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„INŻYNIERIA I KSZTAŁTOWANIE ŚRODOWISKA”

6th CONFERENCE

„ENVIRONMENTAL ENGINEERING AND DESIGN”

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BOOK OF ABSTRACTS

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6th CONFERENCE „ENVIRONMENTAL ENGINEERING AND DESIGN”

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ALMEIDA José Carlos

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The concrete cover’s role in the sustainability of reinforced concrete bridges

Transport networks are essential for the economic development of societies. Bridges, in these networks, are key elements that allow the connection of different geographical areas, enabling the crossing, for example, of water lines and valleys. Due to their nature, they consume a large amount of human and financial resources. The correct management of infrastructures, such as road bridges, can contribute to achieving several Sustainable Development Goals, established by the United Nations General Assembly. For example, goal 9 is achieved by building resilient infrastructures, promoting inclusive and sustainable industrialization, and fostering innovation. On the other hand, incorrect and non-optimized planning may hinder achieving goal 15, which aims to protect terrestrial life. Since reinforced concrete bridges inevitably suffer from corrosion, this article presents a sensitivity study of the reinforcement cover in concrete bridges. The effects resulting from the corrosion of the reinforcements are presented, considering not only the life cycle costs related to the users of the bridges, but also the environmental impact.

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“Green cities” in Poland - comparative analysis based on the composite measure of development

The aim of the article is to assess the degree of "green" development of cities with county rights. We used a synthetic measure. It was built on the basis of a dynamic version of the linear ordering method – the zeroed unitarization. The analysis covers the years: 2010, 2015, 2018, 2020. Taking into account the highly differentiated state of natural environment of Polish cities and related sectors of the urban economy, two research questions were posed in the article - one concerns the scale of differences in the analyzed phenomenon and the other refers to the determining elements of the environment or processes related to it. In addition, we applied the method of quartiles to group cities. The results of the study made it possible to present the differences in the "greening" of the surveyed units, as well as the status and dynamics of the changes taking place in a given period. The analysis is a contribution to "green city" monitoring research, which responds to the direction of sustainable development set by, among others, the New Leipzig Charter, the National Urban Policy, and the European Green Deal. "Green city" monitoring is essential for cities to develop urban policies and development strategies that respond to climate change. The analysis indicated a moderate development of Polish cities in this direction at an average level of about 2.5% per year over the decade. In addition, a wide variation between cities is evident. However, it is possible to observe a gradual leveling off of the differences of the surveyed units in terms of the aggregate measure. This makes it possible to make a cautious inference about the leveling off of the development of "green cities." An important aspect determining the study was the availability of statistical data, which in turn determined the choice of years of analysis. It should be noted that public databases are very limited. This does not change the fact that diagnosis and monitoring, as well as related urban data, are essential for cities to develop development strategies, or more broadly, urban policies that respond to climate change. It is crucial, therefore, to enter into public and accessible databases of statistical information those metrics that will enable the evaluation of development processes taking into account the directions of the "green city”.

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The role of National Agency for Great Green Wall (NAGGW) in promoting climate change adaptation among communities in Northern Nigeria

The Nairobi Declaration 2023, which is the outcome of the inaugural African Climate Summit (ACS) and adopted by African Heads of State and Government (including Nigeria) on the 6th September, 2023 has acknowledged that climate change is the single greatest challenge facing humanity and the single biggest threat to all life on Earth. It demands urgent and concerted action from all nations to lower emissions and reduce the concentration of greenhouse gases in the atmosphere. It noted the 6th Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC), which stated that the world is not on track to keeping within reach the 1.5°C limit agreed in Paris and that global emissions must be cut by 45% in this decade. This is a clear demonstration of the political will and commitment of African Countries to address the challenges of climate change

As a result of the high vulnerability and low adaptive capacities of communities and systems to the challenge of climate change, Nigeria is committed to addressing the challenges of climate change especially in the area of adaptation. It has put in place institutional and regulatory frameworks in place. One of such institutions is the National Agency for the Great Green Wall. (NAGGW) The Nigerian Government signed the Great Green Wall Convention in 2010 and established the National Agency for the Great Green wall (NAGGW) in 2015 under Act No (3) of the Federal Government of Nigeria. The Act mandates the Agency to manage and reverse desert encroachment in the eleven frontline states of northern Nigeria. This poster presentation highlights some of the efforts by the Agency in enhancing adaptation of communities within the northern region of Nigeria.

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Natural material in construction as an element of a circular economy

Construction is one of the areas of the economy in which the costs of potential recycling of materials used today are very high. The use of natural materials with a low degree of processing and low reuse costs may be a future solution for many ranges of building forms. Modern technologies for using natural materials that consume significantly less energy in a closed-circuit process create favorable grounds for the development of this field of construction.

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Central heating control charts the basis for the economic use of energy in residential buildings

Methods and types of regulation of central heating installations in residential buildings were presented. Transient states (heating and cooling) and dynamic characteristics of the adjustment facility for a residential building are presented.
The input parameters of the heat node supplying the target tested residential building in which the test stand exists were compared to the output parameters from the heat node 115/55 °C / 90/70 °C. These data were referred to the control charts of the heat networks allowing for direct reading of the required feed water temperature for a given outdoor temperature according to the Warsaw Heat Energy Enterprises data and differences were presented.
The actual measurements read at the test stand located on the 2nd floor of the 4-storey building with input parameters of 90/70 °C during the entire month of December 2022 are presented in a reading every 6 hours and are tabulated and graphed in comparison with the calculation parameters. Inflow and outflow temperatures on the vertical supplying the heater and values exterior temperature sensor were analysed.

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Microwave heating for synthesis of carbonaceous adsorbents for removal of toxic organic and inorganic contaminants

The residues obtained from the extraction of Inonotus obliquus fungus were used to produce car-bonaceous adsorbents. The initial material was subjected to pyrolysis in a microwave oven. The adsorbents were characterized through elemental analysis, low-temperature nitrogen adsorp-tion/desorption isotherms, and Boehm's titration. The carbonaceous adsorbents were tested for the removal of NO_2, methylene blue, and malachite green. The results indicated that the obtained carbonaceous adsorbents exhibited basic characteristics and possessed specific surface areas of 268 and 415 m^2/g. Numerous factors affecting the efficiency of the adsorption process have been in-vestigated. These factors include process conditions, dye concentration, contact time between the adsorbent and adsorbate, pH of the dye solution, and process temperature. The adsorption process of liquid contaminants was modeled using the single-layer Langmuir model. The maximum ad-sorption capacities were found to be 101 and 109 mg/g for methylene blue, and 75 and 77 mg/g for malachite green. The kinetic study demonstrated that the adsorption of methylene blue and mal-achite green was better described by a pseudo-second order model. Additionally, the influence of temperature on the adsorption of the dyes allowed for the determination of thermodynamic pa-rameters (ΔG0, ΔH0, and ΔS0). The study affirmed that the adsorption of organic dyes onto the re-sultant carbonaceous adsorbents was both spontaneous and endothermic. The study also demon-strated that the presence of an air stream during the NO_2 adsorption process and prehumidization of the adsorbent with humid air had a beneficial effect on the obtained sorption capacities. In conclusion, the study was demonstrated that pyrolysis of the extraction residues from the fungus Inonotus obliquus yields highly effective, environmentally-friendly, and cost-efficient carbonaceous adsorbents for the removal of both gaseous and liquid pollutants.

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Assessment of the possibility of using unmanned aerial vehicles to identify and map air pollution from exhaust emissions from road infrastructure

Sustainable development and the creation of smart, green cities require cooperation in many areas of science, including: related to ecology, mobility and sustainable management. Environmental protection is particularly important. Atmospheric pollution, due to air movements, spreads over very large areas, therefore monitoring air quality is crucial to ensure protection against substances harmful to health. One of the most severe sources of air pollution, accounting for approximately 25% of total annual emissions in the EU, is road transport. It is not without reason that the European Union sets an ambitious goal of reducing total pollutant emissions to 55% for passenger cars and 50% for commercial vehicles by 2030. In recent years, it has become increasingly popular in many fields of science, including environmental protection, measurement surveying or photogrammetry are gaining ground in unmanned aerial vehicles (UAV). The use of UAV to identify harmful pollutants allows you to gain an advantage over conventional detection methods due to the possibility of remote, and therefore safe for people, faster and area measurement. Taking into account the constantly expanding scale of use of this technology, this article presents the possibilities of using UAVs to identify and image (map) pollutants. Examples presented in foreign literature, as well as our own research in the field of imaging the altitude distribution of air pollutants, both gaseous: C6H6, HCHO, SO2 and suspended dust: PM1, PM2.5, PM10, demonstrate the validity of such activities. The results presented in the article concern the area of one of the key A4 motorways in Poland. The maps obtained make it possible to present, in terms of area and altitude, one of the important air pollutants that is a problem throughout the EU. Moreover, they can be a valuable source of information for the implementation of future projects and improvement of road infrastructure, and thus contribute to the reduction of air pollution and the creation of the so-called "green cities".

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Comparison of the effectiveness of Artificial Neural Networks and elastic net regression in surface runoff modeling

The study compares the effectiveness of Artificial Neural Networks and Elastic Net Regression for surface runoff modeling in stormwater catchments. Research analyzes various catchment scenarios using attributes like catchment properties, precipitation patterns, and runoff behavior. Both models are developed, parameter-tuned, and tested with the aim of predicting surface runoff. An assessment is carried out to gauge the predictive accuracy, computational efficiency, and ability to withstand data noise of the models. The outcomes highlight the relative advantages and drawbacks of each modeling technique, offering crucial perspectives for enhancing water resource management in urban settings.

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Urban and rural areas as a source of bio-waste

The European Commission defines bio-waste as biodegradable waste from gardens, parks, food and kitchen waste from households, restaurants, caterers, and retail premises, and comparable waste from food processing plants (EC, 2008). Bio-waste is the largest single component of municipal waste. In 2017, the average share of bio-waste in municipal waste generated in the 28 EU countries exceeded 34% (European Environment Agency, 2020). The proportion of bio-waste in municipal waste varies significantly among countries. For instance, Hungary has a proportion of only 17.5%, while Romania has a proportion of 51%. In Poland, approximately 31% of household waste is bio-waste.

Without a high level of separation at source, it is unlikely that new targets for preparing municipal waste for re-use and recycling will be met. The quantity of waste due to urbanization processes will increase. The main problem in areas with different levels of urbanization is determining the composition of the waste and capturing its temporal variation before future treatment.

The aim of the work was to determine the morphological composition of bio-waste collected from households segregated at source from four rural municipalities and four towns (single-family housing). In household bio-waste, the proportion of food waste content ranges from 36.7% to 47.6% (annual average values). The annual average share of garden waste ranged from 35.8% to 52.8%. A significant share of impurities (e.g., plastics, glass, stones) was found in the bio-waste stream. The share of pollutants contamination in bio-waste collected in bags both in rural areas and in towns with single-family housing does not exceed 10%.

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Reclaimed disposal sites as a source of secondary raw materials – the cost-effectiveness assesement of extracting of accumulated waste

The analysis of the possibilities of reuse of accumulated waste was conducted on the selected reclaimed heaps, dumps and landfills. The case studies considered the use of recovered waste as a substitute of natural aggregates, but waste accumulated can be reuse among others for: the road construction, the production of aggregate as well as the recovery of metals and the reclamation of anthropogenically transformed areas. Next the simulation process of the economic effectiveness on the selected reclaimed sites was carried out. In this analysis, 3 key elements: rehabilitation costs, costs related to the implementation and execution of the investment as well as the possibility of selling the recovered waste at a price guaranteed to cover the costs incurred have been taken into account. The second type of costs includes among others administrative expenses, costs of laboratory analyses, direct costs of project implementation (e.g. personnel costs, costs of services and outlays on tangible fixed assets (purchase of machinery and equipment). Furthermore, the costs of environmental restoration (land reclamation and development) have been also taken into consideration.
The calculated costs of extraction and preparation for sale of waste from the selected waste facilities have been compared with the average prices of aggregates used in the road construction. Finally, this simulation of cost effectiveness process of waste used as a secondary raw materials assumed that the profitability condition would be fulfilled when the difference between the sales price of waste and the incurred investment expenditure were greater than zero. Thus, the existence of economic premises determining the conduct of broader research on the use of waste accumulated on reclaimed facilities has been confirmed.

The study was financed from funds allocated to the statutory activities of PGI-NRI (Project No. 61.4104.1801.00.0).

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The application of a machine learning algorithms for prediction of raw materials potential from mining and industrial waste facilities

Waste accumulated in the industrial waste disposal sites, dumps and heaps may represent potential (due to the type as well as the amount of accumulated waste) raw material for use in various sectors of the economy. The qualification of a facility as an investment for a specific direction of use (e.g. recovery of potential raw materials) is problematic without detailed data on, among others: chemical testing of accumulated waste. Nowadays, verification of faclities in terms of the possibility of using accumulated waste requires both costly boreholes (or excavations) for sampling and costly laboratory analyses. However, the obtained results do not always confirm the raw material potential of the analysed site which can be exploited with currently available techniques and technologies.

Therefore, the use of a machine learning algorithms has been proposed for the process of forecasting and modeling the assessment of the raw material potential of post-mining facilities (heaps, industrial landfills). The use of the Python language with libraries of procedures implementing a machine learning algorithms, including deep learning, has been assumed. A set of input data has been built and it was then subjected to initial transformation before entering them into the target prediction model. The data set was randomly divided into training data (70%) and validation data (30%). A large number of different machines learning models were tested, including decision trees, multi-layer neural networks or self-organizing networks in order to determine the optimal learning mode, the method and architecture that returns most promising results. Those most promising algorithms have been selected for further analysis, including both data adjustment (e.g. changing the way data is represented, removing irrelevant or redundant data) and tuning model parameters. It has been shown that depending on the quantity and quality of the input data, the effect of obtaining the output data is more or less accurate. It has been proved that using a method based on artificial neural networks, it will be possible to predict parameters affecting the raw material evaluation of untested objects by classifying objects as perspective or non-perspective.

The study was financed from funds allocated to the statutory activities of PGI-NRI (Project No. 61.3794.2300.00.0)

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Changes in biochemical properties of sediments formed in the process of rainwater treatment

The paper assesses the biochemical properties in the sediments of a large rainwater treatment plant that collects runoff from a city with an area of about 500 ha. The main elements of this technological line are screen chambers, grit chambers, a settler and a retention pond. During the gravitational flow, physical, chemical and biological self-cleaning processes take place. Sediments with an intact structure were obtained from the bottom of individual treatment plant objects from a layer of 0-10 cm. The assessment of sludge properties was made on the basis of the content of mineral forms of nitrogen and the activity of enzymes involved in the transformation of N compounds, i.e. urease and proteases. The amount of ammonium nitrogen in the sediments from the grit chambers and settler was several times higher than in the material from the retention pond. In the case of nitrate nitrogen, no such trend was observed. The sediments accumulated in the grit chambers and settler were characterized by several times higher activity of proteases and urease than the sediments in the retention reservoir. The observed stimulation of enzymatic activity in the material from these installations was the result of the high content of organic matter in the sludge. The presence of carbon substrates stimulates the biosynthesis of enzymes and has a positive effect on the rate of pollutant decomposition. The decrease in enzymatic activity and the loss of mineral forms of nitrogen and heavy metals in the sludge accumulated in the retention reservoir indicates a significant efficiency of rainwater treatment.

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Improving acidic sandy soil properties for plant growth with dam reservoir sediments in the face of soaring fertiliser prices

Fertiliser prices are increasing rapidly in response to recent geopolitical events. It led to a ‘renaissance’ of alternative fertilisation. It includes use of dam reservoir (DR) sediments. The objective of our study was to evaluate the agricultural value of DR sediments in the face of changing mineral fertiliser prices. The quality of sediments was established based on pot experiment: four different sediment dosages (5%, 10%, 20%, 40%) and three plants in rotation (mustard, maize and grass) were tested. Application of tested material into sandy soil improved its texture (depending on dose: decrease of sand fraction by 4-31%, increase of silt by 50-412% and clay by 40-70%) and sorption properties, increased pH (the soil was acidic). The content of total organic carbon total nitrogen, ammonium nitrogen, nitrate nitrogen, total phosphorus (P) and available phosphorus increased significantly. Yield of all three plants increased significantly correspondingly to the sediment application. It shows that DR sediments might be a good alternative to chemical fertilisers. Since the catchment of the analysed reservoir is mostly agricultural, N and P compounds accumulated in sediments originated from farming. Therefore, using DR sediments as fertilisers closes the cycle of these elements. Additionally, this alternative fertiliser is cheap – since the analysed reservoir has to be dredged, large amounts of sediments will be obtained as a ‘side-effect’ of this process. Agricultural application of this nutrient-rich material would transform sediments from waste into a resource. Recent steep increase of mineral fertilisers prices – in Poland, the prices in 2022 were 2–3 times higher than in 2018 – showed that fertiliser sources have to be diversified. Low cost, ecological sustainability and good physical and chemical properties make DR sediments, if not a substitute, a good addition to the traditional methods of agricultural fertilization.

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Financing of low emission reduction measures in local government units in 2019-2020 in Poland - a case study

The activities of local and regional governments related to improving energy efficiency, developing renewable energy sources, low-carbon technologies and clean public transportation, promoting new patterns of consumption, etc. are part of the idea of sustainable development in the low-carbon economy. The multitude of environmental, economic, political and social challenges posed to local governments makes the implementation of these activities require considerable effort and commitment from municipalities. The article is based on a literature review and qualitative analysis of activities undertaken by local governments in Lubusz Province.

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Socio-structural changes and the load of nutrients in the environment

The aim of the presentation is present the results of statistical analysis of data on the quality of surface water, monitoring of nutrients and socio-structural changes in non-urbanized areas and their impact on the water environment of Małopolska.
The developed data concern the Małopolska Voivodeship, where the results of measurements of the concentrations of nutrients, mainly Nitrogen and Phosphorus, were analyzed. Additionally, parameters related to agricultural production were collected, such as: livestock population, number of farms, crop area, yield and fertilization level.
Based on the analyzes performed, it was found that the condition of the aquatic environment is classified as 'below good'. Therefore, it is necessary to take corrective and preventive actions. The level of agricultural production in the Małopolska Voivodeship - compared to the production’s level in the country. Voivodeship can be divided into the northern part (intensive agriculture - mainly vegetable farming) and the southern part, where the level of agricultural production (mountains and foothill areas) is characterized by strong agricultural extensiveness.
A positive aspect of the research is the reduction in the amount of mineral fertilizers used, which does not reduce yields, which in most cases increases. It influences to a more rational and conscious use of fertilization by plant and animal producers, as well as the development of technology and improved production of agricultural produce. Of course, this is a beneficial phenomenon from the point of view of environmental protection, especially water resources.
The presented data constitute part of the information collected to prepare a broader analysis and study of the impact of agriculture on environmental changes in the Małopolska Voivodeship. The structure of agricultural production, livestock and crops will allow for the determination of, incl.: balance of NPK or biogenic compounds, and then estimation of the impact on eutrophication processes. This will allow for a real assessment of the state of the environment and, consequently, provide plants with the appropriate amount of ingredients ensuring better yields without excessive fertilization.

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PCM development and their impact on the environment

Phase-change maetrials (PCMs) are substances or mixtures of substances that exhibit a phase change over an assumed temperature range. These materials can store or release thermal energy during the phase change. Currently, several hundred compounds are known that can be used as PCM materials and there are no raw material limitations.

Phase-change materials are used throughout the world, such as in the construction industry in the form of panels or admixtures for concrete and cements. Their use makes it possible to reduce the amplitude of temperatures inside a building by 6-8˚ C without additional energy expenditures such as those associated with the use of air conditioning or heating systems. The use of PCM materials in climate floors in the Netherlands reduces the energy consumption of the heat pump (by up to 50%). Phase change materials are also used in solar systems.

The environmental impact of these materials during their use is minimal. However, the production and disposal of phase-change materials requires an energy input and leaves a non-zero carbon footprint.

This paper presents an overview of phase-change materials along with their power range, durability, number and efficiency of cycles and their life cycle. The carbon footprint for selected PCM materials is presented, for the different stages of the life cycle of these materials.

It is noted that the functioning and operation of phase-change materials can be carried out as emission-free especially when the material is used as an admixture to building materials. In the case of thermal inputs, it is necessary to prepare them, which may involve carbon dioxide emissions when this energy is obtained from fossil sources.

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Analysis of chimney systems and their environmental impact based on polish standards

The paper discusses new generation chimney systems used in singlefamily housing and collectivehousing and theirimpact on the environment. The advantages and disadvantages of individualsolutions as well as the criteriadetermining the selection of the appropriatesolutionaregiven. The analysis was based on Polishstandards.

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Comparison of the efficiency of selected processes for the removal of estrogens from wastewater

The presence of pharmaceuticals in the aquatic environment is a worldwide problem that is becoming more serious every year due to the thriving pharmaceutical market. Currently, a significant problem of water and wastewater management is the presence in wastewater of human hormones, especially oestrogens, among others, consumed by women in contraceptive preparations and subsequently excreted from the body. Attention was drawn to the potential danger posed by short-term or long-term exposure of living organisms to pharmaceuticals and, above all, to the effectiveness of removing drugs from wastewater. The various methods of removing them from wastewater were presented and which parameters determine their effectiveness. Processes were then compared in terms of the efficiency of estrogen removal from wastewater, such as: Coagulation, Nanofiltration, Adsorption, Filtration, Electro-Fenton, Electrolysis, AOP. According to the studies, no method was found to eliminate 100% of estrogens from wastewater, while the efficiency in some processes is very high, but at the same time has quite serious side effects on living organisms.

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New approach to urban green areas as an important element of rational water management in the city in the context of climate change

Global climate change is a process that is shaping ecosystems, including those on the brink of ecological threat. In Central Europe, large areas have already been in negative hydrological balance for 40 years. These include permanently urban areas, characterized by surface sealing, high surface runoff of water, and consequently a precipitation-retention type of soil water management.

Much of today's urban greenery is filled with lawns which require a significant amount of water, as well as fertilizer, and pesticides. Intensive irrigation additionally threatens groundwater by drenching contaminated urban soils. The answer to all these challenges is to replace a significant portion of lawns with native vegetation, floral and xerophytic meadows. Nowadays, when climate change occurs the new technologies in the municipal green areas constructing sector, based on a brand new assumptions, easily, safely and effectively applicable worldwide must be introduced. They will be based on new forms of greenery creating interesting cityscapes, introduced as ready-made elements (e.g. mats) on a base of specially prepared soil with enhanced water retention capabilities. The result will be new, aesthetically pleasing arrangements that are self-sufficient with regard to water requirements – with lower water demand, and maintaining integrity and aesthetic appearance despite temporary drought conditions.

This is in line with the general understanding of the functioning of a contemporary city that includes in the development assumptions the issues of: optimizing water management, improving air quality, increasing biodiversity, and stabilizing ecosystems. The paradigm shift of urban greenery is currently the subject of many scientific considerations, as well as real-world implementations. Already in the US, more water is used to irrigate lawns than 7 major agricultural crops. Some local governments pay property owners to convert their lawns to xerophytic arrangement. In other conditions, it is proposed to increase the retention capacity of soils, without changing existing forms of landscaped greenery.

Both concepts are in the early stages of testing at the Institute of Environmental Engineering in Zielona Gora, Poland. The feasibility of using mineral sorbents (waste clays) and organic sorbents (humic acid concentrate) as materials to improve the retention capacity of soils in the short and long term has been determined. The

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specified water characteristics of the fertilized soils (filtration rate, percolation rate and water retention time) are promising.

GRIGOROV Borislav

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Forest habitats of svoge municipality, Bulgaria

The study is focused on the investigation of the forest habitats of Svoge Municipality, situated in the western parts of the country. The total area of Svoge Municipality is 868 km^2. 134 relevés were collected during the period of 2015-2019, following the Braun-Blanquet approach and 445 field points were verified, as well. As a result, 10 forest habitat types, included in Directive 92/43/EEC, were identified. They are covering 135.89 km^2 or 15.7% of the total municipality’s area. The habitat type of the Asperulo-Fagetum beech forests (9130) owns the largest territorial share with 57.86 km2, followed by the habitat type of the Medio-European limestone beech forests of the Cephalanthero-Fagion (9150), covering 31.03 km^2. The study was focused on forest habitats and it may serve as a basis for the conduction of research, aiming at the investigation of other habitat types.

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The role of alley cropping in the reclamation of degraded agricultural land – a review

Alley cropping is the growing of trees or shrubs in defined rows (alleys) and arable crops (alley crops) between the alleys. Land reclamation, the process of revitalizing degraded or barren land for productive use, is a critical endeavor with profound implications for agriculture, the environment, and sustainability. This literature review examines the multifaceted role of alley cropping, an agroforestry practice, in the context of land reclamation. Beginning with a historical perspective, this review explores the evolution of land reclamation methods, highlighting their limitations in light of contemporary environmental challenges. The literature review critically analyzes studies and projects that specifically investigate the application of alley cropping as a method of land reclamation. It reveals that alley cropping has the potential to significantly enhance soil quality, mitigate erosion, and restore degraded land. Furthermore, the ecological benefits, including biodiversity enhancement and carbon sequestration, are discussed, alongside its impact on agricultural productivity and economic feasibility. Challenges and limitations, such as resource competition and labor-intensive management, are scrutinized. The review presents case studies from various regions, highlighting the adaptability and effectiveness of alley cropping in diverse contexts. A comprehensive comparison with other reclamation methods evaluates its effectiveness, cost-efficiency, and sustainability. Future research directions emphasize the need for long-term studies, localized adaptations, and knowledge dissemination to farmers. In conclusion, alley cropping emerges as a multifunctional, sustainable solution for land reclamation, addressing both ecological and agricultural objectives. This review offers valuable insights into the potential of alley cropping to transform barren landscapes into productive and ecologically balanced spaces.

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Enhancing municipal solid waste leachate treatment efficiency: ai-based prediction of electrocoagulation/flocculation recovery using iron electrodes

The growing challenge of managing municipal leachate, a complex wastewater stream originating from landfills and waste disposal sites, calls for innovative treatment approaches. This research explores the integration of artificial intelligence (AI) with the electrocoagulation/flocculation (EC/EF) process using iron electrodes to enhance the efficiency of municipal leachate treatment. We propose an AI-driven framework that combines experimental data and modeling to predict and optimize the performance of the EC/EF system in removing turbidity (TDY) from leachate. AI-driven models are developed using a multi-layer perceptron (MLP)-based feed-forward artificial neural network (ANN). Through extensive experimental investigations and ANN modeling, this study demonstrates the exceptional predictive capabilities of the ANN model, with high R-squared values and low mean square error, affirming its reliability in forecasting leachate treatment outcomes. Statistical analyses, including main effect analysis and ANOVA, assess the significance of process parameters. The results emphasize the pivotal role of factors such as current intensity and settling time in influencing the EC/EF process's performance. Additionally, Pearson correlation analysis reveals a strong positive correlation between EC time and turbidity reduction. The study identifies an acidic pH range as favorable for the EC/EF process, reducing particle repulsion and aiding pollutant agglomeration. Elevated temperatures, conversely, are found to be unnecessary and negatively impact turbidity removal. This research showcases the potential of AI-guided EC/EF in achieving high TDY removal rates, offering a promising solution for eco-friendly and efficient wastewater management. By contributing to the advancement of municipal leachate treatment strategies, this work seeks to protect ecosystems and public health in the face of increasing urbanization and waste generation.

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Forms of metals occurrence in surface waters

Heavy metals can be introduced into natural surface waters in dissolved and undissolved form with suspended particles. The concentration of heavy metals dissolved in water does not fully reflect the degree of pollution of the aquatic environment because they may occur in various forms other than the dissolved form. The primary form of the metal in which it migrates into water is also important. Some metals are adsorbed on the surface of suspension particles. Other sparingly soluble forms of metals are sorbed on the surface of solid particles and then deposited in bottom sediments as a result of the sedimentation process.

The aim of the study was to determine the content of heavy metals in the Oder water, occurring in colloidal and dissolved form. Water samples from the Odra River were taken at four measurement points: Nowa Sól, Cigacice, Krosno Odrzańskie and Urad, at a frequency of one sampling per month, from June to August 2023. The concentration of selected heavy metals in the water was determined in unfiltered samples and those filtered through a membrane filter with a pore size of 0.45 µm.

Approximately 73.3% of the calcium contained in the river water was in dissolved form, the remaining 26.7% was calcium in colloidal form. Magnesium occurred mainly in dissolved form - 86.4%, and 13.6% of magnesium was in colloidal form.

The analysis of the results showed that iron and manganese were contained mainly in the colloidal form in the Oder waters, 86.9% and 93.7%, respectively. The highest values of total iron were found at the measurement station in Urad. In August, higher concentrations of manganese were found in water than in June and July.

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The influence of the type of filter partition on the quality of beer after the filtration process

Beer filtration allows to separate the sediment that remains after the beer brewing process. Filtration improves the optical qualities of beer, enhances its taste and allows it to extract a more distinctive aroma.
The aim of the work was to determine the influence of the type of filter partition on the quality of beer after the filtration process. The filtration process was carried out on a laboratory scale using cellulose membrane with a pore diameter of 0.45 µm and on a technological scale on a polymeric tubular module with a pore diameter of 0.03 µm. The effectiveness of retaining bacteria and yeasts on filter membranes was assessed on the basis of cultivation on prepared selective culture media.
The dry matter content in beer decreases slightly with filtration time. Degree filtration of solid particles is greater after filtration on the pipe module. Both membranes removed beer turbidity to a comparable extent. Inoculations on agar media showed complete retention of yeast from beercellulose membrane. The membrane module reduced the yeast content by over 90%.
The concentration of the reference protein - bovine albumin - was relatively constant during filtration on both membranes. The presence of proteins in beer is desirable and determined at a level 500 mg/l. In the tested beer, this concentration was approximately 1380 mg/l after filtration cellulose membrane and 1250 mg/l after filtration on the tubular module. Increased quantity proteins may be caused by autolysis of yeast during long aging period filtering.
The results showed a reduction in turbidity, protein concentration, amount of dry matter and color change after the filtration process. The cellulose membrane achieved a higher filtration rate and enabled the complete removal of the living part of the suspended solids. The polymeric tubular module, due to its smaller pore diameter, more effectively reduced turbidity and the amount of dry matter after the filtration process. Both filtration baffles reduced the protein concentration to a similar extent.

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Assessment of the possibility of using unmanned aerial products for emissions and mapping of residues from road infrastructure exhaust emissions

Sustainable development and the creation of smart, green cities require cooperation with many fields of science, including those related to ecology, mobility or sustainable management. The protection of the environment is especially relevant. Due to the movement of air, pollution is spread into very large areas, therefore monitoring the air quality is a key protection against health problems. Road transport is one of the most serious sources of air pollution, being approximately 25% of the total annual emissions in the EU. It is not without reason that the European Union imposes an obligation to remove emissions to the level of 55% for passenger cars and 50% for commercial vehicles by 2030. Recently, it has become increasingly popular in many sources of science, including environmental protection, geodetic measurements and unmanned photogrammetry aircraft (UAV). UAV leads to the origin, allows the use over conventional therapeutic methods, due to the possibility of direct coverage, then distributed to people, covered and area measurement. Taking into account the possibility of using this technology, the article presents the possibility of using UAV for alternative use and imaging (mapping). Cases presented in foreign literature, as well as our own research on the image of the altitude distribution of both gases: C_6H_6, HCHO, SO_2 and suspended dust: PM1, PM2.5, PM10, explaining the principles of such activities. The results presented in the article concern the area of the main field in Poland, the A4 motorway. The maps available include area and elevation, one of the detailed coverage data that is a problem across the EU. An additional source of information about the implementation of road infrastructure activities and improvements may be available, thus contributing to the removal of air pollution and the creation of the so-called "green cities".

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Carrying out detailed and confirmed calculations concerning the proposed thermomodernization projects for a single - family building located in a selected locality - Energy audit

The article presents three variants of thermal modernization, that improve the efficiency of energy usage for a specific residential building. The main aim was to fulfil the requirements for new buildings, which were outlined by WT2021. The guidelines mainly refer to the maximum value of the annual demand rate for non-renewable primary energy (EP). As of now, this value must not exceed 70 kWh/(m^2·year).
The first thermomodernization variant assumes a change in the central heating and hot water preparation system and is based on the replacement of the existing central heating and hot water system with a direct evaporation heat pump in the ground/water. This system is to be based on solar energy, i.e. the use of photovoltaic panels. The second thermomodernization variant assumes the change of the central heating and hot water system and is based on the replacement of the central heating and hot water system with a glycol/water heat pump, compressing and electrically driven (55/45°C). This system is to be based on electricity from the power grid, without using photovoltaic cells. Surface water heating was adopted as a type of heat distribution system. The third variant of thermal modernization assumes that the current central heating and hot water system will be maintained. This variant is based on a central heating and hot water system in the form of a biomass boiler (wood: logs, briquettes, pellets, wood chips), automatic, with a power of up to 100 kW. This system is to be based on electricity from the power grid, without the use of photovoltaic cells. Underfloor water heating was adopted as a type of heat distribution system.
The SPBT (Simply Pay Back Time) for the 1st option is 18 years with the planned total costs of PLN 312,576, and the building achieves the status of a passive house, with an EP of 5.4 kWh/(m^2·year), which is a reduction of over 95% compared to the original state. In option 2, the assumed maximum annual demand rate for non-renewable primary energy (EP) has not been achieved. A decrease of this indicator by 31% was achieved to the value of 86.3 kWh/(m^2·year). This is due to the high demand for electricity to drive auxiliary equipment for the heating and hot water system. The SPBT ratio in this version was 16 years, and the planned financial outlay amounts to PLN 279,100.
The most advantageous option is option 3, where the SPBT is 12 years and the financial outlays are PLN 205,300. The value of the EP indicator in this variant decreased by 76% to the level of 28.9 kWh/ (m^2·year).

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Biochar technology for climate change mitigation, circular economy, crop protection, and soil remediation for sustainable agriculture

Biochar technology is gaining significant attention for its potential in addressing the pressing global challenges. It involves converting organic biomass in the form of agricultural wastes into a stable carbon-rich material through pyrolysis. This paper provides an overview of the diverse applications of biochar technology, including climate change mitigation, circular economy, crop protection, and soil remediation, all of which contribute to the promotion of sustainable agriculture. Biochar has a huge potential in mitigating climate change due to its ability to sequester carbon. When added to soil, biochar not only locks carbon away for extended periods but also improves soil quality and reduces greenhouse gas emissions. By enhancing soil carbon stocks, biochar can play a pivotal role in achieving climate-related goals. The process of production of biochar creates a circular economy by converting organic waste, such as agricultural residues and forestry by-products, into a valuable resource. This not only reduces waste and pollution but also generates a sustainable source of carbon that can be used in various sectors, including agriculture and energy production. Studies have demonstrated that the application of biochar to soil enhances plant growth and protects crops against various stressors. Its unique properties, including improved water retention and cation exchange capacity, enhance nutrient availability and provide a physical barrier against soil-borne pathogens, thereby increasing crop productivity while reducing the need for chemical inputs. Biochar's porous structure and high surface area make it an effective tool for soil remediation. It can adsorb and immobilize various contaminants, including heavy metals and organic pollutants, reducing their impact on the environment. This capability makes biochar a valuable asset for revitalizing degraded soils and reducing environmental contamination. Combining these attributes, biochar technology promotes sustainable agriculture by offering solutions to multiple challenges faced by the sector. By increasing soil fertility, reducing the environmental footprint of agriculture, and bolstering crop resilience, biochar contributes to the development of a more sustainable and ecologically conscious agricultural system. In summary, biochar technology stands as a versatile and promising tool with the potential to address several critical global challenges, offering a multifaceted approach toward a more sustainable and resilient future.

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The use of phase change materials to improve the external walls' thermal parameters of heated buildings

Currently, it is estimated that the construction sector consumes over 40% of the energy produced and about 50% of the mass of processed materials. As a consequence, there is a challenge to look for alternative material solutions allowing for the storage and conversion of energy. Phase change materials give us such opportunities. Their introduction leads to additional benefits related to thermal parameters. The work presents a short overview of PCMs along with the possibility of their application. Then, as part of the research, the selected phase change material was applied to the internal plaster layer of an external wall to check its activity. The obtained results were compared to the values of reference samples (without PCM). The proposed solution leads to the improvement of the analyzed partitions' thermal parameters.

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Pumped hydropower energy storage plants in Poland

Hydropower is considered the cleanest as well as the safest of all energy sources. Nevertheless, the available hydropower potential can be used to a much greater extent, both at home and abroad. This can be done by building new hydroelectric power plants or by modernizing and increasing the power of existing facilities. The longevity of the installation also guarantees sustainable and environmentally friendly energy production for decades. These include pumped hydropower energy storage plants (PHESP), which have been the optimal solution for large-scale energy storage for over 100 years. Their operational life is 80-100 years, efficiency is 80%, and storage costs are low.

In the work, the authors analyze existing, planned and potential locations of PHESP for their construction. Among the technologies available in the world, they account for 99% of the global energy storage capacity. The total PHESP capacity in the world in 2020 was 161 GW and the storage capacity was 8.5 TWh. There are over 40 units of this type in operation in Europe today, and 10 more are planned to be built. According to the European Commission, PHESP with a total capacity of 44 GW accounts for almost all energy storage capacity in the EU. Currently, with the growing share of renewable energy sources such as photovoltaic and wind installations, PHESPs are gaining in importance. The most important advantage of PHESP is the ability to efficiently, long-term store large amounts of energy in a cost-effective manner. Power plants of this type efficiently fulfill their tasks in the process of optimizing energy supplies, as well as in the aspect of securing the launch of generation sources, balancing instability in energy supplies, buffering the transmission and distribution of energy and guaranteeing its appropriate quality. Power from renewable energy sources (RES) in the National Power System is increasing very quickly, but unfortunately there are no possibilities of storing it. In the period 2018-2023, the installed capacity of renewable energy in Poland increased from 8.7 GW to 26 GW. PHESPs constitute one of the best large-scale energy storage facilities, we need them not only to develop RES, but also for Poland's energy security in crisis situations. The potential of energy storage allows you to accumulate energy from renewable sources and, in a very short time, activate a large energy resource that will meet the demand for electricity. Currently, we have six PHESPs in Poland with a total installed capacity of 1,877 GW and a storage capacity of 58,970 GWh. These include: Żarnowiec (power 780 MW), Porąbka-Żar (552 MW), Solina (198 MW), Żydowo (165 MW), Niedzica (92 MW) and Dychów (90 MW).

To increase the stability of Poland's power system and enable further development of wind energy and photovoltaics, the power system needs new PHESP facilities with a capacity of at least 3–4 GW. This will enable, among others: new act of 2023 on the preparation and implementation of projects involving the construction of pumped-storage power plants, giving them the status of public purpose investments. It provides for a number of procedural simplifications: no need to adopt a local spatial development plan, easier acquisition of real estate intended for PHESP infrastructure, includes preparation and implementation of new PHESP and modernization of existing facilities. The PHESP projects planned for implementation and currently being analyzed are: Młoty (1,050 MW), Tolkmicko (1,040 MW) and Rożnów 2 (700 MW), which will have a total power of 2,790 GW and a capacity of 19.5 GWh. It is also worth mentioning the locations that were and are still considered as PHESP facilities, with estimated capacities: Jawor (520 MW), Niewistka (1000 MW), Sobel (1000 - 1400 MW), Pilchowice III (612 MW), Smolnik (200 MW). An interesting idea regarding energy storage and the construction of PHESP is also the use of degraded areas of workings and dumping sites after the exploitation of lignite deposits, aggregate and hard coal mines, as part of recultivation works, among others Turów (700 - 2300 MW) and Bełchatów (500 MW).

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Ozonation in wastewater disinfection

Due to the potential microbiological hazard associated with discharging treated sewage into the receiving body, its disinfection is a key issue to protect ecological safety and human health [1]. Water scarcity and drinking water supply, irrigation, rapid industrialization, use of treated water, protection of water sources, overpopulation and environmental protection force us to look for solutions to ensure safe reuse of wastewater, and this depends primarily on the quality of wastewater disinfection. New legal regulations proposed by the European Commission encourage the reuse of water (e.g. in agriculture), which leads to attempts, among others, of its recovery from treated sewage leaving municipal sewage treatment plants [2] .

Many wastewater disinfection methods are commonly used. One of the chemical processes of disinfection sludge is ozonation. Ozonation is widely used in wastewater treatment by oxidation, because ozone is a very strong and effective oxidizing agent. Studies have shown that the effectiveness of ozone in disinfecting water and sewage is up to 50% greater than that of chlorine [3] . An additional advantage of this method is that it also eliminates odors that may be unavailable.

The article presents the results of research on the effectiveness of ozonation treatment in disinfection of treated sewage, based on indicator bacteria such as coliforms, including Escherichia coli, mesophiles, psychrophiles and spores. The study took into account various effects of time (dose) and temperature. For the purpose of this study both traditional and modern methods of assessing microbiological quality of wastewater were used. The first one represented by conventional culture measurements and the second one by using luminometer (ATP) and flow cytometer (FCM).

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Thermal waters of the Zielona Gora region

In the southwestern part of Poland, the geological unit within which the largest number of wells were probably drilled is the Fore-Sudetic Monocline. Most of these drillings were carried out in search of prospective hydrocarbon deposits (Bojarski, 1996a; Karnkowski, 2000). In general, groundwater within the sedimentary series of the mentioned unit is characterised by high mineralisation (sometimes more than 300 g/dm3), and in areas of tectonic involvement it even shows characteristics of chloride-magnesium leaching (Bojarski, 1996b; Dowgiałło, 1971). Significant depths of aquifers allow the formation of thermal waters.

In the Zielona Góra area, the IG-1 well in Łagów Lubuski encountered thermal waters in the Lower Jurassic sediments, at a depth of 463-717 m below sea level. Although the temperature obtained in the outflow was 21.5°C and the mineralisation of the water was 6 g/dm3. The content of microelements allows this water to be considered as medicinal (Dowgiałło, 2007; Paczyński and Płochniewski, 1996; Pilich, 1979). Therefore, in 2006, by a decision of the Council of Ministers, the water deposit was included in the list of therapeutic and thermal water deposits (Dz.U. 32, 220). In Sulechów (northeast to Zielona Góra), brines (with mineralisation 264 g/dm3) were found in the IG-1 well. Brines with therapeutic components were also discovered in Łagów Lubuski (Goebel, 1963). Thermal brines (with a temperature of 31°C at the head and 45°C at the bottom) were found to the north of Głogów in Sława IG-1 borehole (Paczyński and Płochniewski, 1996). Triassic sedimentary formations are the main aquifer in the depth range of 1000-1100 m.

High values (more than 100 mW/m2) of the heat flux density in this area suggest a possibility of thermal water deposits in the Zielona Góra area. Favorable conditions with temperatures of up to 78°C were found in Radoszyn, Lelechów, Kisielin, Mozów and Kije.

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Biological stabilization of mixed unsorted municipal waste for landfilling: potential implications in leachate treatment?

On 9 January 2023, the Decree of the Minister of Climate and Environment on the mechanical-biological treatment (MBT) of mixed unsorted municipal waste (MUMW) was published. According to this document, MBT consists of mechanical and biological processes combined into one integrated process of MUMW treatment to prepare it for recovery, including recycling, energy recovery, treatment for energy purposes or disposal. The biological treatment of MUMW aims to stabilise it as quickly as possible. The process should be carried out in such a way that the emissions from the decomposition of the organic fraction, which in the case of landfilling would become a substrate for the production of methane-containing biogas, are minimised and an odour-neutral material is obtained. Biological treatment is therefore intended to result in a reduction in the mass of greenhouse gases with a reduction in the weight and volume of waste sent to landfill and also a reduction in the degree of pollution of the leachate generated. The study analysed the changes in the physicochemical parameters of the leachates potentially generated during the biological stabilisation process of the subscreen fraction (under 80 mm) of MUMW on a technical scale. The three-stage extracts were then prepared from samples taken during the 6 weeks of the process. It was found that the pH and COD values in the aqueous extracts corresponded to those of the raw leachate from the so-called young landfills operated for less than 5 years, but in the case of the BOD5 index they were similar to leachate from landfills 5 to 10 years old, and the PEW, BOD5/COD and TOC indices were the same as in leachate from landfills more than 10 years old. The concentrations of heavy metals (Cu, Pb, Cd, and Zn) were found to increase in the extracts studied with the time of stabilisation of municipal waste. Therefore, the process of biological stabilisation of the MUMW subscreen fraction may, in some aspects, increase the environmental risk in the case of leachate emissions to the environment and lead to new problems in wastewater treatment technology.

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Constructed wetlands as a tool to treat emergency outflow from nuclear power plant

The use of constructed wetlands (CW) for the treatment of various types of wastewaters gains increasing attentions as nature-based solution leading to preservation or improvement of the chemical status of water recipients [1] [2]. Their use in the disposal of emergency leakage of contaminated water from nuclear power plants or other operation using radionuclides is very limited. Therefore, one of the goals of the paper is to verify in experimental mesocosm the possibility of using CW for the removal of radionuclides and to verify suitability of different types of filter additives (biochar, crushed bricks, soil) for removing Cs from water. Water contaminated with stable analogues of radionuclides, primarily 133Cs, was used for experimental work to minimize the possible risk. A physical model of vertical flow CW (75L barrels, 10 replicates per additive) was used to study the removal efficiency. The experiment took place from fall 2019 till present.
The Cs removal efficiency for all tested filter material compositions exceeded 97%.

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Determinants and opportunities of using water from mine dewatering systems in rejecting and recovering condensation heat of mine underground refrigeration plant

Harsh climatic conditions occur in most Polish underground mines. Therefore, it is necessary to use air cooling systems in mine excavations. For this purpose, a refrigeration plant in underground excavations is built. Compressor chillers are the most widely used in those systems where condensation heat must be rejected. Cooling capacity and localization of a refrigeration plant have the most significant influence on deciding of rejecting condensation heat to air or water. The limitation of the heat rejection capacity of return air streams in a typical mine and conditions facilitative to using underground water from an underground mine dewatering system are presented. Determinants and opportunities for heat recovery from water discharged to the surface are also discussed.

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Environmental impact assessment as part of environmental engineering and design

Environmental impact assessment as a part of environmental engineering and spatial planning is a structured activity aimed at the efficient land use, reconciling the interests of various users and pursuing social and economic objectives. In Poland, spatial planning is carried out at the three levels: national, regional, and local, operational in medium and long term. Within their framework, the following documents are drawn up: National Development Strategy, Regional Spatial Development Plan, Landscape audit, General Land Use Plan, and Local Spatial Development Plan. The most important documents are undoubtedly the local ones (GLUP and LSDP) with a significance of local law acts. The two local documents must be mutually consistent. In order to capture their environmental effects, an assessment is carried out, which, in the case of the GLUP and LSDP, takes the form of an environmental impact forecast (ecophysiographic study). The main purpose of such a study is to determine the impact of the plans implementation effects on the environment (biosphere, atmosphere, hydrosphere, pedosphere and lithosphere), as well as on human health and living conditions. The state of atmospheric air, soils, surface water and groundwater, noise levels in the area indicated and neighboring ones, water regime including the management of rainwater, collection and disposal of municipal and industrial waste and wastewater, forest areas, forms of nature protection, with particular reference to Natura 2000 areas, forms of landscape, the way the land is used by animals, and the cumulative impact of the proposed land use with other cases of urbanization in the area being determined.
A major spatial planning reform has been introduced in Poland in 2023. The main goals of the reform are to increase the coherence of the system, simplify procedures and improve spatial order in the country, as well as to increase the flexibility and integrity of the spatial planning system, prevent the dispersion of development into agricultural, forest and naturally valuable areas, facilitate investment in already developed areas, digitize spatial planning data and increase the public participation. The amendment to the new Act on Spatial Planning and Development introduced a number of new tools, including the aforementioned GLUP. Until January 1, 2026 all municipalities have to implement the new tools of spatial planning to the decision practice.

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Overview of the Lausitz hydrogen network “Take a deep breath”

In 2019, the "HyStarter Hydrogen Region Lusatia" project was launched as part of the HyStarter program of the German Federal Ministry of Digital Affairs and Transport. Results of the "HyStarter Hydrogen Region Lusatia" project included the development of a "Hydrogen Strategy for Lusatia" (roadmap) and the networking of hydrogen stakeholders in Lusatia. In 2021, the Lusatia Hydrogen Network "Durchatmen" was consequently founded as a network for the overall Lusatia region, i.e. the Brandenburg and Saxon parts. The network now has 300 active members from industry, SMEs, administration and science. The main objective of the network is to promote the hydrogen economy in Lusatia as quickly as possible, especially in the areas of mobility and infrastructure. Outstanding projects of the Lusatian hydrogen economy are the hydrogen filling stations in Cottbus and Schipkau, the hydrogen reference power plant in Schwarze Pumpe, the Fraunhofer IWU Hydrogen Lab Görlitz and many more.

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Application of active dolomite beds to mixture of groundwater and surface water treatment

Dolomite deposits are typically used to treat aggressive groundwater and acidic and soft surface water. When water is filtered through a dolomite bed, physical processes and chemical reactions take place, resulting in an increase in alkalinity, hardness and a change in the reaction of the water. Organic matter sorption processes also take place in the bed. The aim of the study was to determine the efficiency of removal of organic matter fractions from the groundwater-surface water mixture after coagulation with polyaluminium chlorides by filtration through a dolomite bed. The analysis of the obtained test results showed that the filtration on a dolomite bed mainly increased the effectiveness of removing organic substances containing aromatic rings, as well as lowering the color measured at a wavelength of 340 nm at which they absorb mainly organic substances containing chromophoric groups. In water samples after the filtration on a dolomite filter bed, decrease in the zeta potential. Decreasing the zeta potential was most likely an effect of the reaction between disassociated functional groups of organic substances and calcium and magnesium ions from the dolomite filter. The processes of removing organic substances from water as a result of filtration through a dolomite bed, and especially removing organic substances containing aromatic rings, is connected with the ability of these substances to create complexes with calcium and magnesium ions. The complexes formed by calcium and magnesium ions with organic substances are formed as a result of the ion exchange of the H+ cation to a metal ion or as a result of the formation of coordinate bonds by –COOH and –OH functional groups containing oxygen, which play the role of a ligands as well as partially by ionic bonding.

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Removal of natural organic matter from groundwater using Fenton's process

Increasing the oxidation efficiency of organic compounds that are difficult to chemically degrade is provided by advanced oxidation processes, which are used in water treatment plants when conventional processes such as coagulation or sorption fail. In advanced oxidation processes, highly reactive hydroxyl radicals are generated, and one way of doing this type of oxidation is by using Fenton's reagent. Fenton's reagent is a mixture of hydrogen peroxide and iron(II) ions, catalysing the breakdown of H_2O_2 to hydroxyl radicals. The hydroxyl radicals formed have a high oxidation potential of 2.70 mV and act non-selectively on most organic compounds. It was hypothesised that the deepening oxidation process using the Fenton reaction, with optimal technological parameters (pH = 2-4, Fe(II):H_2O_2 = 1:5, flocculation time 30-45 minutes), should provide high efficiency of oxidation of organic substances present in the groundwater. In order to test the above hypothesis, technological tests were carried out. The subject of the studies was groundwater abstracted at the Zawada Water Treatment Plant (WTP), characterised by elevated contents of organic substances and iron (II) compounds. The studies, carried out on a laboratory scale, determined the effect of the ratio of the concentrations of Fe(II) ions, naturally occurring in the groundwater, to hydrogen peroxide, as well as the oxidation time and pH on the efficiency of removal of organic substances. The analysis of the obtained test results showed that the highest removal efficiency of organic substances, as well as the removal of iron compounds in the deep oxidation process using the Fenton reaction, was obtained for a concentration ratio of Fe(II) to H_2O_2 = 1:5 and a hydrogen peroxide dose of 13.32 mgH_2O_2/dm^3. Acidification of the water samples to a pH of approximately 4 significantly increased the removal efficiency of all organic matter fractions, with dissolved organic matter containing aromatic rings, mainly trihalomethanes precursors (UV_{272}), being oxidised to the greatest extent.

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Application of the SUVA254 indicator for the qualitative assessment of organic substances present in water from the Odra River

The concentration of dissolved organic matter (DOM) is measured using proxies such as total or dissolved organic carbon (TOC or DOC). A commonly used index to characterize DOM is also the specific UV absorbency ($SUVA_{254}$). The aim of the study was to qualitatively assess the organic substances present in the water from the River Oder by analysing the $SUVA_{254}$ index values. Water samples from the Oder River were taken at four measurement points: Nowa Sól, Cigacice, Krosno Odrzańskie and Urad, at a frequency of one sampling per month, from June to September 2023. Dissolved organic carbon (DOC) was determined in the water and absorbance was measured at 254 nm. At the measurement site in Nowa Sól, DOC varied from 5.598 to 6.795 mgC/dm^3, in Cigacice from 5.162 to 6.070 mgC/dm^3, in Krosno Odrzańskie from 4.603 to 5.500 mgC/dm^3 and in Urad from 4.624 to 5.461 mgC/dm^3. The UV254 absorbance, which indicates the presence of dissolved organic substances containing aromatic rings, varied from 11.390 to 13.880 m^{-1} at the Nowa Sól test site, from 11.090 to 14.1200 m^{-1} at Cigacice, from 10.980 to 13.020 m^{-1} at Krosno Odrzańskie and from 10.840 to 12.710 m^{-1} at Urad. The most dissolved organic substances containing aromatic rings were found in September at all measurement sites, and the highest absorbance value at 254 nm was found at the measurement site in Cigacice. The calculated SUV_{254} value varied from 1.767 to 2.298 m^2/gC at the Nowa Sól, from 2.132 to 2.427 m^2/gC in Cigacice, from 2.143 to 2.385 m^2/gC in Krosno Odrzańskie and from 2.036 to 2.584 m^2/gC in Urad. Irrespective of the measuring site, the highest values of SUVA254 were found in August and September, and its lowest values were found in June, with the exception of the measuring site in Nowa Sól. Analysis of the results showed that both hydrophilic and hydrophobic as well as small- and large-molecule natural organic compounds were present in the Odra River water from June to September 2023 at the measurement sites in Cigacice, Krosno Odrzańskie and Urad. In contrast, mainly hydrophilic low-molecular-weight non-humic substances occurred at the measurement site in Nowa Sól in July 2023.

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Reception of radioactivity in modern society

Despite having access to a large amount of scientific and popular scientific information, the modern citizen is not aware of the radioactivity that they experience on a daily basis [1]. Air quality studies indicate the need to pay attention to the health exposure of the human occupant, which occurs through exposure of radioactive radon with its decay products [2, 3]. However, it is not possible to protect ourselves well from something we do not know exists [4]. The aim of the research carried out was to assess contemporary forms of knowledge transfer in the public about radioactivity. The objective was achieved through a literature review and various forms of gamification. Research indicates that current published news resources approach radioactivity topics in a frivolous and unprofessional manner. One of the most common fictional images of ionising radiation is that of instant mutations manifesting themselves as body transformations of the exposed victim. The solution to the problem of an uninformed public may lie in properly prepared forms of gamification.

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The stone market in the context of rapid construction development and protection areas of Major Groundwater Reservoirs

Over the last few years, the demand for stone raw materials has increased significantly. The stone industry is an unusual sector that combines domestic stone extraction with the global market. The stone market supported by the achievements of new technologies provides a processed product, which in consequence create great potential for development of this sector. What is more an intensification of the demand effect on raw stones can be initiated by the construction industry, which is one of the basic drivers of the country's economy. In this paper there are presented conclusions from an analysis of the local and global stone market. What is more authors presents the results of analysis the mining potential of dimension and crushed stones deposits occurring in Poland in the context of limited exploitation possibilities due to selected protection areas such as areas of Major Groundwater Reservoirs (hereinafter: GZWP).

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The effect of biochar-enriched digestate on soil CO_2 fluxes

In recent years, increasing attention has been paid to the potential of using biochar and digestion to achieve benefits and manage greenhouse gas emissions. The work was carried out to investigate the effect of biochar enriched with digestate on CO_2 emissions when applied in the field. A field experiment with different applications of biochar-enriched digestate. Measurement of CO_2 emissions with chamber control using a CO_2 probe at specific time intervals. The study was conducted from 11 May to 22 September 2022.

The results, which include the application of supplemental biochar in the summary, are carried out with CO_2 control in mind. The changes observed were alternative to the biochar change in digestion. Analysis of the composition and consequences after conducting an experiment that results in some of the soil effects caused by supplemental biochar in the digestate.

Our research has shown that digestate-enriched biochar can be a key driver in managing CO_2 emissions with impact, while also producing an effect with improved quality. Further research is needed to determine the effects and methods of application"

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Flow interrupted: dams and water quality shifts

The presence of the protected species Castor fiber L., which constructs natural barriers for its own needs, may influence changes in water quality parameters. This study assessed changes in water quality parameters (EC, BOD_5, COD, TN, TP, N-NH4, $N\text{-}NO_3$, $N\text{-}NO_2$, $P\text{-}PO_4$, SO_4^{2}, Fe^{3+}, Cl^{-}) in small rivers.

The research was conducted in areas with similar land use intensity but different land management practices (forests, meadows, shrublands). The study areas encompassed two national parks located in eastern Poland: Poleski National Park (PPN) and Roztoczański National Park (RPN). Selected sampling points were located on six watercourses: Świerszcz, Szum, Tyśmienica, Piwonia, Włodawka, and Mietiułka. For the purposes of the study, 10 beaver dams were selected, within which measurements were taken above beaver barriers (AB) and below beaver barriers on the river (BB). Water samples were collected at all 20 research points every three months (January, April, July, October). In the years 2021-2022, 8 measurements of surface water quality parameters were carried out. In the first stage, only changes in water quality parameters above and below the barrier (AB, BB) were analyzed. In the second stage, the influence of the study period (seasonality) and land use on the studied water quality parameters was determined. The assessment of the impact of the studied impoundments on water purification was carried out using intervention analysis (IA).

The conducted research indicates that changes in river water quality parameters result from various factors such as the presence of Castor fiber L. habitats, seasonality, and land use. Significant relationships have been demonstrated between waters flowing into natural impoundments and waters filtered through beaver dams. However, statistically significant impact of natural barriers on changes in river water quality was not observed. Statistically significant changes in water quality parameters were identified as a result of seasonality and land use. Due to the relatively minor recorded changes, it is not possible to definitively determine a positive or negative impact of beaver dams on water quality. The diversity of dam constructions and their age influence their functionality. During certain periods, individual dams may contribute to pollution reduction or emissions. The maximum increase or decrease in water quality parameter concentrations can be as high as 300% at a given time. Ensuring the durability and impermeability of beaver dam structures may contribute to future water quality management. It is essential to conduct further research to verify the impact of natural river barriers on environmental changes.

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Effects of groundwater table manipulation on greenhouse gas emissions: CO_2 reduction and N_2O challenges

Managing groundwater levels is a potent strategy for reducing harmful CO_2 emissions in fen meadows. While it's known that higher groundwater levels can decrease CO_2 outflux resulting from organic matter decomposition and enhance the carbon sequestration potential in the soil, the precise effects on N2O emissions remain unclear. We hypothesized that in soils, when intensively fertilized, with higher water content we would observe an increase in N_2O emissions alongside an expected decrease in CO_2 emissions. To investigate this, we conducted a comprehensive lysimetric study, examining the relationships between groundwater levels, topsoil moisture levels, and CO_2 and N_2O fluxes.

In our study, we utilized 48 mesocosm-scale lysimeters, each adjusted to various groundwater levels, resulting in different gravimetric water content levels in the topsoil. Subsequently, we applied a 100 kg N/ha manure dose and measured CO_2 and N_2O emissions. The linear regression analysis revealed that both groundwater table levels and topsoil moisture significantly influenced CO_2 and N_2O emissions. However, these effects were in opposite directions, suggesting that groundwater alteration strategies aimed at reducing CO_2 fluxes may inadvertently lead to increased N_2O emissions from agricultural soils. This finding underscores the need for further examination to minimize this potential side effect.

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Zeolite catalysts for the conversion of biomass into biofuel - review

The article presents a broad review of metal-based zeolite catalysts (Ni, Ru). The wide range of applications of zeolites was presented and discussed, with particular emphasis on zeolites obtained from fly ash. The materials are evaluated for use in petrochemical processes, but also in applications related to the synthesis of fine chemicals, biomass conversion and CO2 utilization. Based on literature data, various techniques for the synthesis of zeolites and their conversion into catalysts were compared. Zeolites have many practical applications, including: for the purification of gases and sewage, as a raw material for the production of cement, as a component of dressings for difficult-to-heal wounds, for purification of blood, for the controlled release of drugs, as molecular sieves, or for the protection of monuments. Due to their unique antibacterial, antifungal and regenerative properties, they are also widely used in the cosmetics industry. They are subjected to continuous research, which discovers the unknown properties of these inconspicuous aluminosilicates.

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Can the presence of microplastics affect the accumulation and harmfulness of herbicide preparations?

Microplastics are currently one of the main types of pollutants in nature and the environment. Over the course of their stay in soil or water, they undergo aging processes under the influence of various factors (physical, chemical or atmospheric) that change their surface and properties. Therefore, they are not inert matter in the environment and can interact with xenobiotics.

Until now, few papers have been published on the behavior of selected xenobiotics such as herbicides and herbicidal ionic liquids in the presence of microplastics. Do interactions occur and does this affect the toxicity of herbicides to microplastics?

The study was conducted to evaluate the effect of the presence of microplastic on the accumulation processes of selected herbicides and the impact on the harmfulness of these compounds to microorganisms.

The study consisted in determining the effect of the presence of microplastics (ABS and PE) as a sorbent on the accumulation of model herbicides and herbicide ionic liquids under aqueous conditions. In the next step, toxicity tests of the analyzed compounds were carried out against the model bacterial strain Pseudomonas putida KT2440.

Based on the tests, the ability of the tested microplastics to adsorb the tested compounds was confirmed. The amount of adsorbed significantly differed - surfactant cations were retained on the surface of the microplastic, while herbicide anions were not. Toxicity tests of substances after interactions with microplastic indicated a reduction in harmfulness on bacteria.

In conclusion, the presence of microplastic can be a direct cause of increased sorption by cationic surfactant. This occurrence may result in their immediate aggregation and decreased toxicity to microorganisms.

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Cerium oxide-supported nickel and cobalt catalysts for hydrogen production via steam reforming of ethanol

The energy crisis results from the growing global demand for natural resources, which, as we know, are limited but still essential sources of energy. Therefore, many efforts are being made to develop or improve alternative methods of generating energy. There is a growing interest in using hydrogen as an energy source, particularly in the energy and automotive sectors. One of the interesting methods of hydrogen production is the process of catalytic steam reforming of alcohols, especially ethanol. Using bioethanol obtained from various biomass sources for this purpose is very beneficial. The ethanol steam reforming process is stoichiometrically efficient, as from one volume of C2H5OH, six volumes of hydrogen can be produced. The selection of a suitable catalyst is crucial for achieving such high efficiency. Currently, in the role of the active phase, among others, cobalt or nickel are investigated as substitutes for expensive noble metals such as palladium or platinum. No less important is appropriate support for depositing the active phase. Among the various redox-active oxides, cerium oxide has been recognised as a very beneficial support due to its exceptional redox properties. One of the simplest and relatively cheap methods of support synthesis is the one-step hard template method, which allows obtaining oxides with a specific structure that facilitates the dispersion of the active phase. A fractal structure characterises the synthesised supports. The macrosized oxide spherical grains consist of spherical species at the nano- and microscale. The grains themselves are easy to handle, and their shape does not depend on the used calcination temperature, solvents or concentrations of the precursor solution.

This study presents the synthesis of cerium oxide-supported nickel and cobalt catalysts for hydrogen production via steam reforming of ethanol. The support was synthesised using the one-step hard template method, which involved the usage of the moderately polar porous resin, preferably the Amberlite® XAD7HP. Co or Ni was incorporated via incipient wetness impregnation procedure. The fresh and spent catalysts were characterised by various physiochemical methods such as scanning electron microscopy (SEM), transmission electron microscopy (TEM), temperature-programmed reduction (H2-TPR), and low-temperature nitrogen adsorption/desorption. Finally, the catalysts' activity and selectivity in the ethanol steam reforming process (SRE) were assessed.

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Occurrence of *Chaetomium globosum* on building partitions and in the air of public buildings

The genus *Chaetomium* are moulds that are widely distributed throughout the world. In the indoor environment, the most common species are *Chaetomium* globosum and *Chaetomium elatum*. They can synthesize mycotoxins such as chaetoglobosins and chaetoglobosins A and *C. Chaetomium* globosum is known to produce mycotoxins in damp buildings. These toxins can cause illness in building residents, so any presence of this species should be analyzed in terms of the threat to the health of residents. Literature data show over 200 biologically active metabolites of various *Chaetomium* species, which include compounds such as chaetomugillins, cochliodinol, cochliodones and chaetoglobin A [1].

In a public building in Lubuskie Province, a mycological analysis of a building partition was carried out in the place of visible growth of moulds. Additionally, using Mas 100 ECO air sampler (Merck), the microbiological quality of indoor air in the infected room was examined and outdoor air was tested as a background for the research. Tests were also carried out with a Trotec moisture meter.

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Indoor air quality in humid utility rooms of a public building

Indoor air quality (IAQ) is very important issue because people spend 80% of their time indoors. This also applies to workplaces, where we spend about 30% of our time during the day. Many factors influence air quality, among others humidity, temperature, presence of microorganisms and chemical compounds in the air. Excessive moisture may cause the growth of microorganisms on building partitions, which results in the release of large amounts of spores into the air, which may pose a threat to the health of employees.

In the Lubuskie Province, microbiological and humidity tests were carried out in utility rooms of a public building. Due to a technological failure, these rooms were periodically flooded with water. Microbiological tests of the air were carried out using the MAS 100 ECO air sampler (Merck) in the utility rooms, and samples of external air were taken as a background for the tests. Samples were taken from building partitions with visible biodeterioration and placed on the culture medium according to the methodology established by CBS (Centraalbureau voor Schimmelcultures),. Humidity and temperature in the rooms were measured using a Hygropen hygrometer. The results were assessed with Report No. 12 concerning biological particles in an indoor environment.

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Assessment of spacio-temporal variation of land surface temperature to mitigate the effects of climate change in Nigeria

The Nairobi Declaration 2023, which is the outcome of the inaugural African Climate Summit (ACS) and adopted by African Heads of State and Government (including Nigeria) on the 6th September, 2023 has acknowledged that climate change is the single greatest challenge facing humanity and the single biggest threat to all life on Earth. It demands urgent and concerted action from all nations to lower emissions and reduce the concentration of greenhouse gases in the atmosphere. It noted the 6th Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC), which stated that the world is not on track to keeping within reach the 1.5°C limit agreed in Paris and that global emissions must be cut by 45% in this decade. This is a clear demonstration of the political will and commitment of African Countries to address the challenges of climate change

As a result of the high vulnerability and low adaptive capacities of communities and systems to the challenge of climate change, Nigeria is committed to addressing the challenges of climate change especially in the area of adaptation. It has put in place institutional and regulatory frameworks in place. One of such institutions is the National Agency for the Great Green Wall. (NAGGW) The Nigerian Government signed the Great Green Wall Convention in 2010 and established the National Agency for the Great Green wall (NAGGW) in 2015 under Act No (3) of the Federal Government of Nigeria. The Act mandates the Agency to manage and reverse desert encroachment in the eleven frontline states of northern Nigeria. This poster presentation highlights some of the efforts by the Agency in enhancing adaptation of communities within the northern region of Nigeria.

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Microplastics in raw and treated drinking water

Contamination of drinking water with microplastic particles has become a global problem. The analysis of the quantity and origin of microplastics is challenging and requires advanced analytical methods. The presence of microplastics in drinking water causes concern among the public, due to poor information on its health effects. For this reason, the European Drinking Water Directive requires the monitoring of microplastics in drinking water. It has been added to a "watch list" of compounds of potentially hazardous.

In the present work, a monitoring study was conducted to assess the degree of microplastic contamination in drinking water. The study was performed on tap water from a metropolitan distribution network. Microplastics were monitored both in treated water coming from three treatment plants, fed with raw water of different origin, and in water drawn from the distribution network. Quantitative and qualitative characterization of the isolated plastic particles, was carried out using scanning electron microscopy (SEM) combined with mapping using an EDS detector.

The results confirmed the presence of microplastic particles in all analyzed waters. The isolated plastic fragments were characterized by small sizes, diverse shapes and different origins. Among the identified microplastic-forming polymers were plastics commonly used in various industries, such as PE, PVC, PP, PS, PA and polyureas, as well as perfluorinated polymers. Based on the results of the study, it was possible to compare the degree of primary polymer particle contamination of raw water with secondary contamination of treated water, the source of which is plastic fragments from in-service transmission pipes made of PE and PVC.

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Pipes renovated by polyurea resin as a potential source of microplastic in drinking water

Drinking water distribution networks are complex pipe systems made of various materials, primarily plastics. The ageing process of plastic pipes involves degradation of the material surface, which, due to their long-term use in water supply systems, can lead to the release of microplastic particles into water intended for human consumption. There are now an increasing number of reports of microplastic particle contamination of drinking water, which is causing public concern [1]. Operational wear and tear on pipes is associated with the occurrence of frequent failures, which are often difficult or impossible to repair. Trenchless pipeline rehabilitation techniques [2,3] address the need to effectively repair failures in hard-to-reach areas. An innovative technique is the spray-in-place pipe (SIPP) method. Materials that could potentially find application in this area are polyurea resins due to their properties [4-6].
The purpose of the research is to evaluate the potential for the release of microplastic particles into drinking water from the surface of polyurea resin used in trenchless pipeline rehabilitation under simulated operating conditions. A semi-technical modular model system was used for the tests. At set intervals, material fragments were taken from the system, properly prepared and cleaned, and analysed using scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS) techniques.
The microscopic images obtained during the study indicate a lack of continuity of the material's surface, resulting from insufficient mixing or incorrect preparation of the components. As a result, numerous irregularities, particles, and lumps are visible on the surface of the coating. Elemental analysis of the visible particles indicates their origin in the polyurea resin. In addition, a contributing factor probably increased the potential of the tested polyurea resin to release microplastic particles is the fact that the basalt fibre use for coating reinforcement have potential to slipped out during exploitation. Unfortunately, the basalt reinforcement fibres have not been properly bonded in the structure of the material and undergo slipped out as a consequence of the influence of water flow. The consequence is formation of numerous cavities, which are easily accessible to water and significantly less resistant to mechanical damage. The results of the study indicate the possibility of releasing polymer particles from the tested polyurea resin into potable water due to operation in a drinking water distribution system. However, a final assessment requires further testing and/or modification of the material.

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Laser confocal microscopy as a tool for detecting and studying microplastics in cellular structures based on the absence of fluorescence signal

Microplastics have become a global environmental problem, with potentially negative impacts on ecosystems and human health. The study presented here introduces a novel approach to detect and analyze microplastics in plant tissues, utilizing a laser confocal microscope as a tool. The method is based on the detection of microplastics through fluorescent staining of plant tissues, while simultaneously taking advantage of the absence of a fluorescent signal from microplastic particles. This enables precise localization and identification of their presence within cellular structures.

The study employed plant samples, specifically runner beans (Phaseolus coccineus), which were cultivated in an environment containing microplastics in the form of powdered epoxy resin, all measuring less than 300 µm in size. Control samples were also used for comparison. The results demonstrate that laser confocal microscopy is not only an effective tool for detecting microplastics but also facilitates the examination of their effects on plants at the microscopic level. This method holds significant potential for further applications in studying the impact of microplastics on terrestrial ecosystems, ultimately contributing to a better understanding of the mechanisms of microplastic uptake and their effects on plant organisms.

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Microscopic method to verify the efficiency of removal of organic chemicals in the form of fulvic acids from microplastic surfaces

Among the impurities that quite often appear on the surface of microplastics are those associated with the presence of organic matter. Due to its good solubility in water, fulvic acid (FA) is a very mobile and important fraction of natural organic matter (NOM). One of the main methods proposed for the purification of microplastics from NOM is Wet Peroxide Oxidation (WPO), described in detail in Laboratory Methods for the Analysis of Microplastics in the Marine Environment: Recommendations for Quantifying Synthetic Particles in Waters and Sediments also known as the Fenton reaction [oxidation of Fe(II) with hydrogen peroxide]. In view of the fact that, the presence of fulvic acids can cause an increase in the rate constant of the Fenton reaction, quite interesting results were expected in the purification of microplastic surfaces. When confronted with the Fenton reaction, it was also decided to use perhydrol itself, as well as the use of sonification in water with a cooling system to prevent too much degradation of the microplastic itself, both as a result of the sonification itself and the increase in heat generation during the process.

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Green and eco-friendly façade systems for the sustainable tomorrow

The article discusses current trends in shaping green and pro-ecological façades of cubature objects of various functions, in the world and in Poland. The information collected on the realised façade projects and the research carried out on their basis, as well as the conclusions formulated, indicate trends and possibilities for the use of contemporary material solutions and technologies in the design of various forms of vertical 'greenery', supporting sustainable development of urban areas. In order to conduct the research, a case study containing a description of the features and qualitative elements of the 100 most interesting architectural buildings with with a characteristic external walls structure was created. The data compiled, showing an overview of global directions, served as a guideline and were set alongside selected diagrams and visualisations of student innovative and pro-ecological design concepts made at the Faculty of Architecture of the Poznan University of Technology, showing high aesthetic solutions that could be implemented in the near future.

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Environmental risks from the medical sector

Medical care should adhere to strict regulations to guarantee the highest quality of service provided to patients. Nevertheless, this practice generates environmental hazards due to medical waste and contaminated wastewater. Appropriate disposal procedures are necessary to mitigate these risks. Improper waste management may contaminate the air, water, and soil with hazardous substances and greenhouse gases, ultimately leading to climate change, the reduction of biodiversity, and the destruction of ecosystems. The three most common approaches to waste management are recycling, incineration, and landfill, and the option chosen is dependent on the waste's source and its characteristics. However, healthcare waste must have bespoke strategies as waste reduction opportunities are non-existent. Wastewater can pose a considerable environmental risk due to drugs and metabolites present. Human waste, food waste, and chemicals from residential, industrial, and stormwater sectors comprise wastewater. Testing wastewater can provide information on chemical residues, including pharmaceuticals, drugs, and their by-products. This data is essential for estimating community consumption habits, obtaining statistics, and gaining insights into measures, such as public health programmes and water quality monitoring.
Collecting statistical data to monitor trends in drug and prescription abuse and managing medical waste are critical. Moreover, it is imperative to bolster legal regulations in these sectors to ensure the implementation of practical and eco-friendly resolutions. An ingenious approach to this is the implementation of artificial intelligence methods that can, for example, analyse complex surveillance data.

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Potential of hyperspectral imaging for surface water quality monitoring

One of the aims of surface water monitoring is to provide information on the status of water for management planning and to assess the achievement of environmental objectives. Using only the classical approach (in-situ measurements) to monitor surface water quality, we are always dealing with point information, not surface distribution. It is of course possible to obtain a surface distribution of various parameters using interpolation algorithms, but this will be a spatial distribution with a relatively low degree of confidence (especially in lakes with flowing watercourses). In this context, the use of hyperspectral camera data for continuous monitoring of large reservoir areas is being investigated. Exploiting the variation in reflection, emission and scattering properties of electromagnetic radiation is the idea behind remote sensing research. The different bands of electromagnetic radiation vary the spectral characteristics of surface waters and can therefore be used to estimate different water quality parameters. The visible bands are generally used to determine water transparency and total suspended solids, while the red and near-infrared bands are used to estimate the chlorophyll-a content of water. These indicators are the easiest to obtain from hyperspectral data. A literature review was conducted on the feasibility of using hyperspectral imagery for continuous monitoring of surface waters. The aim of the analysis was to select parameters for research within the project entitled: A comprehensive system for monitoring the quality of surface waters and coastal areas using a multi-sensor system with the hyperspectral cameras (HYDROSTRATEG1/001/T/2022 (acronym HIPER)). The project will develop a comprehensive system for monitoring the quality of surface waters using unmanned aerial (UAV) and underwater (UUV) vehicle equipped with innovative data collection and continuous measurement methods.

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The influence of sewage sludge compost on the soil carbon management indicators in reclaimed post-mining soil

The mining industry puts a lot of pressure on the environment, including removal of native vegetation, loss of biodiversity, environmental pollution, generation of large amounts of waste, occupation and degradation of large areas of soil. Particularly noteworthy is the devastation of soils, which are the support matrix of terrestrial ecosystems. After mining is completed, degraded land must be rehabilitated to mitigate the destructive effects of mining activities. The primary goal of reclamation of degraded soils is the initiation of soil-forming processes, including the accumulation of organic matter in the soil.

The aim of the study was to assess the subsequent impact of compost from sewage sludge (100%) and sewage sludge (70%) with fly ash (30%) on soil carbon management indicators in reclaimed post-mining soil.

The research was carried out in a plot experiment established on land degraded as a result of sulfur extraction. As part of biological reclamation, the soil was fertilized with composts, which were applied at a single dose of 180 Mg ha−1. A mixture of grasses was sown on the plots. Soil samples for testing were collected before sowing the plants (beginning of the experiment) and after 12, 13 and 14 years of vegetation. Laboratory tests determined total organic carbon (TOC), total nitrogen (TN), soil carbon management indicators: C pool index (CPI), lability index (LI), C lability (L) and carbon management index (CMI).

The obtained results showed that compost fertilization significantly increased the TOC and NT content compared to the control soil. In the soil of the control object, CPI had values less than 1, which indicates that the soil of this control object was characterized by a lower organic carbon content compared to natural forest soil. The CPI index in the soil fertilized with sewage sludge compost after the first growing season was 4.28 and decreased in subsequent research dates. Nevertheless, at the end of the study it had a significantly higher value (2.85). In the soil fertilized with compost from sewage sludge and ashes, the discussed indicator had similar values, but at the end of the study it was slightly higher compared to the soil fertilized with compost from sludge. In the control site soil, with low (less than 1) CPI and LI of approximately 58%, the CMI in the control site soil was significantly lower compared to the reference soil. The CMI in the soil reclaimed with compost from sewage sludge was 143, and in the soil fertilized with compost from sewage sludge (70%) + ashes (30%) was 114. Taking into account the carbon utilization rates in the soil, it can be

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concluded that the CMI can be concluded that the use of composts in the recultivation of highly acidified, soilless soils (after neutralizing the reaction), it has a positive effect on the state of carbon management in the soil.

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Site selection of photovoltaics and energy storage systems based on multi-criteria spatial analyzes – a case study from Nieporęt municipality

The selection of the most optimal locations in terms of energy, economics, environmental and social aspects for the construction of photovoltaic installations with energy storage requires continuous multi-criteria analyzes taking into account local legal, environmental, technical and social conditions. The complex nature of the factors determining the optimal choice of location makes it necessary to apply specialized analytical tools to support the process of making objective investment decisions. As part of the research, based on the analysis of literature sources and expert knowledge, the most important location determinants for this type of investment were defined and parameterized, analysis methods were selected and a computational model for selecting the most favorable location was built. The model is based on GIS technology supported by other analytical tools/methods, including: the AHP method (Analytic Hierarchy Process) - for determining the weights of selected criteria, fuzzy computational methods - for developing suitability maps for individual criteria and a multi-criteria method using Weighted Linear Combination (WLC) – to integrate partial results into the final suitability map. The research area was conducted on the basis of the Nieporęt municipality (Masovian Voivodeship) in order to identify the most favorable location for a photovoltaic farm with energy storage. As a result of the multi-criteria spatial analysis, three areas were selected for the location of the investment in question. The result of the model analysis positively verified the preliminary location analyzes conducted using traditional methods, i.e. existing GIS tools, but without taking into account the entire complexity of the influence of individual determinants on the final result. Due to its functional features and easy availability of input data, the developed model can be considered a useful tool for the purpose of the selection of optimal areas for the location of photovoltaic installations and energy storage facilities, due to the defined objective function.

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Predictive modeling of unfrozen water content in copper-contaminated bentonites using machine learning techniques and physicochemical parameters

Unfrozen water content is a crucial parameter in engineering, environmental, and ecology sciences, particularly in the context of designing and managing infrastructure in cold regions. Predicting changes in unfrozen water content is especially vital in bentonites, a type of clay, as they are consistently exposed to the influence of potentially toxic metals. Current predictive models for unfrozen water content primarily focus on uncontaminated soils, utilizing various physicochemical parameters for estimation. The assessment of a set of physicochemical parameters to evaluate unfrozen water content is now feasible due to the advancement of modern machine learning techniques. The objectives of this study were to create novel machine learning prediction models based on Gaussian process regression (GP), Support Vector Machine (SVM), and Random Forest (RF) algorithms for estimating the unfrozen water content in copper-contaminated bentonites. These models were constructed using seventeen soil physicochemical parameters. A total of 180 experimental observations of unfrozen water content, determined by the DSC method over a temperature range of -23 to -2 °C, were analyzed. The results demonstrate that the unfrozen water content in copper-contaminated bentonites can be effectively predicted using Soft Computing techniques: Random Forest (RF, R=0.963), Gaussian Process Regression (GP_Poly, R = 0.958), and Support Vector Machine (SVM_Poly, R = 0.957) algorithms. Machine learning models have proven to be more effective than existing empirical models in estimating unfrozen water content in copper-contaminated bentonites. Therefore, further research efforts should be focused on their development, utilizing a broader range of copper concentrations.

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Retention capability of a rain collector laid with a high slope

The scope of the study area included a selected rainwater catchment area in Zielona Gora with a sewer system discharging rainwater through a single outlet to the Gęśnik. The Gęśnik as a receiver of rainwater can generate local problems due to the fact that most of the local outlets were designed in an unreflective manner. As they include, among others, runoff from a large-format commercial building and an ever-expanding multi-family housing development, any form of drainage delay can be very important.
The analysis area has low to medium residential development with service elements such as a large-format store, sports facilities and part of the Zielona Gora hospital complex.
Based on the simulation results obtained, for both historical and model precipitation, no overloading of the network occurred at any of the analyzed sections. The maximum outflow rate at the outlet was 365 dm^3/s. Even during heavy rainfall, the value of which was assumed for the model, the filling of the canals did not exceed 25% of the possible filling height of the pipes. The consequence is the occurrence of very high average flow velocities exceeding 3 m/s. A potential way to reduce the flow velocity in the system could be the use of damming valves or orifices on selected sections, which, by reducing the functional cross-section of the canals, would cause a significant reduction in flow velocity, increase the filling of the canals and delay the outflow of rainwater to the receiver.

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Efficiency of solid waste management methods in Keffi Metropolis, Keffi L.G.A, Nasarawa State, Nigeria

This paper focused on solid waste management efficiency in Keffi Metropolis, Nasarawa State. The study discusses the socio-economic characteristics of household heads, methods of waste disposal by household heads and modes of collection and transportation in Keffi. The study area was divided into high- and low-density areas of Keffi. The results were largely based on the data gathered through administration of questionnaire using systematic sampling methods. 300 copies of questionnaire were administered to household heads in the two areas selected, where high density area has 175, while low density area has 125. It was deduced from the results that solid waste generated in all the areas remain for days or weeks without been cleared and containers use for waste collection are not adequate, majority of household heads in the two areas use either plastic or metal buckets to collect and disposed their waste at the locations where the containers are placed and also that the socio-economic characteristics varied in the two areas at 5% probability level as $0.842<2.78<4.60$. Furthermore, at 5% level of significance where $9.21>5.99$, which shows that solid waste management is not efficient in the two areas. It is recommended that Nasarawa State as a matter of priority should release more funds to Urban Development Board who is responsible for management of wastes through Nasarawa State Berau of waste management a unit under NUDB and individual households should also be encourage to contribute to cope with the increasing volumes of wastes in the areas.

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Characteristics of water consumption in Zielona Gora

The analysis of water consumption was carried out on the basis of 10 years of data (2012-21). The results are indicators of unit water consumption and characterisation of the irregularity of consumption in different time intervals, as well as own needs and water losses in the water supply network. The results obtained confirm the typical values and trends - the values of unit water consumption by inhabitants varied between years from 90 to 105 dm3/Md, with the highest consumption values falling in the summer months and the lowest in the winter months. Own needs were estimated at 4% and water losses were reduced from 21% to 7%.
The values of water demand indicators are the basis for the design of individual components of water supply systems, and their correct selection affects the maintenance of appropriate operational parameters and the reliability of water supply. In addition, positive effects have been demonstrated in reducing water losses.

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Analysis of the operation of selected thermal waste treatment plants

The functioning of societies, especially highly developed ones, is associated with the generation of large quantities of municipal waste. The problems associated with their excessive quantity have led to the search for new disposal methods. One of these is thermal treatment, which has an additional positive impact on the energy development of countries. The subject of this analysis is the quantities of waste incinerated, emissions of pollutants and the general characteristics of the thermal waste treatment process. Four facilities were analysed: two installations with the highest waste treatment capacity in Poland and one with the lowest capacity. The Copenhagen installation was chosen because of its strategic location in the very centre of the city. Installations treating waste to electricity and heat are required to comply with the Best Available Techniques (BAT) and have appropriate locations that do not create undue environmental nuisance.

After analysing both instantaneous and annual emissions at the selected installations, it can be concluded that environmental safety is maintained at the highest level. The application of Best Available Techniques makes it possible to meet emission standards for various air pollutants. The public's fears about the efficiency of equipment operated at incineration plants are unfounded and often misplaced. Malfunctions occurring in installations treating waste thermally concerned pressure equipment, i.e., boilers, water tanks or pumps. Due to their specific nature, installations exceeding the permissible emissions of pollutants are taken out of operation when an exceedance of a particular compound is detected. The waste incineration process is restored to operation once emissions have stabilised. In the history of the operation of the thermal waste treatment installations, no emergency cases with potential environmental impact have been recorded.

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Soil bioremediation: selected biosorbents

Human activity has contributed to the increase in dust and gas emissions. Continuous exploitation and industrialization may intensify this effect. The implementation of available, renewable, and cheap solutions can contribute to protecting the environment against excessive pollution. Bioremediation techniques, including biosorption processes, are effective tools enabling efficient removal of pollutants. The main challenge in using this method is to discover a cheap, highly effective, and common (potentially treated as waste) biosorbent. For this purpose, sorption of chromium(III), chromium(VI), copper(II) and zinc(II) ions by selected biosorbents was carried out to assess their biosorption properties as additives to contaminated soil from a former military training ground. The analyzes were performed to characterize the raw materials and phytotoxicity tests - on contaminated soil and contaminated soil with the addition of tested biosorbents, to check the potential toxicity of this soil to plants.

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Adsorpion of organic compounds on biocarbons obtained by chemical activation of biomass by sodium carbonate

Activated carbons are most commonly used in adsorption processes. The efficiency of the adsorption process depends on the physicochemical properties of the adsorbate and adsorbent. In the case of the adsorbent, factors such as the degree of development of the specific surface area, pore size and surface chemistry are among the most important parameters affecting the efficiency of the adsorption process. In addition, the raw material used to prepare activated carbon should be readily available, inexpensive and contain a high mass percentage of elemental carbon. The material should also have a low mineral content and low biodegradability during storage.
The aim of the study was to obtain activated carbons from fennel (Foeniculum vulgare) seeds by applying a chemical activation process with sodium carbonate at different precursor:activator weight ratios, using conventional heating. The physicochemical properties of the obtained carbon materials were studied, and their sorption capacities toward methyl red and methylene blue were checked. The effect of pH and temperature of the aqueous dye solution on the sorption capacity was determined, and two models (Langmuir and Freundlich) were used to determine the mechanism of adsorption of the dyes on the obtained activated carbons.

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Greening urban spaces in the context of climate change adaptation: a comparative analysis of planning and implementation

Cities, as places of maximum concentration of buildings and human population, as well as creation, innovation and development, face the challenge of adapting to changing climatic conditions. The subject of the article is the greening of urban spaces as one of the ways to counteract climate threats. Successive greening of urban spaces is becoming an indicator of civilization development and is considered necessary to improve the quality of life of residents and sustainable development at the local level. Part of the research is to identify ways, opportunities and tools for greening cities in the context of adaptation to climate change. The aim of the article is a comparative analysis of adaptation activities related to the planning and implementation of areas and greenery elements in 44 large Polish cities with Municipal Adaptation Plans to Climate Change. The research, which covers the years 2017-2022, has become the basis for assessing the completeness of initiatives in the process of spatial planning and urban design. The result of the research is the formulation of conclusions and guidelines for urban development policy, leading to an increase in the role of greening Polish cities in the process of adapting urban spaces to climate change.

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Effect of ash fertilization on selected micro-biological and physico-chemical properties of the podzolic and chernozem soil

This study investigated the effect of different doses of fertilization with biomass combustion ash (*Salix viminalis* L. willow) on changes in the biological, chemical, and physical properties of soil. The experiment was carried out on podzolic and chernozem soils in a one-way field experiment (fertilization dose: control (without fertilization), NPK (nitrogen (N), phosphorus (P) and potassium (K)), 100, 200, 300, 400, 500 kg K2O ha−1). The biomass ash was characterized by a pH value of 12.83 ± 0.68 and a high content of macronutrients. The samples were collected from 0–5, 10–15, and 20–25 cm soil layers under the cultivation of spring barley (*Hordeum vulgare* L) cv. Planet in April and August 2021. Mass spectrometry (MALDI-TOF MS) was used for microbiological analyses, which revealed the presence of 53 culturable species from 11 genera: *Bacillus, Pseudomonas, Paenibacillus, Lysinibacillus, Pseudarthrobacter, Arthrobacter, Staphylococcus, Paenarthrobacter, Micrococcus, Rhodococcus*, and *Flavobacterium*. The podzolic and chernozem soils exhibited the presence of 28 and 44 culturable species, respectively. The study showed an increase in the number of microorganisms in the top layer of the soil profile. However, the number of bacteria decreased at the depths of 10–15 cm and 20–25 cm. With depth, the moisture increased and the pH decreased.

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Strontium (Sr) in rock raw materials and soils - geochemical monitoring

The aim of the work is analyse of strontium distribution in the environment. Attention was paid to its concentration in rocks used in construction and in Polish soils. The concentration of strontium in stone building materials was determined by atomic absorption spectroscopy (ASA) and inductively coupled plasma atomic emission spectroscopy (ICP AES). Soil geochemical data were obtained from the Institute of Fertilization and Soil Science (IUNG) in Puławy (Poland). Based on the results obtained, the rock raw materials with the highest content of strontium were selected. It was found that the content of strontium increases from geologically older to younger Cretaceous formations. It was confirmed that the enrichment factor in surface soils with strontium in relation to the geochemical background is related to the geological structure. The geochemical analysis of soils allowed us to identify areas of enrichment of strontium (Sr) and associate them with cement and concrete production zones. The analyses performed show that strontium (Sr) can be used in environmental monitoring as a marker of an individual anthropogenic source. Based on the work carried out, a model of the circulation of strontium (Sr) in the natural and anthropogenic environment was constructed.

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Evaluation of quantitative and qualitative changes in the bacterial metabiome in anaerobic digestion induced by microbial carriers

What guarantees high efficiency of biogas/methane production is the good condition of bacterial flora, which acts as a catalyst of biochemical changes. The function of methanogens can be improved if they are immobilised with the right carrier. Interactions between microorganisms and material result in the formation of a biofilm, the durability of which depends on the type of matrix and individual characteristics of the environment. A good carrier should be insoluble, non-toxic, compatible, available, inexpensive, porous, mechanically and thermally stable. In this study verified the effect of the carrier materials that had not been used in anaerobic digestion before: the kraft lignin/silica system, the peat/diatomaceous earth system and polylactide (PLA). The carriers underwent a complementary analysis of their morphological, dispersion and adsorption properties. They also underwent thermal, elemental spectroscopic and mechanical analyses, which confirmed that these materials could be used as carriers in the AD. The microbiological and biochemical analyses performed during the digestion revealed intensive proliferation of bacterial cells and increased dehydrogenase activity in the samples containing each of the carriers. The PLA granulate and the silica/kraft lignin had the most favourable effect on the enzymatic activity. These results translated into the efficiency of biogas produced in mesophilic conditions. The carriers significantly increased the biomass conversion rate, reduced the retention time, increased and improved the stability and efficiency of the AD process. The results of the Next Generation Sequencing analysis indicated interesting quantitative and qualitative changes in the bacterial microbiome.

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New model factors that form contemporary domiciliating solutions of peripherial areas of urbanized environments

Consistently about a function of the infrastructure as an important factor considering a social-economic development of the rural areas inform for example quite high values of correlation coefficient between a level of a technical and social infrastructure development and a number of economic subjects rate for example on 10 000 residents who are adults of working-aged. So far, the research undertaken by the group of experts showed that the higher values of correlation coefficient occurred in case of the technical rather than social infrastructure. The use of modern technologies of the infrastructure in the future as a rural areas development factor is connected with an implementation of a relevant investment policy in that area. The local authority handles the investment policy now. In the article are presented some research issues, research of its own and some authorial proposals of new factors that structure a level of an application considering modern technologies of the technical infrastructure and some new forms of a social structure in the areas between cities that are biotopic areas that are used in relation to a spatial eco-planning and areas that represent peri-urban areas (residents of big cities move away to its perimeter) of urban interiors on the example of the Poznań Agglomeration Area.

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Wastewater as a source of public health information

Standard analysis of the quality of municipal wastewater, both raw and treated, is aimed at assessing the effectiveness of wastewater treatment plant operation in removing pollutants that can lead to deterioration of the quality of receiving waters.
However, in recent years, it has become increasingly common to carry out in-depth analysis of wastewater composition using advanced analytical methods as part of the collection of public health information. Wastewater-Based Epidemiology (WBE) is a discipline concerned with obtaining information on the epidemiological risks of a population.
In 2003, the World Health Organisation formally adopted a method to analyse wastewater for the presence of polio virus. Surveillance for the presence of polio virus in wastewater is carried out continuously in countries in the Americas, the United Kingdom and Israel, among others. In 2022 in the United States of America, early detection of the polio virus in wastewater halted the development of an epidemic.
This tool was also used during the COVID-19 pandemic and it was discovered that testing wastewater for coronavirus RNA helps to determine precisely how an outbreak is developing in an area. In this case, an increase in the amount of virus in the wastewater was observed long before people showed symptoms of the disease.
In recent years, WBE has also been used to monitor pharmaceutical residues in wastewater and the problem of drug resistance among bacteria. It also allows the tracking of temporal and spatial trends in the community's use of non-steroidal anti-inflammatory drugs, caffeine or drugs.
A properly constructed monitoring network allows fairly precise identification of areas at risk of epidemic outbreaks and is a good tool for early warning of risks.

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The issue of urban space sealing and the potential of blue-green infrastructure

In recent years, blue-green infrastructure has become a popular solution in response to the challenges resulting from the increasing amount of impervious surfaces in urban space. Pro-ecological interventions have a beneficial impact on air and water quality, improve thermal comfort, and reduce the risk of local floods, while contributing to an increase in biodiversity. Attempts to implement this type of solutions in urbanized spaces are associated with a number of challenges, such as development density, the need to adapt solutions to functional requirements, maintenance costs and lack of appropriate knowledge and social awareness.

The research focuses on analyzing the degree of surface sealing in a selected area of Olsztyn. As part of these studies, special attention was paid to the risk of local flooding. The result of the analyzes is the identification of potential locations for the implementation of blue-green infrastructure elements in order to unseat poorly permeable or impermeable surfaces. The aim of the analysis is to identify opportunities to locally support sustainable development, improve the quality of life of residents and protect the natural environment through proper management of rainwater in urban areas.

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Preliminary research on the use of two willow species as a structural material in the process of bio-waste composting

Composting is an element of the organic waste processing strategy fully consistent with sustainable agriculture. The use of composting products can prevent the outflow of matter from agricultural production areas. During the process, part of the organic matter is fully mineralized and the remainder is transformed into humic substances, which are structurally very similar to those observed in the composition of the soil. Since compost can be produced from quite a wide range of waste, it is very important to assess its quality before using it to improve soil quality. The term “compost maturity” refers to the degree of humification of the processed matter. The paper presents preliminary results on the possibility of co-composting organic kitchen waste and green waste in the presence of structural material differing in the method of fragmentation and originating from two species of willow – Salix viminalis and Salix americana. The feed material consisted of 33% by volume from shredded (approx. 0.5 x 2 cm) or chopped structural raw material (approx. 0.5 to 3 x 15 cm), organic kitchen waste (17%) and grass swaths (50%). Sampling for the analysis of physico-chemical parameters was carried out after 2, 4 and 6 weeks described process. The content of volatile substances was determined in the samples and preparations of humic acids were extracted to examine selected optical properties. Within just 6 weeks of the process, a significant reduction in the content of volatile substances was found, regardless of the type and form of the structural material used. The content of lignin-type compounds and organic compounds in the initial phase of humification in the case of using shaved structural material showed a decreasing tendency, regardless of the tree species. In turn, when larger pieces of material were used, the values of these parameters increased. In all analyzed variants of co-composting, the dynamics of the content of humic compounds indicated their ongoing decrease, which indicates the unfinished composting process.

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Co-fermentation as effective tool for energy recovery in wastewater treatment plants – state of the art and challenges

Co-fermentation is an anaerobic process in which sewage sludge generated during wastewater treatment is treated with various other organic compounds. One of the benefits of the process is the possibility of generating increased quantities of biogas. Different waste materials can be used as organic substrates for co-fermentation, e.g., fats, carbohydrates, etc. The problems connected with co-fermentation are disruption of the ordinary course of fermentation due to increased content of quickly rotting compounds, increased odor emissions, higher content of solids to manage, and possible pollution by various organic and inorganic micropollutants. The paper aims to present the state of the art in co-fermentation technologies, the challenges connected with the management of the process, and the challenges and limitations of the process. Energy recovery and waste product management possibilities are discussed and evaluated, including new micropollutants considered to be analyzed in wastewater, such as per- and polyfluoroalkyl substances or microplastics.

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DairyMix: Multi-criteria assessment, decision support and management tools for sustainable circular mixed farming systems for dairy production

The strategy to move away from linear production and consumption systems towards circular economy models requires holistic approaches including identification of key factors to reduce and recycle waste, as well as reuse material and products within entire systems. The DairyMix project funded under the EraNet Joint Call 2021 on “Circularity in mixed crop and livestock farming systems, with emphasis on greenhouse gas mitigation” focuses on the circular practices across crop-dairy mixed farming systems in key European regions and in South America. The project uses multi-criteria assessment to evaluate current state of farm management practices as well as to identify synergies and trade-offs between environmental and socio-economic sustainability indicators. Further, it also assesses the status quo of crop-forestry integration of European dairy production systems, develops concepts for carbon and nutrient circular flows, protein self-sufficiency as well as elaborates improved manure nutrient utilization to enhance resource use efficiency in integrated farming systems. Based on these results, decision support, modelling and management tools for sustainable circular mixed farming systems for dairy production will be developed. DairyMix outputs will be made available by the long-lasting platform for dissemination and stakeholder interaction. The platform will inform about concepts of circular and sustainable dairy production systems as well as will provide specific management strategies for key European regions and South America.

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Hydrological modeling to predict streamflow and flood hydrographs analysis under changing climate condition in the central anatolian basin using HEC-HMS model

Under the influence of climate change, sustainable planning and management of water resources has become more important. In this study, the probable climate in the in the Central Anatolian Basin in Turkey, using future precipitation forecasts (between 2023 and 2100) obtained for the RCP 4.5 and RCP8.5 scenarios from 3 different regional climate models, effects of change will be examined. For this purpose, firstly, hydrological analyzes will be presented in the basin using the HEC-HMS Model. Then, flood hydrographs will be calculated to evaluate the effects of climate change on the streams and possible flooding in the basin. With the results obtained here, the effects of climate change on surface water resources in the study area will be presented quantitatively.

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Impact of microplastics on soils: what is our real perception?

Plastic contamination has become an environmental concern for all environments, including its potential impact on human health, which is still understudied but with potential human health effects. Although terrestrial ecosystems are the main source of microplastics in the aerial and aquatic environments, research has been focused in the last ten years. Moreover, several studies have been focused on the ecotoxicology of some soil organisms, especially earthworms, but several soil groups are still understudied. A similar issue has been advised with soil properties. Besides, due to several issues, we don’t have a good standardized technique for plastic extraction from soils or even for plastic identification after extraction. In this sense, more research is needed into standardization and interlaboratory analysis or more focus on understudied soil properties and organisms, but with special roles on soil systems. Besides, more research is needed about soil bioremediation with the identification of potential microorganisms that can grow and degrade over plastics.

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Monitoring of the actual condition of critical infrastructure building structures to prevent emergency situations

Failure of any critical infrastructure facility leads, at a minimum, to complications in the functioning of the city and a deterioration in the living standards of its residents. In difficult cases, when the actual condition of structures and networks is transitional from "unsuitable for normal operation" to "emergency condition", accidents, collapses and other non-standard situations can lead to significant environmental, economic damage and human losses. Therefore, continuous monitoring of the actual condition of critical infrastructure buildings is an important task. On the example of a building belonging to the complex of buildings of the city's water supply system, the article considers defects and damages of load-bearing and enclosing structures and recommendations for further operation that will ensure the continuity of the functional process in the building.

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Using ML algorithms to create better environment

In recent years, Machine Learning (ML) algorithms have emerged as transformative tools in various sectors, including environmental science. This presentation delves into the application of ML algorithms to foster a better environment. We explore how ML can be harnessed to predict environmental changes, optimize resource utilization, and monitor ecological systems in real-time. By analyzing vast datasets, these algorithms can identify patterns and trends that might be invisible to human analysts. Predicting air quality can tell us how to prevent air pollution. Optimizing waste management can lead to a more eco-friendly waste disposal. Enhancing renewable energy sources can help us provide cleaner energy. Water monitoring systems can help us with drinking water shortage. ML offers innovative solutions to pressing environmental challenges. The findings underscore the potential of ML in driving sustainable practices and shaping a more resilient and eco-friendly future.

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Interlevel connections as a way to increase the ventilation efficiency of a mine ventilation network - a case study

When mining a deposit using the underground method, it is necessary to ensure that air in sufficient quantity and quality is supplied to each excavation. The workings through which the air flows form what is known as a ventilation network. Main ventilation fans are used to ensure the right amount of air. Exploitation of the deposit at ever-increasing levels and further away from the shafts necessitates continuous optimisation of the ventilation network, as well as the need to change the fans. One way of optimising the network and increasing the efficiency of ventilation may be to make interlevel connections in the form of large-diameter openings. Before such connections are made, the ventilation network should be analysed and evaluated by checking the validity of simulation data against actual data, carrying out simulation calculations for given network states by changing the ventilation method and by assuming the drilling of large-diameter holes, and selecting the parameters of the main ventilation fans. In the case of the mine ventilation network analysed, ventilation calculations showed that it is possible to increase the ventilation efficiency by drilling large-diameter holes between two levels. The results of the calculations are presented using tabular data and simplified ventilation diagrams. The drilling of at least one large diameter hole and the modernisation of the main ventilation fans will ensure a minimum of proper functioning of the ventilation system. The drilling of another borehole will ensure an adequate amount of air in each ventilation area - an increase of 50% in the mine's air volume will be achieved.

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Simultaneous wastewater treatment and electricity production in microbial fuel cells (MFC)

Microbial fuel cell (MFC) technology represents a sustainable and environmentally friendly approach to both wastewater treatment and electricity generation. MFC-based systems harness the bioelectrochemical capabilities of microorganisms to effectively degrade organic compounds present in wastewater while simultaneously yielding electrical energy. The operational principles of MFCs and a comprehensive survey of recent advancements within this domain are intricately examined. The crucial determinants influencing MFC efficiency, including organic matter removal capacity, treatment efficacy, and electricity production, are scrutinized. The authors conduct a thorough cost analysis pertaining to the installation and operation of MFC systems, drawing comparisons with conventional wastewater treatment techniques. The real-world case studies are incorporated, illustrating the successful integration of MFCs in wastewater treatment facilities and suggesting potential directions for further exploration. Ultimately, the authors conduct a balanced evaluation of the merits and drawbacks associated with this technology based on the latest research findings.

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Using biocarbon from compost to reduce odor emissions from food waste collection process

We present progress in mapping and assessing ecosystem services resulting from implementation of the national-wide project 'Services provided by main types of ecosystems in Poland - an applied approach' (ECOSERV-POL).
The ECOSERV-POL project is an ambitious attempt to accelerate the uptake of the ecosystem services (ES) concept by practice. Within the project, research teams representing various scientific disciplines attempt to formulate relevant indicators for capturing ecological, cultural and economic values provided by ecosystems typical for the landscape-ecological structure of the country. The analysis covers ES delivered by forest ecosystems, agroecosystems, urbanized ecosystems, degraded ecosystems, freshwater ecosystems, marine ecosystems and ES on the landscape level. Provided indicators are tested at national, regional and local scales for identifying the spatial distribution of ES as well as synergies and trade-offs between services and relevant ES bundles. The resulting recommendations can support the administration and expert-practitioners in using the ES approach for natural capital management, particularly in spatial planning, environmental impact assessments for investments and strategic environmental assessments for plans and programmes.
Acknowledgments: The project 'Services provided by main types of ecosystems in Poland - an applied approach' received funding from Iceland, Liechtenstein and Norway within the EEA Financial Mechanism 2014-2021 in the amount of 1,509,907 EUR, and from budget of Poland in the amount of 266,454 EUR. The aims of the project are transferring of scientific knowledge on ecosystem services which exists in Europe to the process of mapping and assessment of ecosystem services in Poland, as well as increasing the scientific potential and the ability of administration and interested social groups to implement this approach in environmental management.

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Environmental filter for non-invasive heavy metal ion capture

Environmental pollution by heavy metals adversely affects the proper functioning of flora and fauna. These toxins are present in the soil, groundwater, and groundwater, allowing easy distribution and accumulation of heavy metals in drinking water or plants. Chronic human exposure to heavy metals can lead to cardiovascular, respiratory, and nervous system dysfunction, damage to organs (kidneys, liver), and promote carcinogenesis. Current methods of remediating soils and waters from heavy metals are costly, invasive, and inefficient.

Highly selective filters enable capturing metal compounds from contaminated land and groundwater and remediate already contaminated areas. The material we have proposed that can act as a molecular sieve is mesoporous silica SBA-15. Its structure has micropores and hexagonal cylindrical pores of 5nm diameter. It is characterized by a large specific surface area of pores and the possibility of versatile functionalization. SBA-15 is an interesting selective applicable to waters and soils while being a non-invasive and environmentally inert absorbent.

Our materials contain two different functional groups that enable the uptake of heavy metal ions. To evaluate the sorption potential, suitable functionalized SBA-15 powder was compressed into a pellet with a diameter of 3 mm. The mechanical strength of the obtained pellets was then determined using a testing machine and AFM. UV-Vis spectroscopy was used to determine the sorption potential of the synthesized materials. The experiment was conducted in an aqueous environment with silver, copper, and cobalt ions.

Based on the results, a significant effect of the compression process of the tested material on its structural and physicochemical properties was found. The conducted tests confirmed the sorption potential of the studied metal compounds depending on the presence of a specific functional group.

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Expectations of residents of a post-mining and post-industrial commune regarding the restoration of utility value to brown fields, limiting the impact of mining legacies and directions of post-mine reclamation activities on the example of the city of Piekary Śląskie

Many years of mining industry activity in urbanized areas have led to the creation of numerous residues and effects, which can be broadly divided into permanent or very difficult to remove (mining legacies) and those that can be subjected to remedial action (post-mining reclamation). These include, among others, post-industrial facilities and areas, landfills and places of accumulation of industrial and mining waste, areas of mining damage, subsidence basins, floodplains and flood zones, damage to buildings and infrastructure facilities. In a survey conducted on a random sample selected from adult residents of the city of Piekary Śląskie, they were asked, among other things, what post-mining and post-industrial problems they consider the most troublesome, what actions should be taken to achieve a significant improvement in living conditions in the city and how they evaluate the actually implemented reclamation activities. The obtained results should be taken into account when designing revitalization and remediation projects in relation to the effects of the activities of various branches of heavy industry, in particular mining, in the activities and as part of the just transformation of mining communes. They shed light on the differences between the approaches of policymakers, institutions and industry and societal expectations.

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The impact of methane emitted into the atmosphere from mining areas and the possibilities of its monitoring

Methane (CH_4) has been recognized by the Intergovernmental Panel on Climate Change as one of the most important greenhouse gases, i.e. a substance that absorbs infrared radiation and, therefore, contributes to global warming [1]. The amount of methane in the atmosphere has been greatly modified over the years by human activity, and its concentration has increased by approximately 160% over the last 250 years [2]. Despite its much smaller amount in the atmosphere compared to carbon dioxide, the value of the GWP (Global Warming Potential) assigned to it is 28 times higher (over a 100-year horizon) than for carbon dioxide [3]. However, modern research indicates that this value has actually increased to 32 [2], and taking into account the additional carbon footprint it is 34 in a 100-year horizon and 86 in a 20-year horizon [4]. Additionally, the radiation impact attributable to methane emissions is approximately 0.97 Wm [2,3], and given its relatively short lifetime (11.2 +/- 1.3), reducing its emissions may have a short-term impact on the associated forcing radiation [5]. This, in turn, makes observations of methane emissions an excellent source of information about climate change.

Global methane emissions in 2022 amounted to approximately 274.6 Mt according to the UNFCC and 356.2 Mt according to the IEA [6,7]. It included natural sources in the amount of approximately 40% and anthropogenic sources constituting the remaining 60%. The sector that releases the most methane is Agriculture, which is responsible for about a quarter of total emissions, followed closely by the Energy sector, where the most gas is released from coal, oil, natural gas and biofuels.

Methane is emitted from a variety of sources, which are very dispersed and often overlap geographically, and the uncertainties regarding the estimation of its amounts from Agriculture, Waste and Fossil Fuels range from 20-30% [4,5]. The lack of accurate results for determining the amount of methane emitted mainly concerns the regional scale (e.g. South America, China or India). For this reason, numerous attempts are made to precisely determine the amount of greenhouse gases emitted, including methane, in order to limit their negative impact on climate change.

The paper presents an analysis of methane emissions released from hard coal mines into the atmosphere, the amount of methane captured by methane drainage and managed, as well as released from the methane drainage system. The results were then

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compared with data from databases available in Poland, such as the State Mining Authority, the European Pollutant Release and Transfer Register (E-PRTR), and the UNFCCC. The authors' attention focused mainly on determining the impact of methane emitted from mines on the atmosphere in on a European and global scale, as well as how to properly monitor methane emissions from mining areas.

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Potential application of municipal waste incineration ash in hardening slurries

Poland has seen a marked increase in municipal waste generated in recent years. One of the possible directions for their safe management is thermal conversion. In 2022, 21% of municipal waste (2.9 million Mg) was subjected to this process in 9 existing waste incineration plants in the country. There are plans to build another 30 installations. In addition, the total consumption of hard coal for energy, industrial and construction purposes increased by 11.6% in Poland in 2021 compared to 2020. The energy sector accounted for 61.7% of consumption (43 million Mg). The cited data indicate that the amount of post-process waste from waste incineration plants and the energy sector - ash, slag, gypsum, etc. - is significant (estimated at more than 20 million Mg) and is likely to grow.

One of the areas of use of post-process waste can be cut-off walls (sealing of earthen hydrotechnical structures - dikes, dams, landfill embankments) realized from hardening slurries.

The paper assesses the possibility of adding ash from municipal waste combustion and ash from fluidized bed coal combustion in the hardening slurry. Due to the contact of the cut-off wall with the soil and groundwater, the content of selected heavy metals (Pb, Cd, Zn, Cu, Ni) in the hardening slurries and their leachability were examined.

The experiment showed that the use of hardening slurries based on the discussed post-process wastes in cut-off walls should not pose a threat to the environment in terms of the release of heavy metals from them. Of the elements analyzed, only the concentration of lead was at an elevated level. Further research on this topic is postulated.

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Technology of well sinking

The work will present methods of making wells, their advantages and disadvantages and details of construction solutions. The work will be supplemented with photos of the performed objects.

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The condition of climate change adaptation in Polish municipalities before and after the pandemic on the basis of CSO environmental indicators - management implications

The pandemic undoubtedly had a significant impact on local development processes in municipalities in all segments of this development: social, economic, environmental and institutional-political. It is usually often assumed that the overall impact was rather negative, which can also be confirmed by a wide variety of scientific studies. The purpose of this article is to assess the status of climate change adaptation in Polish municipalities before and after the pandemic on the basis of environmental indicators of the Central Statistical Office at the local level. The purpose of the paper was realized on the basis of a review of the latest literature on the subject, domestic and foreign, and quantitative and qualitative comparative analysis. The research was carried out in thirty Polish municipalities, district cities, with varying own incomes.

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Anthropogenic impact on soils of the former Berlin Tegel Airfield - a case study

Soils in the urban environment, also known as SUITMAs (Soils of Urban, Industrial, Transport, Mining and Military areas), are altered to a certain degree by human actions. In the Berlin Metropolitan Area (BMA) more than half of the soils are regarded as anthropogenic. Industrialization, World War II and constant city development had a major impact on the soils of the BMA. In order to improve soil surveys and to face current challenges in urban environments such as climate mitigation, increasing soil carbon storage and emerging environmental risks, a new soil survey guideline for the BMA was developed in the years 2016-2020.

On behalf of the Berlin Senate Department for Mobility, Traffic, Climate Protection and the Environment (SenMVKU), a detailed soil survey (2021-2024) is carried out on the area of the former Berlin-Tegel inner-city airport in order to map the soil condition and its capacity by assessing physical and chemical properties, to designate and protect soils with a high functional value as well as to assess the degree of human impact on the soil.

Preliminary results show that around 90 % of the investigated soils have been altered by the use of the airfield as an artillery and small arms shooting range, rocket testing area as well as military and civilian airport. Furthermore, anthropogenic relief changes created during the expansion of the airfield shaped the natural geomorphology of the study area. While the soils in the Western part of the airfield are only changed in top- and subsoil, the soils in the Central and Eastern part of the airfield are thoroughly transformed up to greater depths and highly heterogenic in genesis, structure, substrate, and degree of human impact. Technogenic materials available for soil formation, e.g. war debris, rubble and construction sands and land use change altered soil parameters such as pH, humus and calcium carbonate content and partly increased the content of heavy metals and organic contaminants.

This presentation will give a short outlook on recent investigations as a part of the future landscape and city development.

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Cities and climate change

Cities are increasingly exposed to negative climate phenomena. When planning cities, the challenge of building cities resistant to these phenomena is taken up. The aim of the article is to present the elements of public space that enable adaptation to climate change.

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Accumulation of Pb and Ni in forest soil in Poznań-Morasko Station

One of the characteristic features of soils developing in urban areas, particularly with dense build-up areas, is an increased content of trace elements. This is due to the long-term accumulation of these elements of anthropogenic origin associated, among others the deposition of dust from combustion of fuels in thermal-electric power stations, stokeholds and factories. In the last decade, emissions from house-heating have had a major impact on the environment. A recent report prepared by the city on air quality in Poznań showed that only 22% of particulates originate in the city, while 78% come from the surrounding municipalities. Additionally, existing road network is a constant source of linear emission.

Object of this study was to determine total content of Pb and Ni in top soil layer (0-20 cm) of the Poznań-Morasko Station. The study area was located on the campus of the Adam Mickiewicz University in Poznań in the catchment area of Różany Stream. This catchment is located within the mesoregions: Poznań lake district and Poznan Meander of the Warta River. A 40x40 m^2 square was delimited in the forest area. From the plot, 100 soil samples were taken from 0-20 cm depth. The total content of studied metal was determined by Aqua regia extraction according to the PN-ISO 11466 (2002) protocol, the concentration of these elements was measured by FAAS techniques on a 249 FSAA Agilent Technologies atomic absorption.

In the study area, the content of Ni and Pb in the top soil did not exceed the Polish Quality Standards adopted by Minister of Environmental Protection (2016), therefore, the analysed soil samples were classified as uncontaminated. The content of Pb varied from 8.75 till 60.25 $mg \cdot kg^{-1}$ with mean value 22.90 $mg \cdot kg^{-1}$, while Ni 2.05 – 70.80 $mg \cdot kg^{-1}$ (mean = 4.84 $mg \cdot kg^{-1}$). Both elements showed average variability (CV 37.5% and 37.8% for Pb and Ni, respectively). However, 98% of the samples analysed had lead contents above the geochemical background, which for Poznań is 10 $mg \cdot kg^{-1}$. This indicates a significant enrichment of the investigated soils with this element. While only 59% of samples exceed local background level of Ni (3,5 $mg \cdot kg^{-1}$). This may be related to the deposition of lead both from the combustion of solid fuels but also to the historical aspect associated with the addition of this element to petrol. Moreover, the much earlier human use of lead may have influenced its higher content relative to nickel in the investigated soils.

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Energy transition for a sustainable society

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Under the impression of the double challenge of climate change and energy security, a need for better understanding the ways of energy provision in Europe arises that encompasses current conditions and expected or possible transitions into a system ready for future challenges. In such a view a single country cannot be seen separately, it merely reflects just one element on a European scale. In the framework of the Austrian Academy of Sciences, a working group ""Energy Transitions"" was established. Informed by invited presentations of external experts, engaged in internal discussions and structured into a report, important facets relevant for a future energy system became visible. The transformation of an energy system turns out to be an immense challenge. It can only be achieved by a combination of (i) ultra-fast extension of renewable energy generation, based on cheap photovoltaics and wind, preferably in areas rich in solar/wind availability, (ii) maximizing the capacity of smart power grids by supply-side provisions, (iii) storage and transport of such energy taking advantage of hydrogen-carriers such as methane, ammonia or methanol, (iv) enhancing carbon uptake by biomass rather than maximizing bioenergy harvests, (v) maximizing energy services instead of energy consumption, and (vi) fostering fair and just energy distribution avoiding both excessively rich energy lifestyles and energy poverty. Huge potentials can be reaped from energy savings. The challenge to implement is largely a social challenge, with technology playing a subordinate role.

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Water quality in the Pustelnik stream

Pustelnik is a stream flowing through Zielona Góra. Its source is in the Piast Hills, then it flows into the Silesian Ochla. In the Pustelnik area there is an area for indirect protection of the surface water intake to protect the quality of intake water. The aim of the work was to analyze the water quality in the Pustelnik watercourse.
Tested water from the Pustelnik stream. in terms of selected physicochemical indicators, i.e. dissolved oxygen, specific conductivity, ammonium nitrogen and nitrate nitrogen, showed that the water is in surface water quality class 1 (Journal of Laws 2021, item 1575).

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Retention of microplastic particles in oils in the presence of surfactants

Microplastics are tiny plastic particles, ranging in size from 1 micrometer to 5 mm. In wastewater treatment processes, even more than 90% of it is retained in sewage sludge. Microplastics are also retained in oil and fat stains, to which they have an affinity. Oils and fats are contaminants present in sewage. It can be assumed that in the wastewater treatment process, some of the microplastics will be retained in the oil and fat fraction. The presence of surfactants in wastewater may influence this process. The aim of the research was to determine the effect of surfactants on the capture of small PVC particles from the aqueous phase. Two types of oils and fats were used in the research: edible oil and engine oil. In the first series of tests, these oils were mixed with water containing fine PVC particles (fraction < 100 micrometers) in proportions from 1:100 to 1:10. The efficiency of removing microplastics from the water phase was analyzed. Then, a preparation containing anionic, non-ionic and amphoteric surfactants was introduced into the solutions - one of the commercially available dishwashing preparations. The influence of the presence of surfactants in various proportions to oils on the efficiency of removing small microplastic particles from the water phase was determined. The obtained results indicate that in the range of analyzed concentrations and proportions of oils and detergents, microplastics were removed from the water phase.

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Supporting the organic compounds oxidation with electric power

Anthropogenic sources introduce significantly more organic micro-pollutants into the aquatic environment than natural processes. This is primarily observed in industrial activities involving the processing of coal and metal ores, refining of crude oil, and production of chemicals, pharmaceuticals, textiles, or cosmetics. Advanced oxidation and photochemical processes, with or without catalysts, are commonly employed to eliminate xenobiotics that are biodegradation-resistant. These processes are typically assisted by the flow of electric current through the solution being treated, in a specialized system, including processes such as electrocoagulation, electroflotation, and advanced chemical and photochemical oxidation supported by electric power, to maximize their effectiveness. The electro-Fenton and photo-electro-Fenton processes have also been described as processes in which Fenton's reagent is utilized as an oxidant. The study compares these methods with a demonstration of their benefits. The process parameters, reagent dose selection, and energy usage are geared towards mineralising organic pollutants whilst reducing intermediate product formation and toxicity in the post-process solutions. However, complete decomposition may sometimes be time-consuming and raise operational costs. Process modifications involve the use of different radical precursor materials and catalysts to expedite radical reactions. In electrochemical methods, the selection of electrode materials is crucial. Advanced oxidation methods may either act as a unit process or complement conventional processes applied for treating industrial and domestic wastewater, including landfill leachates.

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Feeding a membrane-less microbial fuel cell by mixed domestic and industrial wastewaters

Due to the constant growth of the world's population, the amount of generated wastewater is also constantly increasing. One of the devices that can use wastewater as a raw material for energy production is a microbial fuel cell (MFC). MFCs technology is constantly evolving. However, to increase its use, it is necessary to improve its efficiency. There are various possibilities to ensure this, such as the use of new electrode materials, new cell designs, or the use of wastewaters from different sources. In this paper the analysis of microbial fuel cell operation (cell voltage, power) fed by various types of wastewaters was shown. Moreover, the change in time of wastewater basic parameters reduction was analyzed. Due to cost reduction the membrane-less microbial fuel cell (ML-MFC) was chosen. An increase of generated bioelectricity during fed ML-MFC by mixed domestic and industrial (from yeast production) wastewater was demonstrated. Additionally, it was noted that the addition of industrial wastewater shortens the COD reduction time.

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Effect of the use of various cathodes on a membrane-less microbial fuel cell operation

Wastewater has high potential as an energy source. Therefore, it is important to recover even the smallest part of this energy, e.g., in microbial fuel cells (MFCs). The obtained electricity production depends on the process rate of the electrodes. In MFC, the microorganisms are the catalyst, and the cathode is usually made of carbon material (e.g., with the addition of Pt). To increase the MFC efficiency (and reduce costs by reducing use of the noble metals), it is necessary to search the new cathode materials. In this work, the electricity production from yeast wastewater in membrane-less microbial fuel cells with Ni-Co, Cu-B, and Cu-Ag cathodes was analyzed. In the first place, the measurements of the stationary potential of the electrodes (with Cu-Ag catalyst obtained by the electrochemical deposition technique) were performed. Because the cathode is constantly oxidized during the operation of ML-MFC, it was necessary to pre-oxidize the cathodes. Next, the analysis of the electric energy production during the operation of the membrane-less microbial fuel cell (ML-MFC) fed by process yeast wastewater was performed. The highest parameters (the power and the cell voltage) were obtained for a Ni-Co and Cu-Ag catalysts. This research proved that it is feasible to use analyzed alloys as catalysts to obtain the bioelectricity in the ML-MFC.

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Current state of knowledge about plastics’ ability to sorption

The term “plastic” is widely used in reference of man-made materials consisting of synthetic or natural polymers and substances that modify them. As of now, these anthropogenic pollutants can be named humanity’s biggest problems. According to the United Nations Environment Programme, between 19 to 23 million tonnes of plastic waste are being discarded into world’s waters annually [1], and even more of these pollutants end in landfills [2]. Additionally, scientific research has led to the detection of miniscule particles of plastic in water, air, soil and even in humans [3].

Such omnipresence of an anthropogenic pollutant is worrisome. Plastic waste can contain significant quantities of harmful substances used as modifiers, including heavy metals, bisphenols, and phthalates, among others. These substances can leach into the environment or living organisms, depending on where plastic waste is present [3]. However, many scientists have changed their focus to find out more about plastic interactions with the ecosystem. It has been proved that plastic has an ability to concentrate many environmentally present substances on its surface. Due to human activity, there are many harmful and toxic substances that are currently present in our ecosystem. This raises a possibility of a scenario, in which pesticides or various other toxic chemicals can gain increased mobility in environment and they can be transported into living beings [4].

Effective addressing of the plastic pollution problem relies heavily on having access to crucial information. The primary objective of this work is to assess the current state of knowledge regarding the sorption ability of plastic. The outcome of this research will help to gain a better understanding of the current environmental situation and generate ideas on how to deal with plastics’ omnipresence.

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The toxicity of microplastics towards living organisms – current reports

Nowadays, it is difficult to imagine society functioning without plastics. However, apart from the obvious benefits associated with their use, it turns out that plastics may pose a threat to the environment and, above all, human health. Micro- and nanoplastics (MNPs) are particularly problematic. MNPs are degradation products of larger plastic particles. Plastic degradation may occur, for example, as a result of UV radiation [1].
Research conducted on living organisms suggests that MNPs can cross the blood-brain barrier [2]. There, they can increase inflammation and possibly increase the risk of neurodegenerative diseases. It has been proven that polystyrene (PS) particles can be detected just two hours after ingestion. Moreover, experiments on laboratory mice provided information that, in addition to being present in the blood, PS crossed the blood-brain barrier. This barrier protects the brain from harmful toxins. The presence of PS in the brain increases the risk of inflammation, neurological disorders and the occurrence of diseases such as Alzheimer's or Parkinson's disease.
Additionally, MNPs have been proven to have a negative impact on the digestive system, causing inflammation and intestinal disorders [2]. These types of symptoms may, in turn, lead to the development of cancer. MNPs enter the body mainly with food and drinks. The aim of the work is to present the ways in which MNPs penetrate the environment and show the potential negative effects that MNPs may cause based on the latest literature on the subject.

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Increase the efficiency of the energy source by using energy batteries with rational capacity

The current trend of increasing the installed capacity of photovoltaic installations in Poland coincides with the trends observed in the EU. However, the development of these sources causes disruptions in the power system, which has become a European system due to its characteristics and international connections.
Reducing the disruptions caused by photovoltaic power generation, the amount of which depends significantly on local temporary weather conditions, is possible in particular through the selection and installation of photovoltaic panels of reasonable capacity, as well as the use of energy accumulators. The latter makes it possible to increase the self-consumption of electricity generated by the photovoltaic system, thus further reducing the cost of energy purchasing from external operators. The final financial effect of measures in the form of the selection and installation of energy accumulators depends on determining the favorable and rational capacity of these storage facilities.
The study analyzed the operation of a photovoltaic system that generates electricity for a complex of buildings, including office buildings. The following part simulated the effects of the potential installation of energy batteries. Calculations were performed for two different sizes of energy accumulators. The potential for increased self-consumption due to installing these additional elements in the electricity supply system was evaluated. The financial aspect of purchasing and installing energy storage was also presented.

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Properties and yield potential of soil-like substrates made from Carboniferous mining waste

Implementing the concept of circular economy is a particular challenge in economic sectors with high pressure on the environment, a good example of which is the mining industry. Waste is a significant problem in mining, and one of the possibilities for its recovery is to use it for the production of soil-like substrates.

The aim of the research was to assess selected properties of mining coal waste and its mixtures with addition of 2,5 i 5% municipal sewage sludge and 1% mineral wool waste from covering plants in terms of their suitability for the production of soil-like substrates.

The research was carried out in a 2-year pot experiment in which the properties and yield potential of soil-like substrates based on coal waste were assessed. In the following years, white mustard and corn were grown in pots. Laboratory tests included pH, sorption properties, content of organic carbon, total N and available forms of P, K and Mg. The yield of plants was also determined.

Coal waste from the mine was characterized by a significantly higher pH, sorption capacity, the content of basic cations, organic carbon, total N, available forms of K and Mg, and lower available P compared to the control soil. The substrates in which the mineral matrix of coal waste was enriched with sewage sludge were characterized by a higher content of organic carbon, total N and available forms of P and Mg and better sorption properties. Extending the composition of post-mining waste substrates to include mineral wool additionally improved the sorption properties, slightly reduced the content of organic carbon and N, and increased the content of available forms of P and K.

Compared to anthropogenic soil, the yields of plants grown on post-coal soil were significantly lower. The yield potential of substrates with sewage sludge was significantly higher, and the addition of mineral wool further increased this potential.

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Photovoltaic farm on agricultural land - problem or solution?

These days, the effects of climate change are becoming increasingly severe for a large part of society. One way of counteracting the effects of negative climate change is to invest in energy generation from renewable sources, such as wind or solar energy.
Solar energy generation can be done on an individual basis (panels mounted on the roofs of buildings or private plots) or in a more organised manner (large-scale photovoltaic farms). The latter, however, require significant areas that are obviously changing their original use. Such areas very often include land that was previously used for agricultural purposes.
The implementation of a large-scale project is always a challenge and often a burden on the natural environment. Before a final decision on location is made, an analysis covering the prospect and effects in the short, medium and long term is necessary.
This paper attempts to analyse the location of a selected photovoltaic farm and to forecast the consequences of implementing this decision. The location, design and potential impacts on various environmental components including flora and fauna and the integrity of ecological corridors were analysed.

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