intensity that was allowed to pass through the treatment plant. At intersections between the collection line and the cut-off line, where the flow load occasionally became too great, overflow drains were installed, combined sewer overflows (CSO) as they are called. CSOs have therefore become the most common way to regulate flow in combined sewer systems. In case of overload in connection with rain or snowmelt, wastewater overflows from the system without prior treatment to the nearest recipient.

CSO flooding is usually the least known part of the urban water balance. This was considered particularly serious in connection with the establishment of remediation plans for the municipalities' wiring networks. Good knowledge of the overflow conditions in the pipeline network means that the chapter set aside for rectification can be used optimally both with regard to the function of the pipeline system and the conditions in the recipient. The most common shortcomings in connection with overflows have poor flow control ability (unnecessary overflow), poor compound-reducing effect, poor accessibility (maintenance problems), poor working environment conditions. The following considerations should be made for the recipient; what is the biological status in the recipient today, how large are the CSO discharge today and what amounts of pollution burden does it give to the recipient, what will the recipient be used for (bathing, fishing, bird ponds, water pollution, etc.), which quality requirements must then be applied, is any overflow situation at all acceptable today in relation to recipient use and established requirements.

Many municipalities in Sweden have today removed the CSOs and recipient water quality has in most cases locally been improved.

Note. Part of this presentation material and text is taken from the report “Bräddavlopp” by Hogland, Berndtsson and Larsson, Byggforskningsrådet, 1986. ISBN 91-540-4580-0 (In Swedish)

Keywords

Combined Sewer Overflows, history, wastewater, flooding, treatment, Sweden

STORMWATER IN A HISTORICAL PERSPECTIVE

William Hogland,

Linnaeus University

Abstract

Before urbanization the natural landscape in the form of forests and meadows water infiltrated and the soil adsorbs the dominating part of the stormwater. Plants are important for stormwater reduction and improve infiltration, interception occur, and the root zone reduce the water percolating to form groundwater. A rainfall over a city occurs as frontal or convective rainstorm. Frontal rains usually have a duration of many hours and falls with a relatively low (moderate) intensity in southern Baltics, occurring normally during late summer and autumn. A strong local variation of rainfall intensity exists in urban areas related to orographic effects. Convective rains are generally caused by unequal cooling of the air the urban area or mountains and large waterbodies. The rains are characterized by highly intensity and short duration and also the areal distribution is wide. Heating from the city might warm air to rise which cause unequal cooling in particular in big cities with high buildings. Air pollutants increase condensation nuclei, vigorous turbulence and ascendent ais streams might originate in urban areas, higher temperature creates special air pressure with ascendent air streams and cloudiness. Stormwater is generated mainly from rainfall but also from melting hail and snow. The climatic changes seams increase both intensity and rainfall amount per event and the snowmelt which affect the urban runoff. The amount of water entering into the sewer system is of important for flooding and the imperviousness that increases city centers and today the impervious areas are of better quality and has les depression and less water evaporate. The number of pervious areas is of important for avoidance of flooding problems in urban areas and but also the groundwater level underneath the city. Before the 1960s in Sweden combined sewer was the most common and wastewater from household and industries was transported in the same pipe. The cities grow and the capacity of the pipes and more stormwater was added which created flooding in villa areas. Combined sewer overflow was constructed which means that a mixture of stormwater and untreated wastewater discharged directly to the recipient. Duplicate sewer system was constructed in new town districts which means wastewater and stormwater are transported in separated pipes and the stormwater was led directly to the recipient without and treatment and wastewater was lead to the waste water treatment plant which also had overflow for spill during heavy rainfall. It was more natural at that time to lead the stormwater directly to recipient because the stormwater was less polluted at that time because of not so heavy traffic in urban areas. The ratio between storm-water runoff and river flow is an important factor while considering the risks of erosion of the riverbanks and pollution of the receiving waters. The most critical situation from the quantitative point of view occurs during summer, when the river flow usually is low, but the stormwater and combined sewer overflow discharge is high during heavy rainfall. During a rainy day the ratio mentioned above on daily basis can increase 10 times compared to the 3h values and for the ten minutes value perhaps 25 times or more dependent on the size of the river (mentioned values are representative for small rivers in southern Sweden). The effect of climate related changes in rainfall and snowmelt intensity has to be studied and modelled. Stormwater is a potential water resource om great importance for use in the future society.

Furthermore, stormwater harvesting, and purification is of great importance to cover the water demand.

Keywords

Stormwater, history, generation, CSO, combined sewage system, duplicate sewage system, harvesting, purification

MAPPING THE INVISIBLE – FLOWS OF MICROPLASTICS IN A MODEL CITY

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Linköping University

Abstract

Microplastics have received increased attention in the last decade as a pollution of concern. As part of the zero pollution vision for 2050, the European Commission has formulated a target to reduce emissions of microplastics to the environment with 30% by 2030. Most of the microplastics originate from sources on land and urban wastewater and stormwater have been identified as pathways to the environment. In this study, flows of microplastics in wastewater and stormwater were quantified for a hypothetic city of 100 000 inhabitants. Two types of data were used for the quantification: 1) source estimates based on literature values and, 2) estimates based on extrapolation of measurements in urban waters. The quantified flows were also connected to potential mitigation efforts that have been brought up in policies, both preventive and in terms of treatment. The results show that the emissions of microplastics to stormwater were estimated to be much higher than those to wastewater. The largest source to wastewater was estimated to be synthetic fibres (mainly polyester) released during laundry washing. Polyester also had the largest share in the wastewater measurements. Tyre wear particles and cigarette butts were estimated to be the largest sources to the stormwater. While measurements confirmed tyre wear particles, other source could not be confirmed. Instead, the samples contained other types of microplastics. This mismatch indicates that large flows of microplastics may come from sources that have yet to be identified and quantified. The measures introduced to wastewater had the potential to reduce the load of microplastics in the wastewater by half. However, as wastewater treatment retain most of the microplastics, and because the largest emissions came from stormwater, this reduction made a small difference in terms of total loads to receiving waters. Reduced urban traffic, changed driving behaviour, and more stormwater treatment, were also required to reduce emissions of microplastics from the urban water system to receiving waters by 30% in accordance with the EU target.

Keywords

Control measures; microplastics; stormwater; substance flow analysis; waste water

POST-CATASTROPHIC ACTIONS – AN INTRODUCTION TO REMEDIATION

William Hogland

Linnaeus University

Abstract

If you go to google search you find catastrophic events are something very harmful or disastrous which even can make the stock market crashes which might be catastrophic event for private persons and for large investors. During recent years we have seen strong terrible momentous tragic events harmful for society and devastating things, caused by for instant wars, earthquakes, tornadoes, tsunamis related to catastrophic weather events and as well as huge forest fires. This is leading to flush flooding, deforestation, and huge erosion as well as landslides killing thousands of people on its way and leaving great harm and destruction of land as well as urban areas which leads to large ecological effects which might take decades to repair. The size of the catastrophe, disaster or accident can be experienced individually by person to person and how they physically have been affected. In the Linnaeus Eco-tech 24 conference, we highlight; war, flooding, fires, landslide, earthquake, oil, mining and industrial pollution, leachate, air pollution and include phytoremediation in the action plan to reduce the effect of the catastrophe and how to recover/remediate air, water and land.

Everybody is probably familiar with the theory about how Dinosaurs were extinguishing as animal species (by an asteroid/meteorite for 66 million years ago). At that time global devastation made air black brought iron and probably microorganisms to earth and created the highest tsunami ever and the asteroid is said to had diameter larger than height of Mount Everest.

In 1952 my hometown had a disaster not just by the fact I was born that year, but the new built glass factory burned down, and many work opportunities were lost. My first own contact with local catastrophe was a large forest fire when I was a kid, and I was helping the fire men and the fire brigade to extinguish the fire and spend numerous hours in the smoke from the fire and my health was temporally affected and I had to stay in bed some hours at home to recover. Furthermore, as a teenager I experienced a highly intensive convective rainfall. During a night the village got 160 mm rain and fathers commercial garden was totally flooded and I could padel canoe over the land and lots of soil masses were transported into the river, so much as a three-story building was in the risk to fall into the river. I got the first opportunity to appear in the TV news reporting about the disaster. I have also experienced several catastrophes in Brazil related to heavy rainfalls, landslides and collapses of mining sludge storage dams. The first I experienced on site I preceded 12 January 2011in the Serra do Mar Mountain region and with the nearby cities of Teresopolis and Nova Friburgo. The rain generated flash floods and sent huge masses of mud down the steep hillsides and 860 persons were killed and about 8 700 homeless. I was sitting just some 10 km from the site, and I registered a rain intensity of about 2.2 mm/minute and the highest intensity I have registered in Sweden is 1.8 mm/minute. The difference was that the area in Brazil had got 10-20 mm/day almost every day during the week before and the ground was saturated.

Another disaster at the Mariana in Brazil, where 170 people died in a landslide. A large dam collapsed containing a very large amount of sludge, an entire valley was flooded

into the sea with major consequences for the inhabitants. But unfortunately, at that time, the authorities escaped responsibility because the poor affected cannot wait for the relevant countermeasures, as the mining company provides many of them with their livelihood. Later, the Brazilian government took some minor measures, including some compensation for the families affected by the accident.

I was also on site in the Mariana Mine dam disaster, 5 November 2015, some weeks after the incident (the Bento Rodrigues or Samarco dam catastrophe, the Fundao tailing dam at the Germano iron ore mine in Samarco Mariana). I tried to raise money to help with the clean-up and involve Swedish experts. 19 people were killed, and the pollutants spread along 668 km in the river. The terrible thing is that another dam collapsed 25 January 2019, at Brumadinho in the state of Minas Gerais with the same mining company involved (owner mining company Vale). This time the location, and the number of casualties was around 300.

Weather-related natural disasters will probably be very common in the future globally, which we already can see many examples of reported in media. The intension must be to develop efficient bio-remedial technologies for sustainable recovery and protection of air, water and land in the Baltic Sea as well as for the entire world. Assessment of number and areas of contaminated sites in the Baltic Sea Region, type of contaminants involved, identification of stakeholders, and in long term calculate and make a cost benefit analysis of phytoremediation projects is the main objective of the project ROOTS (Roots for Remediation: Collaborative Phytoremediation in Post-Catastrophe Environments) led by Linnaeus University, Sweden.

Keywords

Climate change, tornadoes, disasters, flooding, landslides, dam-collapses, mining, contamination, land protection, remediation, post catastrophic actions

MICROPLASTICS IN HUMAN TISSUES: PATHWAYS OF EXPOSURE AND HEALTH IMPLICATIONS

Divya Pal

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Abstract

Microplastics (MPs), small plastic particles typically less than 5 mm in size, have become a pervasive environmental contaminant, being widely reported in a variety of ecosystems, including terrestrial, aquatic, and atmospheric environments. Due to their small size, these particles can easily enter the human body through various routes, primarily inhalation and ingestion, leading to growing concerns about their potential impact on human health. The continuous exposure to microplastics, whether through air, food, or water, has prompted researchers to investigate their occurrence in human tissues and explore the associated risks. To address the growing concern of microplastic contamination in human tissues by focusing on two key systems of exposure: the respiratory and digestive systems. To accurately identify and measure the presence of MPs, the researchers employed laser direct infrared spectroscopy, a technique capable of detecting particles larger than 20 µm. Most studies revealed the microplastics occurence in all the tissues examined, including lung tissue, the small intestine, the large intestine, and tonsils. Among these tissues, the lungs exhibited the highest concentration of microplastics, followed by the small intestine, large intestine, and tonsils. The researchers also found significant variability in the levels of microplastics among different individuals, with females showing higher concentrations than males, although the reasons for this variation remain unclear and warrant further investigation. Identified a wide range of microplastic types within the tissues, with polyvinyl chloride (PVC) being the most dominant polymer. PVC is known for its widespread use in various industries, particularly in construction, plumbing, and packaging, making it a common source of environmental contamination. The high abundance of PVC in human tissues raises particular concern due to its hazardous properties. PVC has a high polymer hazard index, meaning that it is associated with significant health risks, including potential toxicity and carcinogenicity. Thus, PVC microplastics may pose a greater risk to human health compared to other types of microplastics due to these factors. The significant accumulation of microplastics in the lungs, suggesting that inhalation may be a primary route of exposure, especially in areas with high levels of airborne microplastic pollution. Inhaled particles can become trapped in lung tissues, where they may induce inflammation, oxidative stress, and other adverse health effects over time. The detection of microplastics in the digestive system, including the small and large intestines, indicates that ingestion is another important exposure pathway. Food and water contaminated with microplastics can lead to their accumulation in the gastrointestinal tract, where they may interfere with normal physiological functions or be absorbed into the bloodstream. Despite the detailed findings of this study, there is still much to learn about the full impact of microplastics on human health. The research underscores the need for further studies to better understand how microplastics are absorbed, distributed, and excreted by the human body. Additionally, the long-term health consequences of chronic exposure to microplastics remain largely unknown, and more comprehensive research is needed to assess the potential risks posed by different types of microplastics, particularly those like PVC with a high hazard index. As the

prevalence of microplastics in the environment continues to grow, understanding their impact on human health is critical for developing effective public health strategies and regulatory policies aimed at minimizing exposure and protecting human well-being.

Keywords

Microplastics exposure; Human tissues; Respiratory system; digestive systems; Health risks

DISASTER AND RESTORATION

Gunnar Silfwersvärd,

Senior lawyer, Kalmar, Sweden

Abstract

This paper is dealing with all kinds of disasters, whether they stem from nature itself or are due us humans. In brief retrospective term it was not until the second half of the 20th century that the word environment gained a meaning. In the past, people lived as if the earth's resources were infinite and could be used almost free of charge. In the years after the Second World War, what has been called “the Great Acceleration” began, when a number of processes, fueled by cheap fossil energy, began to grow exponentially. Growth was the goal above all – this applied to both companies and governments. Consumption would be promoted at the expense of deforestation impact, soil erosion, ocean acidification, emissions, etc.

Politicians thought about the people and in 1948 the UN voted on human rights. Only later do you realize that nature, or in a warmer word, Mother Earth, also needs a lawyer. We can now quote Doris Ragettli, a delegate from Switzerland, who said the following at the UN conference in Rio de Janeiro in 2012: “But now atrocities are being committed against Mother Earth. She suffers. It is time for a declaration that gives her protection and rights, so that the UN can rest on two pillars". A concept was created: Ecocide. It means murder of nature/large-scale environmental destruction.

In 2020, plastic, asphalt and metal exceeded the world's total biomass. The richest 10% of the population, received 52% of the revenue, and they own 70% of the global wealth. The UN has a special envoy for human rights and the environment. In order to be fully covered by human rights, you are dependent on biodiversity, otherwise the right to life, health, food and water is reduced. In October 2021, the UN voted through a new human right – the right to a safe, clean, healthy and sustainable environment. On paper, everything sounds good, and this is when the law comes in. We must build a society that gives cover for all the fine words. This requires agreements, conventions, treaties, control and sanctions. Threats of punishment provide tools for the police. Legislation was introduced in the 1960s and ownwards. Natural areas were to be protected, toxic chemicals were banned, requirements were set for how agriculture, forestry and industries were managed.

What are the conditions like in Sweden? Let's say a flood of the same magnitude as hit Eastern Europe in September 2024 hit Sweden. A number of institutions are going into staff mode: The Swedish Civil Contingencies Agency (MSB) shall have carried out preventive work and have flood mapping and shall seek to mitigate the effects of environmental disasters. The National Board of Housing, Building and Planning (Boverket) must have taken the dangers into account in its planning, SMHI (Swedish Meteorological and Hydrological Institute) has hopefully been able to show the risks of torrential rain and flooding. The Swedish Food Agency (Livsmedelsverket) manages food supply and drinking water, and the Swedish Environmental Protection Agency (EPA) has prepared global sustainability goals. Each municipality also has a partial responsibility.

Advice in connection with international disasters with special environmental Experts contribute to reduced environmental impact even if the disaster area itself has been severely affected from an environmental point of view. There are challenges and

opportunities to make important contributions to the environment. It is necessary to integrate effort to work with the environmental management system also outside the country's borders. This is what it looks like in theory. Often, the practical result turns out to knock out the theoretical ideal. The road to hell is, as we know, paved with good intentions.

In September, a trial started after Sweden's largest environmental crime investigation. A company, Think Pink, had managed municipalities around our country to sign an agreement for garbage collection. The company gave the lowest tender, and communes were happy about the funds saved. The company, in turn, buried the unsorted rubbish in the ground, used it as filling material or dumped it on rubbish heaps, thereby spreading environmentally hazardous substances such as poisoned soil, water and air. The company's CEO Bella Nilsson was sentenced to a few years previously to prison for 3.5 years and was known as a porn club manager and stripper. According to prosecutors, waste crime is the third largest source of income for the criminal networks in Europe. Also compare garbage scandal in the valleys of Naples! Garbage in fire on the streets. The Italian military service had to clean up the garbage chaos on the streets. In the battle between laws and stupidity, stupidity often wins, which likes to go hand in hand with greed. They do not request references and do not follow up on how commitments are carried out.

I also would like to draw attention here to the problem of PFAS. This is not a single topic but around 15,000 substances with similar properties. They are synthetically produced and are often referred to as forever chemicals, as they never break down in nature. Fields in the United States are poisoned with PFAS. Sweden should ban the spread. All drinking water in southern Sweden is affected by PFAS. They are synthetically produced and are called forever chemicals, as they never break down in nature. Fields in the United States are poisoned. Sweden should ban the spread. All drinking water in southern Sweden is affected by PFAS.

We are thus talking about the concept of sustainability law, which is a new and rapidly emerging area of law after 50 years of research. The starting point is what the conditions should be for society and the economy to be able to survive for a long time without collapsing. Remember what the world looked like, when industries were allowed to spew out unlimited amounts of smoke, when waste from glass manufacturing was emptied into nearby lakes, etc., etc. Sustainability law is aimed at states and perhaps mainly companies. It is not possible to achieve lasting sustainability without considering the three parts that sustainability consists of: economic sustainability, social sustainability and environmental sustainability. No goal can be reached at the expense of another, and success is required in all areas for the goals to be achieved. When conducting business, businesses must exercise due diligence. What this means becomes a moral question, with the answer apparently coming in law or regulation.

In 1999 we will have an environmental code (Miljöbalken). With the code, the legislator wants to achieve sustainable development, which means that current and future generations ensure a healthy and good environment. In particular, it mentions that the recycling and reuse of materials, raw materials and energy should be promoted. If possible, restoration should be carried out. Supervisory authorities are primarily the Swedish Environmental Protection Agency, the County Administrative Board (Länsstyrelsen) and, at grass-level the municipalities. A special chapter in the Environmental Code obliges companies to contribute to restoration, so that damage for which they are responsible is repaired or, if this is not possible, compensated to an

acceptable standard. If the responsible company is acquired, the acquirer may become liable.

Society gets involved in how people live, what we do with our property, and if we misbehave, we can expect fines, sanctions and, in serious cases, imprisonment up to six years. And almost everything is decided in great agreement in Sweden. Should something similar happen in the US, Trump would claim that Marxists are running the country.

Future historians will note that the democratic development took a big step forward and peacefully transformed our society. But our society is not stable. As a rule, you intervene only when the damage has been done. For sure we must secure after life through demands for control. Get more positions as a controller in municipalities and larger companies and make transparency a word that inspires respect. The authorities must constantly check whether people themselves have preparedness for accidents: we should have supplies at home to be able to face the accident. Law can be seen as a net, which is supposed to protect people. The meshes in the net must not be too tight - then the state has misconceived its task and become all-powerful. Law should be the general awareness of law and morality, clothed in words, which should act preventative and educationally. It is therefore gratifying to study a national survey of environmental education in our Swedish school. You can read there about the work to develop strategies for sustainable development in the countries of the Baltic Sea region. The governments of these countries agreed in 1996 to develop an Agenda 21 and name it Baltic 21. Seven sectors were selected as particularly important: agricultural energy, fishing, forestry, industry, tourism and transport.

The education ministers have an agreement, called the Haga Declaration, which states that basic knowledge, competence and skills are required in all areas and by all people to implement and achieve sustainable development. One should be able to look to the future with confidence. Do not forget that no chain is stronger than its weakest link - and that link is in many cases us humans.

Keywords

Environmental catastrophes, restoration, juridical aspects, Miljöbalken, Agenda 21, Sweden

POST-CATASTROPHIC ACTIONS: CASE STUDIES FROM BRAZIL AND THE BALTIC SEA REGION

William Hogland, Muñoz Acuña Ulyana

Linnaeus University

Abstract

During recent years we have seen harmful environmental effects caused by catastrophic weather events such as heavy rain leading to flush flooding as well as landslides. Low rain fall causing drought and huge forest fires causes great harm and destruction of land which leads to large ecological damage which might take decades to repair. Strong winds cause tornadoes that have devastating effects. Deforestation and huge erosion as well landslides may kill thousands of people. In the Linnaeus Eco-tech 24 conference, we highlight; war, flooding, fires, landslide, earthquake, oil, mining and industrial pollution, leachate, air pollution and include phytoremediation in the action plan to. reduce the effect of the catastrophe and recover/remediate air, water and land.

The first own contact with local catastrophe was a large forest fire when I was a kid, and I was helping the fire men and the fire brigade to extinguish the fire and spend numerous hours in the smoke from the fire and my health was temporally affected and I had to stayed in bed some hours at home to recover. Furthermore, as teenager I experience a highly intensive convective rainfall. During a night, the village got 160 mm rain and fathers commercial garden was totally flooded and I could padel canoe over the land and lots of soil masses were transported into the river, so much as a three-story building was in the risk to fall into the river. I got the first opportunity to appear in the TV news reporting about the disaster. I have also experienced several catastrophes in Brazil related to heavy rainfalls, landslides and collapses of mining sludge and storage dams. On the 12th January 2011in Serra do Mar, nearby the cities of Teresopolis and Nova Friburgo, the rain generated flash floods and sent huge masses of mud down the steep hillsides and 860 persons were killed and about 8 700 became homeless. I was sitting just some 10 km from the site, and I registered a rain intensity of about 2.2 mm/minute and the highest intensity I have registered in Sweden is 1.8 mm/minute. The difference was that the area in Brazil had 10-20 mm/day every day during the week before and the ground was saturated.

The disaster at the Mariana Mine in Brazil, caused the death of 170 people in a landslide. A large area collapsed and with large amounts of mining sludge, an entire valley was flooded into the sea with major consequences for the inhabitants. The authorities showed no responsibility since the affected persons could not wait for the relevant countermeasures, as the mining company provides their livelihood. Later, the Brazilian government took some minor measures, including some compensation for the families affected by the accident.

I was also on site in the Mariana dam disaster, 5 November 2015, some weeks after the incident (the Bento Rodrigues or Samarco dam catastrophe, the Fundao tailing dam at the Germano iron ore mine in Samarco Mariana). I tried to raise money to help with the clean-up and involve Swedish experts. 19 people were killed, and the pollutants spread along 668 km in the river. The terrible thing is that another dam collapsed 25 January 2019, at Brumadinho in the state of Minas Gerais with the same mining

company involved (owner mining company Vale). This time the location, and the number of casualties was around 300.

There are many examples of weather-related natural disasters reported in media. The ecological damage caused by oil, mining, industrial pollution, leachate, and air pollution in the aftermath of natural disasters require an action plan to recover and remediate air, water and land. The intension will be to develop efficient bio-remedial technologies for sustainable recovery and protection of air, water and land in the Baltic Sea. Assessment of number and areas of contaminated sites in the Baltic Sea Region, type of contaminants involved, identification of stakeholders and in long term calculate a cost benefit analysis of phytoremediation projects is the main objective of the project ROOTS (Roots for Remediation: Collaborative Phytoremediation in Post-Catastrophe Environments)

Keywords

Climate change, tornadoes, disasters, flooding, landslides, dam-collapses, mining, contamination, land protection, remediation, post catastrophic actions

PFAS A GIGANTIC HIDDEN THREAT FOR ENVIRONMENTAL AND HUMAN HEALTH-WHICH TECHNIQUE ABLE TO SOLVE IT?

Yahya Jani

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Abstract

Sustainability of water resources is facing real challenges connected to the limited sources of freshwater, climate change effects and contamination. Emerging contaminants like PFAS are getting considerable attention from policy makers, industry, scientific world and society due to the well documented health and environmental risks connected to the accumulation of even low concentrations of PFAS in human bodies. There are more than 15000 PFAS in the market which have the same properties and are non-degradable compounds in nature. The major sources of PFAS are firefighting foam, nonstick cookware production, paper and packaging manufacturing, electronics and semiconductor industries, metal plating, cosmetics and others. With the recently adopted European regulations that came into force on 1st January 2023 focusing on measuring and detecting PFAS in drinking water to levels of low concentration of up to 4 nanogram/l of PFAS21 among other PFASs that need continuous monitoring. Many challenges are identified regarding the treatment of PFAS in water including diverse chemical structures, persistence in nature, low concentrations with high toxicity, high treatment costs, scale of contamination, deficient knowledge of PFAS chemistry and behavior as well as the need for continuous monitoring. In this talk, sources and potential techniques for treating PFAS in wastewater will be presented. This talk is part of the Wastewater2reuse project sponsored by Mälarenergi AB and Eskilstuna Energi & Miljö.

Keywords

PFAS, Wastewater treatment, emerging contaminants, sustainability of water

PHYTOREMEDIATION: A PROMISING METHOD FOR REVEGETATION OF HEAVY METAL-POLLUTED LAND

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Abstract

From a practical point of view, the ability of plants to accumulate various heavy metals from the soil is one of the most available means to significantly reduce heavy metal contamination of agricultural land. By fertilizing plants with sewage sludge, we greatly improve soil quality and productivity, but at the same time we pollute it with heavy metals. By fertilizing with sewage sludge, we greatly improve the quality of the soil, but at the same time we pollute it with heavy metals. The field experiment is being conducted at the Vėžaičiai branch of LAMMC (Western Lithuania), the aim of which is to evaluate how particular annual and perennial plant species, growing naturally in acidic Albeluvisol, can purify the soil from individual heavy metals (Zn, Cr, Cd, Pb, Cu, Ni and Hg). Based on the data received, investigated plant species differ in their phytoremediation ability to accumulate heavy metals in their biomass. By producing high annual biomass yield, these species are able to accumulate significant amount of soil pollutants.

Keywords

Sewage sludge, heavy metals, plant species

IMPACT OF INDUSTRIAL ACTIVITIES ON AIR QUALITY IN JELGAVA

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Abstract

Air pollution from industrial activities poses significant risks to environmental quality and public health, particularly in urban areas where industrial facilities coexist with residential zones. Trace metals such as lead (Pb), cadmium (Cd), nickel (Ni), zinc (Zn), arsenic (As), and copper (Cu), emitted from industrial processes, are toxic even at low concentrations. Chronic exposure to these pollutants is linked to severe health impacts, including respiratory, neurological, and cardiovascular disorders, with heightened risks for vulnerable populations such as children and the elderly.

This study investigates the spatial distribution of heavy metal concentrations in Jelgava, Latvia, a major urban-industrial hub, using snow sampling as a proxy for air pollution. Sampling was conducted at 59 monitoring points within city limits and one rural control site after the first snowfall, with a five-day snow accumulation period. Samples were collected 5 meters from road edges, melted, acidified with 1% nitric acid, and analyzed using inductively coupled plasma mass spectrometry (ICP-MS). Cluster analysis was employed to categorize pollution levels and identify hotspots. The findings revealed that urban air pollution is predominantly caused by industrial activities and vehicular emissions. Through cluster mapping, areas of varying contamination levels were identified. Cluster 1, representing low contamination, was predominantly situated in suburban areas with minimal industrial influence. Cluster 2, classified as moderate contamination, was found near moderately industrialized zones and city centers. Cluster 3, indicative of high contamination, was concentrated near major industrial facilities and high-traffic roadways. Lastly, Cluster 4 highlighted metal-specific contamination, scattered near industrial sources and reflecting unique emission profiles.Elevated concentrations of lead, nickel, and cadmium were observed near industrial zones, often exceeding regulatory thresholds. These findings underscore the health risks associated with prolonged exposure to heavy metals, emphasizing the need for targeted pollution mitigation strategies. Recommendations include stricter emission controls, enhanced air quality monitoring, and the development of sustainable urban planning frameworks to minimize human exposure in high-risk areas.

Keywords

Air pollution, industrial activities, heavy metals, snow sampling, ICP-MS, cluster analysis, Jelgava, urban health risks, sustainable urban planning

LONG-TERM SPATIAL CHANGES IN AIR QUALITY IN JELGAVA CITY

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Abstract:
Air pollution remains a critical environmental and public health concern, especially in urban areas where industrial activities, traffic, and household emissions converge. Approximately 92% of the global population resides in areas where air pollution exceeds safe limits, leading to severe health consequences, including millions of premature deaths annually. This study leverages lichen-based biomonitoring, a cost-effective and reliable method, to analyze long-term spatial changes in air quality across Jelgava city. The Air Purity Index (I.A.P.), calculated based on lichen species' distribution and sensitivity, served as the primary metric for evaluating pollution trends. The study employed the I.A.P. methodology to assess pollution levels at various sampling plots across Jelgava. The index integrates the toxicity tolerance factor (Q) and coverage degree (f) for each lichen species to derive an aggregate air quality score. A total of 1,250 deciduous trees, selected for uniform age, crown shape, and growth conditions, were monitored. The study analyzed data spanning multiple decades, focusing on pollution levels in 1996, 2006, and 2016. Air quality trends in Jelgava revealed that high-pollution zones accounted for 1.66 km² (2.75%) of the city's area in 2016, showing a reduction from 1996 (4.06%) but a slight increase from 2006 (2.49%). Moderate pollution zones covered 26.54 km² (44.0%), while clean air zones expanded to 32.12 km² (53.25%) in 2016. Spatial variability was observed, with worsening pollution in central areas leading to a decline in clean air zones to 23.08%, whereas clean zones outside the city center increased to 61.54%, reflecting better air quality in less densely populated regions. Pollution hotspots were concentrated near industrial sites, heavy-traffic streets, and Langervalde Park, with moderate pollution dominating central zones and clean areas prevalent in suburban regions. Urban green infrastructure, including roadside deciduous trees, was found to play a critical role in mitigating pollution in moderate and low-pollution zones, highlighting its importance for sustainable urban air quality management. Lichen-based monitoring effectively captured long-term and spatial variations in air quality across Jelgava, highlighting significant improvements in suburban areas and persistent challenges in densely populated zones. The findings underscore the importance of expanding urban green infrastructure, enforcing stricter pollution controls, and increasing public awareness to mitigate risks in high-pollution zones. Continued I.A.P.-based monitoring will be crucial for tracking progress and informing sustainable urban planning.

Keywords:
Air pollution, lichen biomonitoring, Air Purity Index (I.A.P.), urban sustainability, spatial analysis, Jelgava, environmental health

THE CONCEPTUAL FRAMEWORK OF REACTIVE NITROGEN CALCULATION MODULE INTEGRATION IN CONCEPTUAL HYDROLOGICAL MODEL METQ

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Abstract

Effective nitrogen management is critical for addressing global challenges such as climate change, water pollution, and sustainable ecosystem management. The METQ conceptual hydrological model, widely used for water resource analysis, has been extended to include reactive nitrogen transformation calculations. This study focuses on integrating nitrogen dynamics into METQ, leveraging its modular framework to simulate nitrogen fluxes across surface, subsurface, and groundwater systems, with an emphasis on the local Latvian environment. The reactive nitrogen module utilizes hydrological outputs from METQ as boundary conditions for nitrogen simulations. Nitrogen transport through surface runoff was calculated using flow rates and nitrogen concentrations in the upper soil layers. Subsurface nitrogen movement was modeled within shallow and deep drainage pathways, incorporating lateral and vertical flow dynamics. Additionally, leached nitrogen was routed to the groundwater compartment, where delayed outflow to surface water bodies was accounted for, ensuring a comprehensive representation of nitrogen fluxes across hydrological systems.Key datasets, including farm management, meteorological, and soil data, were integrated into the model. Algorithmic blocks simulate nitrogen inputs, transformations, and transport, dynamically coupling with METQ's hydrological outputs. The integration of nitrogen transformation calculations was found to significantly enhance METQ's capability to assess nitrogen pollution and its associated environmental impacts. Modular reprogramming of METQ was shown to enable seamless addition of functionalities, improving computational efficiency and fostering interdisciplinary research. The extended METQ model facilitates comprehensive analysis of interactions among soil, water, and atmosphere, positioning it as a valuable tool for ecosystem and sustainability studies. The advancements in METQ position it as a cutting-edge tool for environmental impact analysis, including nitrogen emissions, nutrient cycling, and sediment transport. By adopting a modular, open-framework design, METQ fosters innovation and collaboration within the scientific community. These enhancements support global environmental goals, such as climate change mitigation and sustainable water resource management.

Keywords

Reactive nitrogen, hydrological modeling, METQ, nutrient cycling, modular framework, water pollution, sustainability, interdisciplinary research

CHALLENGES FOR THE DEVELOPMENT OF LOWLAND RIVERS ECOSYSTEM SERVICES IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT GOALS

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Abstract

The 2030 Agenda for Sustainable Development emphasizes the importance of revitalizing freshwater ecosystems to achieve the United Nations' 17 Sustainable Development Goals (SDGs). Freshwater ecosystems, such as the Svete River in Latvia, offer essential ecosystem services that address environmental, social, and economic sustainability. This study analyzes the Svete River's ecosystem services through the lens of SDGs, identifying opportunities for sustainable development at the municipal level in Jelgava, Latvia. A comprehensive assessment framework for ecosystem services was employed in the study, consisting of three key components. Biophysical assessment was conducted to evaluate the structure and functions of the ecosystem. Social assessment focused on identifying ecosystem services that are most relevant to societal needs. Economic assessment was carried out to quantify the value of ecosystem services, providing an integrated approach to understanding their contributions to sustainable development. Ecosystem services were categorized into supply services (S), environmental and support services (E), and cultural services (C), with each category aligned to specific SDGs. The Svete River plays a vital role in achieving multiple Sustainable Development Goals (SDGs). In terms of Water Management (SDGs 6, 7, 8, 11), the river supports water supply, energy generation, tourism, and flood control, contributing to disaster resilience and sustainable urban development. For Agriculture and Food Security (SDGs 2, 12), the river enhances agricultural productivity, though intensified activities risk water pollution, conflicting with marine health goals (SDG 14). Regarding Health and Well-being (SDG 3), clean water and recreational services were found to improve societal health, while gaps in sanitation pose risks of disease. The river fosters Education and Equality (SDGs 4, 5) by supporting environmental education and emphasizing women's significant roles in water management. Contributions to Biodiversity and Climate Protection (SDGs 13, 15) include facilitating carbon sequestration, biodiversity conservation, and climate regulation. Lastly, effective Cross-border Cooperation (SDG 16) and Partnerships (SDG 17) are essential for managing shared water resources and resolving water-related conflicts, underscoring the river's broader regional and international significance. The Svete River's ecosystem services are integral to achieving sustainable development, benefiting freshwater ecosystems, downstream urban users, and coastal marine life. Aligning local governance with SDG principles ensures balanced ecological health and socio-economic growth. Promoting ecosystem services through municipal initiatives will expedite progress toward SDG targets while fostering regional sustainability.

Keywords

Ecosystem services, Svete River, sustainable development goals, water management, biodiversity, environmental sustainability, Jelgava, Latvia

DRIVING FORCES OF DIFFERENCE IN NITROUS OXIDE AND AMMONIA EMISSION FACTORS FROM SOIL MANAGEMENT

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Abstract. The drive to lower emissions is ongoing to avoid the pessimistic climate change scenario and improve air quality to limit health risks. Agriculture is a relevant contributor to greenhouse gas emissions: nitrous oxide (N2O), methane (CH4), carbon dioxide (CO2), and a key source of ammonia (NH3) emissions. Overall agricultural gas emissions have decreased in recent years in Europe. More significant declines in emissions are in Northern and Western Europe than in Eastern Europe, where agriculture intensification in some sectors is still observed. In Latvia, there is still discussion on the way to meet the reduction target for NH3 emissions because of the increase from 2005 with a slight decrease in most recent years. Management of agricultural soils contributes a large part of agricultural emissions with a high share attributed to the use of mineral fertilisers. The share of mineral fertilizer was 46% of soil management-associated NH3 emissions and 32% for greenhouse gases in 2022 for Latvia. This research aims to investigate parameters that impact the value of the emission factor used for gaseous inventories in soil management. Because it is crucial to understand future research topics. Concentrating in this study on inorganic fertilizers. In Europe, primarily the Tier 1 methodological approach is used to estimate mineral fertilizer greenhouse gases and for NH3 compared, more countries use the Tier 2 approach. The first and most crucial factor in both methodological approaches to impact emissions is a type of mineral fertilizer because of the wide variation of emission factors. The next factor is air temperature: higher temperatures accelerate NH_3 volatilization and microbial activity that increase N_2O emissions. Soil parameters also affect the formation of emissions: higher pH leads to an NH3 emissions increase and wet soil conditions can minimize volatilization. At the same time, in wet soil anaerobic conditions can form that increase CH4 emissions. Soil management practices and mineral fertilizer application technology also impact emissions. Work on adapting emission factors to local contexts has to be done for many countries including Latvia to increase accuracy so that farmers and policymakers can plan to mitigate emissions with more specific approaches.

IDENTIFICATION OF NITROUS OXIDE IN SOIL USING ISOTOPE MEASUREMENTS

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Abstract

Nitrous oxide (N_2O) is a potent greenhouse gas and a significant contributor to climate change, with soil being one of the largest sources of emissions. The European Green Deal prioritizes achieving climate neutrality by 2050, necessitating a focus on reducing greenhouse gas (GHG) emissions from agricultural soils. N_2O emissions arise primarily from microbial processes—nitrification and denitrification—driven by soil moisture, temperature, nutrient availability, and pH. Fertilizer application, both organic and inorganic, significantly influences these processes, intensifying N_2O fluxes. This study investigates the dual contributions of nitrification and denitrification to N_2O emissions in various soil types using isotopic analysis. A total of 28 experimental field samples were collected and analyzed under controlled laboratory conditions. Soil samples were subjected to wet aerobic and wet anaerobic regimes, with periodic moistening using rainwater to simulate natural conditions. Isotope measurements were performed using Picarro G5131-i to determine $\delta^{15}N\alpha$, $\delta^{15}N\beta$, $\delta^{15}NSP$, and $\delta^{15}Nbulk$ values, allowing for the differentiation of nitrification and denitrification pathways. It was observed that both nitrification and denitrification processes occur simultaneously within soil microenvironments, driven by localized anaerobic conditions. Denitrification was indicated by $\delta^{15}NSP$ values, while $\delta^{15}Nbulk$ values signaled nitrification, highlighting the complex interaction between oxygen availability and microbial activity. Variations in isotopic data revealed that soil type, moisture, and fertilization practices significantly influence N_2O emission pathways, demonstrating the intricate relationship between environmental factors and nitrogen transformations in soil. The study highlights the concurrent nature of nitrification and denitrification in soil, driven by microenvironmental conditions at the particle scale. These findings emphasize the importance of optimizing nitrogen cycling through targeted soil management practices. Future research should explore the effects of fertilizer applications on the kinetics of these processes to develop strategies for minimizing nitrogen losses and reducing environmental impacts.

Keywords

Nitrous oxide, nitrification, denitrification, isotopic analysis, $\delta^{15}N\alpha$, $\delta^{15}N\beta$, soil moisture, GHG emissions, nitrogen cycling, agricultural soils

VII.WATER AND HYDROLOGY

PHYTOREMEDIATION WITH SALIX: A SUSTAINABLE APPROACH TO PFAS REMEDIATION AT FIREFIGHTING TRAINING SITES

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Abstract

Per- and polyfluoroalkyl substances (PFAS) pollution has escalated into a significant environmental challenge, with firetraining sites identified as one of the sources. The development of effective, sustainable, and cost-efficient methods to reduce or minimize the further environmental impact of PFAS to the surrounding is necessary. The growth of three Salix cultivars: Ester, Wilhelm, and Loden was evaluated in a laboratory study. The aim was to assess the impact of PFAS-contaminated soil and irrigation water on plant development and to identify the cultivars most suitable for large-scale use in phytoremediation projects.

The cultivars were grown in PFAS-contaminated soil originating from a firetraining site in southern Sweden. The experimental setup involved irrigation with both tap water and PFAS-contaminated groundwater, with a control group planted in uncontaminated soil (commercial potting soil) and watered with tap water. The study was conducted over a period of six weeks, during which the growth of the Salix cultivars was evaluated.

All three Salix cultivars exhibited a well-developed root system and shoot growth compared to control, under the tested condition. These results suggest that Salix has the ability to grow in environments contaminated with PFAS at the levels examined. This study highlights the potential of Salix as a viable candidate for phytoremediation strategies at sites impacted by PFAS.

Keywords

Per- and polyfluoroalkyl substances (PFAS), Firefighting training sites, soil contamination and remediation, groundwater, phytoremediation, Salix.

GROUNDWATER LEVEL DYNAMICS IN EXTRACTED PEATLAND: ASSESSING POTENTIAL FOR RECULTIVATION

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Abstract

Peatlands are among the most carbon-dense ecosystems on Earth, playing a crucial role in climate change mitigation by reducing greenhouse gas (GHG) emissions. As nature-based climate solutions, their restoration is particularly vital for achieving near-term climate goals (2030-2050). The European Union has set an ambitious target to restore 70% of drained peatlands by 2050, with at least 50% rewetted. The Baltic countries, including Latvia, are significant contributors to GHG emissions from degraded peatlands within the EU. In Latvia, peatlands cover approximately 10% of the land area, with 0.4% (from total area of Latvia) actively used for peat extraction.

Balancing environmental and socioeconomic considerations is essential for meeting climate and biodiversity objectives in peatland recultivation. In Latvia, peat extraction companies are obligated by mining licenses to plan post-extraction recultivation, which may involve converting areas into water bodies, forests, or restored natural peatlands. A key factor influencing the success of these efforts is groundwater management, as water dynamics are critical for peatland restoration.

This study focuses on groundwater level fluctuations in a 16.4-hectare extracted peatland in Central Latvia. Six groundwater monitoring wells equipped with TD-Diver loggers were installed to assess water level changes. While the monitoring is ongoing, the first year of data reveals significant groundwater fluctuations, indicating the necessity for active hydrological management. Long-term monitoring will continue, with particular interest in the comparison of groundwater conditions before and after the implementation of recultivation measures. Our findings highlight the importance of stabilizing water levels for the successful restoration of peatland ecosystems.

Keywords

Groundwater, human impact, peatland, peat

OPPORTUNITIES FOR THE DEVELOPMENT OF SEASONAL ECOSYSTEM SERVICES IN THE CONTEXT OF SUSTAINABLE RIVER HYDROLOGY

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Abstract

Floodplain meadows, renowned for their biodiversity and ecosystem services, represent the only completely natural meadow ecosystems in Latvia. These areas play a dual role: as natural sponges mitigating flooding and as nutrient-rich environments fostering agricultural productivity. However, the installation and operation of hydroelectric power plants (HPPs) pose significant threats to these ecosystems by altering natural water flows, causing sediment accumulation, and impacting biodiversity, particularly in Natura2000-protected areas. This study focuses on the Svete River basin in central Latvia, which exemplifies the challenges posed by HPPs to sustainable river hydrology. Utilizing nine monitoring stations across a key river section, this research employed cutting-edge hydroacoustic and barometric pressure compensation equipment to assess water level fluctuations, flow dynamics, and water quality parameters. Data collection included automated 15-minute water level readings and comprehensive flow measurements at each station. Initial findings reveal that HPPs contribute to river overgrowth, fluctuating water levels, and increased sediment deposition, which lead to morphological and hydrological changes. Oxygen content was observed to range from 5.2 to 5.6 mg/L in August, while nitrate concentrations peaked between 52 and 56 mg/L in February, highlighting significant seasonal variations. The prohibition of new mechanical barriers on the Svete River under Latvian legislation emphasizes the recognition of these risks and the need for sustainable solutions. Addressing these challenges requires balancing the operational needs of HPPs with the ecological integrity of floodplain meadows. Recommendations include regular maintenance of HPP hydraulic structures and adherence to building safety programs to minimize ecological impacts. These measures, combined with sustainable river management practices, are vital for preserving floodplain ecosystems and enhancing their seasonal ecosystem services.

Keywords

Floodplain meadows, hydroelectric power plants, Svete River, sustainable hydrology, biodiversity, sedimentation, Natura2000, ecosystem services, water quality, river management

HISTORICAL ANALYSIS AND FUTURE PROJECTIONS OF LONG-TERM WATER LEVEL FLUCTUATIONS OF THE RIVER LIELUPE: A CASE STUDY OF JELGAVA CITY

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Abstract:
The combined impact of climate change and urbanization on the hydrological cycle is a critical focus in hydrological research. This study investigates the response of watershed run-off in the Lielupe River, Jelgava, Latvia, to various urbanization and climate change scenarios using the conceptual hydrological model METQ. Twelve climate change scenarios, ranging from very low to very high impacts, and two urbanization scenarios (pessimistic and optimistic) were modeled, resulting in a total of 24 climate-urban scenarios. Results revealed that urbanization significantly affects watershed run-off under all climate scenarios. Extreme high run-off events were predominantly associated with rain events rather than snowmelt, while periods of minimal run-off became longer and more frequent. Urbanization was found to increase monthly average run-off during winter and spring, with pronounced summer run-off events under high climate impact scenarios. These findings highlight the need for integrated water resource management to address the compounded effects of urbanization and climate change on hydrological systems.

Keywords:
Hydrological modeling, METQ, Lielupe River, climate change, urbanization, watershed run-off, integrated water resource management, Jelgava

SENSITIVITY ANALYSIS OF KEY PARAMETERS OF HYDROLOGICAL MODEL METQ 2007BDOPT

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Abstract

Hydrological modeling is essential for understanding water flow and distribution, especially in regions with limited direct measurements. The METQ 2007BDOPT model, a conceptual tool widely used to simulate daily discharge, depends on accurate calibration of key parameters. This study focused on the Brook Vienziemīte basin to evaluate parameter sensitivity and propose refinements to improve the model's predictive reliability. Daily hydrological and meteorological data from 1994 to 2004 were used to perform sensitivity analysis and calibrate the model for optimal performance. Key findings indicate that parameters such as beta, dz, and C melt significantly influence discharge predictions, particularly during peak flow events, with beta showing a 149% increase in peak discharge under a +50% adjustment. Parameters like P z and D perc were found crucial for maintaining baseflow conditions. The results underscore the importance of targeted parameter calibration for improving model accuracy and reliability, particularly in capturing extreme hydrological events. These insights are vital for enhancing flood forecasting and climate impact assessments in similar basins.

Keywords

Hydrological modeling, METQ 2007BDOPT, sensitivity analysis, parameter calibration, peak flow events, baseflow, flood forecasting, Brook Vienziemīte basin

WATER SUPLY ECOSYSTEM SERVICE OF FORMER KAKHOVKA RESERVOIR

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Abstract

Kakhovka Reservoir (KR) on the Dnirpo River was put into operation in 1956. Its full volume was 18,2 km3 and its usable storage was 6,8 km3. The area of the water surface, when a normal retaining water level was observed, was 2155 km2. It was one of the largest reservoirs in Europe but for several reservoirs on the Volga River in russia. On the 6th of June 2023 at 02:50 AM the Kakhovka dam was demolished by RF military forces and as a result, by June 18-20 the Kakhovka Reservoir ceased to exist.

In spite of its artificial origin, the KR supplied valuable ecosystem services (ESS) important for human being and natural aquatic and coastal ecosystems. In this paper, we evaluate the most significant ESS provided by the KR for the region. This is important for various reasons, but most importantly, such an evaluation can contribute to a discussion on the feasibility of restoring the dam after the war. Among the ESS provided by the KR were supporting and regulating ESS, providing water in the right amounts and at the right time to ensure the functioning of natural ecosystems downstream of the KR, in particular the lower Dnipro aquatic ecosystem, which in turn provides a number of important ESS. Fishing in the KR provided important provisioning ESS. By 2022, for example, up to 3,300 tons of fish annually were caught in the KR. The Reservoir created conditions for rest and recreation, which was used by hundreds of thousands of people (socio-cultural ESS). Arguably the most important ESS from the KR, however, was supply of water for households and diverse sectors of the economy (provisioning ESS). Our estimates of the needs and analysis of actual volumes of water consumption from the KR by the population of the region (for drinking and economic needs), power generating stations (Kakhovka hydroelectric power station, Zaporizhzhya NPP and TPP), industrial enterprises, the agricultural sector (mainly for irrigation) and water transport show that in low-water years before 2022 there was a shortage of water. In the absence of the Reservoir, the available resources of the Dnipro River cannot meet the water needs of the region, as defined by the pre-war situation, even if we do not take into account the water supply to the Crimea.

Keywords

Kakhovka Reservoir; ecosystem services; water supply and consumption; fishing; irrigation

COMPREHENSIVE ANALYSIS OF CALIBRATION AND VALIDATION RESULTS OF THE CONCEPTUAL HYDROLOGICAL MODEL METQ: A CASE STUDY OF RIVER BASINS ACROSS DIVERSE NATURAL CONDITIONS IN LATVIA

Anda Bakute, Inga Grīnfelde, Jovita Pilecka-Uļčugačeva

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Abstract

The METQ2007 BDOPT conceptual hydrological model was applied to simulate daily runoff in six river basins across Latvia, characterized by varying natural conditions, including sandy lowlands, lakes, forested areas, and agricultural landscapes. Data series spanning at least 13 years were used for model calibration and validation, employing statistical criteria such as the Nash-Sutcliffe Efficiency (NSE) and correlation coefficient (r). Results indicated good agreement between observed and simulated discharges, with NSE values ranging from 0.52 to 0.78 and r values from 0.65 to 0.88. Calibration demonstrated that parameter values, such as fillable porosity (ALFA) and capillary rise height (ZCAP), corresponded to the physiogeographical characteristics of each basin. Soil properties, land use, and geomorphological features were identified as critical factors influencing runoff generation. The findings confirm the robustness of the METQ2007 BDOPT model for diverse hydrological conditions, making it a valuable tool for water resource management and ecosystem studies.

Keywords

Hydrological modeling, METQ2007 BDOPT, calibration, validation, runoff simulation, Latvia, river basins, physiogeographical characteristics, Nash-Sutcliffe Efficiency, water resource management