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A Bibliometric Analysis of S-Scheme Photocatalysts for Wastewater Treatment: Research Trends, Knowledge Structure, and Future Perspectives (2021-2025)

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Abstract. The development of S-scheme photocatalysts has attracted considerable attention in recent years owing to their superior charge separation efficiency and strong redox capability for wastewater treatment applications. As research activity in this area continues to expand, a systematic evaluation of the scientific literature is needed to understand its evolution and emerging directions. This study presents a bibliometric analysis of publications related to S-scheme photocatalysts for wastewater treatment from 2021 to 2025. Data were collected from the Scopus database and analyzed using VOSviewer and Bibliometrix to examine publication output, citation performance, leading contributors, collaboration patterns, and research themes. The results indicate a rapid increase in scientific publications, reflecting growing interest in the application of S-scheme heterojunctions for environmental remediation. China emerged as the leading contributor in terms of publication output, while extensive international collaborations were observed among major research groups. Keyword analysis revealed that visible-light photocatalysis, heterojunction construction, charge transfer mechanisms, pollutant degradation, and antibiotic removal are among the most frequently investigated topics. Recent studies have increasingly focused on defect engineering, composite photocatalysts, and practical wastewater treatment applications. The findings of this study provide a comprehensive overview of the current research landscape and identify potential directions for future investigations aimed at improving the efficiency and practical implementation of S-scheme photocatalysts in sustainable wastewater treatment technologies.

Keywords: S-scheme photocatalysts; wastewater treatment; photocatalysis; bibliometric analysis; environmental remediation; VOSviewer.

Analysis of Land Cover and Degradation Using Multi-Index Remote Sensing from 1994 to 2024: The Case of Gijduvan District, Uzbekistan

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Abstract. This study analyzes land cover changes and ecological transformations in the Gijduvan District of the Republic of Uzbekistan over the period 1994–2024. For this purpose, summer-season satellite imagery and eleven remote sensing indices—NDVI, NDWI, SI, IBI, NDBSI, LST, DVI, RVI, SAVI, BSI, and NDMI—were utilized. These indices made it possible to assess vegetation cover condition, surface moisture, temperature, urban expansion, and desertification processes. Spatial analyses were carried out in ArcGIS Pro using Landsat 5 data for 1994 and Landsat 8 data for 2024. The results revealed severe land degradation and a decline in vegetation cover in certain areas, as well as reductions in urbanized and hydrographic zones. Comparative analysis of the indices over time indicated an increasing risk of desertification and a decline in ecological stability. The use of a multi-index approach enabled an in-depth assessment of land surface dynamics and provided essential insights for sustainable land resource management and ecological planning. This research confirms the effectiveness of remote sensing indices in monitoring long-term ecological changes.

Keywords: land degradation; remote sensing indices; land cover change; desertification.

Banana Loop: Waste to Wealth – Transforming Banana Waste into Sustainable Products and Rural Livelihood Opportunities

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Abstract. Agricultural waste management is an important environmental and sustainability challenge in Tando Allahyar District, Sindh, Pakistan, where agricultural residues may be burned or improperly disposed of, resulting in pollution and the loss of potentially valuable biomass resources. Banana Loop: Waste to Wealth is a climate-smart initiative designed to transform banana waste into biodegradable packaging and organic biofertilizer while supporting sustainable rural livelihoods.

The project applies a circular-economy approach through the establishment of three solar-powered composting units for biofertilizer production and one solar-powered banana-fibre extraction facility for biodegradable packaging. Planned equipment and processing infrastructure include solar panels, solar dryers, shredders, compost bins, a fibre extractor, packaging moulds, and associated machinery. The initiative combines waste processing with capacity building and environmental awareness activities.

The project targets 200 farmers and rural women in Sindh. Participants are to receive training in biofertilizer production and use, banana-fibre processing, biodegradable packaging production, sustainable agricultural practices, and the operation of the solar-powered systems. Baseline assessments of crop production, fertilizer use, and environmental awareness, together with participant surveys and interviews, are incorporated to assess implementation and uptake.

By converting banana residues into agricultural inputs and biodegradable materials, Banana Loop aims to reduce agricultural waste and pollution, improve resource efficiency, promote renewable-energy-based processing, and create livelihood opportunities for rural women. The initiative demonstrates an integrated model linking circular agriculture, sustainable land management, community capacity building, and climate-smart rural development.

Keywords: banana waste; circular economy; biofertilizer; biodegradable packaging; sustainable land management; climate-smart agriculture; solar energy; rural livelihoods

Circular Economy Practices in Central Asia: From Waste Management to Resource Recovery

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Abstract. Central Asia faces interconnected challenges related to increasing waste generation, intensive use of primary resources, land degradation, and limited recovery of materials from residual streams. Circular economy (CE) approaches offer an opportunity to move beyond conventional waste management towards systems in which materials, nutrients, water, and industrial by-products are retained in productive use. This review examines emerging CE practices and resource-recovery pathways in Central Asia, with particular attention to municipal waste, construction and demolition materials, agriculture and agri-food systems, and their connections with sustainable land management. A systems-based narrative review was conducted using scientific literature and regional policy and development reports, complemented by selected international practices relevant to Central Asian conditions. The analysis distinguishes biological pathways, including composting, anaerobic digestion, nutrient recovery, and valorisation of agro-industrial by-products, from technical pathways involving reuse, recycling, secondary raw materials, and construction material recovery. Evidence from Kazakhstan, Uzbekistan, and the city of Almaty demonstrates growing institutional and practical interest in circular approaches, although implementation remains heterogeneous. The reviewed cases indicate that resource recovery can reduce disposal requirements, retain material value, reduce demand for virgin resources, and create connections between waste management, production systems, and land management. Industrial symbiosis and cascading resource use provide additional mechanisms for linking currently separated material flows. The findings suggest that Central Asia's shift from waste management towards resource recovery should be based on context-specific combinations of biological and technical solutions rather than direct replication of external models. Integrating waste, production, and land systems can provide a practical foundation for improving resource efficiency and supporting more resilient development across the region.

Keywords: circular economy; Central Asia; resource recovery; waste management; resource efficiency; sustainable land management

Climate Change and Agricultural Productivity: A Global Review

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Abstract. Climate change has become a major challenge to global agricultural productivity by altering temperature patterns, precipitation regimes, and the frequency of extreme weather events. This review examines the effects of climate change on crop production, soil quality, water availability, and pest and disease dynamics. Rising temperatures and prolonged droughts can reduce crop yields, while irregular rainfall and floods damage agricultural land and disrupt farming systems. Climate change also affects soil fertility and increases the pressure of weeds, insects, and plant pathogens, leading to greater production risks. However, several adaptation and mitigation strategies have shown promising results, including climate-smart agriculture, drought-tolerant crop varieties, efficient irrigation systems, precision agriculture, conservation tillage, and sustainable soil management. These approaches enhance agricultural resilience while supporting food security and environmental sustainability. The review concludes that integrating innovative farming technologies with sustainable agricultural practices and supportive policies is essential to minimize the negative impacts of climate change and ensure long-term agricultural productivity.

Keywords: climate change; agricultural productivity; food security; climate-smart agriculture; sustainable agriculture; drought; crop yield; soil management

Climate Resilience in the Turkistan Region: Water Scarcity, Drought, and Land Degradation

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Abstract. Climate change is increasingly affecting water availability, soil conditions and ecosystem stability in arid and semi-arid regions of Central Asia. The Turkistan Region of southern Kazakhstan is particularly vulnerable to rising temperatures, prolonged droughts, water scarcity and land degradation, which threaten agricultural productivity and sustainable land management. This study examines the interactions between hydroclimatic variability, water resource availability and environmental degradation, aiming to identify key vulnerabilities and priorities for climate-resilient land and water management.

The research integrates long-term climatic observations, satellite remote sensing, geographical information systems (GIS) and field-based soil investigations. Climate records covering 2000–2024, Landsat and Sentinel satellite imagery, and soil and sediment samples collected during 2022–2023 are used to assess changes in temperature, precipitation, aridity, vegetation cover, soil salinity and geomorphological conditions. A Composite Degradation Index is also considered to identify areas exposed to multiple environmental pressures.

The results indicate a pronounced warming and drying trend in the Aral–Syr Darya region, with mean annual temperature increasing by approximately 0.99°C and precipitation declining by 29.7% between 2000 and 2024. Environmental indicators also reveal increasing soil salinization, declining vegetation cover, water-body shrinkage and changes in river channel stability. Field observations confirm considerable salinity stress, with electrical conductivity values reaching 8–20 dS/m in saline crusts. These findings highlight the combined effects of climatic pressures, irrigation dependence and land-use practices on environmental vulnerability.

The study identifies several priorities for improving regional climate resilience, including more efficient irrigation systems, sustainable water allocation, soil moisture conservation, salinity control, land restoration and integrated drought monitoring. Particular emphasis is placed on combining scientific observations with geospatial technologies and strengthening cooperation between universities, public institutions and local stakeholders. The findings provide a basis for developing targeted adaptation strategies and demonstrate the importance of integrated water and land management for mitigating climate-related environmental risks and supporting sustainable development in southern Kazakhstan.

Keywords: climate resilience; water scarcity and drought; land degradation; sustainable land management.

Digital Transformation and Circular Economy Transition in Public-Sector Governance: A Systematic Literature Review and Integrative Framework

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Abstract. The growing environmental crisis and increasing pressure on public institutions to achieve sustainable development have intensified global interest in circular economy governance. This study explores how digital transformation can accelerate the transition from traditional linear economic systems toward circular and resource-efficient governance models within the public sector. Drawing on emerging debates in digital governance and sustainability, the paper examines the role of technologies such as artificial intelligence, big data, e-governance platforms, and smart resource management systems in improving waste reduction, resource optimization, and sustainable public administration practices. The study further highlights how digital innovations can support transparent environmental governance, efficient land management, and evidence-based policy implementation. By linking digital transformation with circular economy principles, the paper argues that technologically driven governance systems can enhance institutional capacity for sustainable resource management and environmental resilience. The research contributes to contemporary discussions on sustainable governance by proposing an integrated framework for digital-enabled circular public administration in both developed and developing economies.

Keywords: circular economy; digital transformation; resource efficiency; sustainable development; e-governance; smart governance

Ecological Status of Reservoirs in the Turkistan Region Under Climate Change and Anthropogenic Pressure

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Abstract. Reservoirs in the Turkistan Region of southern Kazakhstan are important components of the regional water-management system, supporting irrigation, water regulation, and the socioeconomic development of surrounding territories. At the same time, climate variability, increasing evaporation, water abstraction, and anthropogenic activities may affect their hydrological and hydrochemical characteristics. Regular assessment of water quality is therefore necessary to identify environmental changes and support sustainable reservoir management. This study aims to comparatively assess the physicochemical characteristics and ecological status of three reservoirs in the Turkistan Region-Koshkorgan, Bogen, and Kensai-Koshkorgan-2-under the influence of climatic variability and anthropogenic pressure. The novelty of the research lies in applying a unified comparative monitoring approach to regional reservoirs that differ in their hydrological conditions, water exchange, and surrounding land-use context. The methodology includes field water sampling at designated monitoring points, laboratory analysis of basic physicochemical parameters, and comparative interpretation of the obtained results. The assessment focuses on pH, electrical conductivity, total dissolved solids, and other available hydrochemical indicators. The results are considered in relation to possible variations in water mineralization, evaporation, inflow characteristics, and anthropogenic water use. The findings indicate that the investigated reservoirs exhibit differences in their basic physicochemical characteristics, reflecting spatial variability in the hydrochemical environment. These differences emphasize the importance of considering local hydrological conditions and anthropogenic influences when evaluating reservoir ecosystems. However, a comprehensive assessment of ecological status requires the integration of additional parameters, including major ions, nutrients, dissolved oxygen, organic pollutants, and potentially toxic elements. The study provides a baseline for continued water-quality monitoring and supports the development of integrated reservoir-management strategies, pollution prevention measures, and climate-adaptation planning in the Turkistan Region.

Keywords: reservoir ecosystems; water quality; physicochemical parameters; hydrochemical characteristics; climate change; anthropogenic pressure; water-quality monitoring; sustainable water management; Turkistan Region; Kazakhstan.

Effect of Water-Saving Irrigation Technology on Winter Wheat Yield in the Soils of the Newly Reclaimed Desert Zone under Global Climate Change

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Abstract. This article presents the results of using a highly swelling hydrogel polymer compound, synthesized from local raw materials, as a water-saving irrigation technology at different application rates during the cultivation of the winter wheat variety “Starshina”. The study was conducted in the newly developed desert zone of the Bukhara region, on light sandy soils with a non-saline composition. The effects of this technology on the productivity of winter wheat are discussed. In the scientific research conducted, the pre-irrigation soil moisture for all options was 70-70-65% compared to the limited soil moisture capacity. Fertilizer application rates were N-250, P-180, and K-90 kg ha-1. The elite “Starshina” variety was planted. Additionally, as part of the water-saving technology, hydrogel polymer compound was applied at different rates: 50 kg ha-1 in the 2nd option, 75 kg ha-1 in the 3rd option, 100 kg ha-1 in the 4th option, and 125 kg ha-1 in the 5th option.

Keywords: water-saving irrigation; hydrogel polymer; winter wheat productivity; desert soil management.

ESG-Driven University Transformation: Benchmarking Global Sustainability Rankings and Strategic Roadmap for Al-Farabi KazNU

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Abstract. The integration of ESG (Environmental, Social, Governance) principles into the activities of higher education institutions has evolved from a peripheral initiative into a strategic imperative, as confirmed by the rapid growth of the specialized QS World University Rankings: Sustainability – from 700 universities in 2023 to nearly 2,000 in 2026. The ranking methodology evaluates universities across three categories (Environmental Impact – 45%, Social Impact – 45%, Governance – 10%) through nine analytical lenses, with data collected via three independent channels: the bibliometric channel (Scopus/Elsevier), the web channel (publicly available policies on university websites), and staff perception surveys.

Based on a benchmarking analysis of the ranking's ten leading universities (Lund University, UCL, University of Toronto, UNSW Sydney, among others), the study identifies key success factors, including interdisciplinary research schools, systematic visibility of ESG policies, integration of the UN SDGs into research output, and management of the carbon footprint of academic mobility.

These findings are applied to the case of Al-Farabi Kazakh National University, currently ranked =569 despite possessing significant institutional assets – the Ban Ki-moon Institute for Sustainable Development, the Centre for Inclusive Education, and the Centre for Psychological Support. The study introduces and substantiates the concept of a "visibility gap" – a systematic discrepancy between a university's actual ESG activities and their digital representation in QS data. On this basis, a twelve-month roadmap is proposed, comprising specific KPIs, responsible units, and risk management measures, aimed at moving KazNU into the global top 300.

Keywords: ESG, sustainability ranking, SDGs, QS Sustainability, THE Impact Rankings, Al-Farabi KazNU, carbon neutrality, higher education transformation

From Degraded Land to Sustainable Agricultural Production: A Practical Case of Land Restoration and Climate-Resilient Farming in Tajikistan

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Abstract. This contribution presents a practical case of community-led land restoration and sustainable agricultural development in Tajikistan. Following severe land degradation caused by a natural disaster in 1991, restoration activities began in 2014, leading to the establishment of Dehkan Farm in 2016. The farm currently manages 24 hectares of agricultural land, including 3.5 hectares of vineyards, and promotes diversified crop production. Particular emphasis is placed on women's participation in agricultural activities and rural employment. The experience also illustrates climate adaptation strategies, including vineyard recovery following severe frost in 2023, and the importance of reliable irrigation water. This case demonstrates how community engagement, land rehabilitation, crop diversification, and climate-resilient farming practices can contribute to sustainable land management and inclusive rural development.

Keywords: land restoration; climate-resilient agriculture; community participation; sustainable land management.

From Illegal Dumpsites to Community Action: The AntiTrash Experience in Kazakhstan

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Abstract. Illegal waste dumping and environmental degradation remain significant challenges in Kazakhstan, highlighting the need for greater public awareness, civic engagement and institutional accountability. This contribution presents the experience of AntiTrash, an environmental initiative associated with the Zhana Adamdar movement, which promotes environmental responsibility through creative activism and community participation. The initiative identifies illegal dumpsites, raises awareness of waste management problems and encourages responsible authorities to take action. Several campaigns are presented, including public demonstrations, artistic installations, environmental performances and the Trash Fashion Day event, which uses recycled waste materials to communicate environmental messages. The initiative also addresses broader environmental challenges, including biodiversity conservation and the ecological crisis of the Aral Sea, emphasising the importance of regional cooperation and shared responsibility. The AntiTrash experience illustrates how creativity, citizen participation and public awareness campaigns can contribute to addressing environmental problems, encouraging behavioural change and promoting more sustainable approaches to waste management and environmental protection.

Keywords: illegal waste dumping; environmental activism; community engagement; environmental awareness.

From Practices to Progress: Challenges and Opportunities for Circular Economy in Central Asia

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Abstract. Circular economy practices are gaining increasing attention across Central Asia as countries seek more resource-efficient approaches to waste management, land use, agriculture, and industrial development. While emerging initiatives demonstrate growing interest in resource recovery and more sustainable production systems, their implementation remains uneven across sectors and countries. This contribution examines the current progress of circular economy development in Central Asia and identifies the key challenges and opportunities influencing its wider application.

The analysis focuses on developments in waste management and recycling, agricultural and organic resource utilization, construction material recovery, and sustainable land management. Particular attention is given to the enabling role of policy development, infrastructure, technological innovation, investment, stakeholder cooperation, and public awareness. At the same time, limitations in collection and recycling systems, markets for secondary materials, access to appropriate technologies, and institutional coordination continue to constrain the wider adoption of circular practices.

Despite these challenges, Central Asia has considerable potential to advance circular solutions by building on its agricultural resource base, expanding material and nutrient recovery, strengthening industrial cooperation, and integrating resource-efficiency principles into infrastructure and land-management strategies. Regional cooperation, knowledge exchange, education, and investment in locally appropriate technologies can further support this progress. The contribution highlights that advancing circular economy in Central Asia requires not only individual practices, but also coordinated efforts that connect policy, business, research, and communities. Such integration can transform emerging practices into measurable progress towards more resource-efficient and resilient development.

Keywords: circular economy; Central Asia; circular practices; resource efficiency; challenges; opportunities.

Geographical Aspects of Local Water Resources and Their Sustainable Use in the Low Mountains of the Desert Zone: A Case Study of Ovminzatov

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Abstract. The low mountain areas of the desert zone are characterized by limited and unevenly distributed water resources, which play an important role in the development of local ecosystems and human activities. This study examines the geographical characteristics of local water resources in the Ovminzatov low mountain area and evaluates opportunities for their sustainable and efficient use. The research focuses on the spatial distribution, availability and seasonal variability of surface and groundwater resources, as well as the natural factors influencing their formation and utilization. Particular attention is paid to the relationship between relief, geological structure, climate and local water availability. The study also considers the potential of water resources for meeting the needs of local communities, agriculture and ecosystem conservation. Geographic and cartographic methods, field observations, analysis of climatic and hydrological data, and GIS-based approaches are used to assess the current state and spatial characteristics of water resources. The results contribute to a better understanding of the water potential of low mountain landscapes in desert regions and provide a geographical basis for improving water management and reducing pressure on limited water resources. Sustainable use of local water resources can support the ecological stability and socio-economic development of the Ovminzatov area.

Keywords: local water resources; sustainable water management; desert low mountain landscapes; GIS-based geographical analysis

GIS-Based Qualitative Assessment of Irrigated Agricultural Lands: A Methodological Approach for Bukhara Region, Uzbekistan

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Abstract. Irrigated agricultural land is a fundamental resource for food security and rural livelihoods in Central Asia. This paper presents a methodology for qualitative assessment of irrigated lands in Bukhara Region, Uzbekistan, using Geographic Information System (GIS) technologies and spatial analysis. Four primary evaluation criteria were established and applied: groundwater depth, soil salinity, soil mechanical composition, and climatic indicators (temperature). A seven-stage technological system was developed, incorporating field surveys using GNSS-i70 equipment, remote sensing data from satellite imagery, and spatial data integration within ArcGIS Pro and ArcGIS Online platforms. Assessment maps were produced for 2014 and 2024, revealing dynamics and spatial patterns of land quality change across the region's 228,114 hectares of irrigated agricultural area. Land quality classification was systematically divided into five quality grades (A-1 through A-5). Based on these assessments, crop placement recommendations were formulated for individual districts. Additionally, an interactive web platform "Assessment-LQ" (Assessment of Land Quality) was developed to enable continuous monitoring. Results demonstrate that GIS-based multi-criteria evaluation substantially improves the accuracy and operational efficiency of irrigated land quality monitoring compared to conventional approaches.

Keywords: GIS-based land assessment; irrigated agricultural lands; soil salinity; land quality monitoring.

Global Research Trends in Renewable Energy and Their Contribution to Sustainable Development Goals: A Bibliometric Analysis (2015–2024)

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Abstract. Research evaluations are essential for comprehending patterns and advancements in the field and for directing future investigations. A bibliometric analysis was performed on 143 Scopus documents spanning the years 2015 to 2024. The publications, significant authors, papers, leading contributing nations, journals, publishers, organizations, and growth patterns of keywords associated with renewable energy are the main subjects of this study. This study's primary objectives were to identify trend indicators for renewable energy. This article has examined the different methods of renewable energy used in different countries. The findings indicate that chemical treatment is the most efficacious technique. It is imperative to identify and implement the most effective techniques through the analysis of these articles. Bibliometric analysis indicated that global research on renewable energy would be enhanced by increasing scientific collaboration on this subject, alongside sustained longitudinal studies and the sustainable incorporation of renewable energy research into future energy frameworks.

Keywords: renewable energy; energy transition; solar energy; wind energy; SDG; bibliometric analysis

Implementing ESG Mechanisms into Management of Internationalization Processes at Universities

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Abstract. The internationalization of higher education institutions is increasingly influenced by environmental, social and governance (ESG) principles, which have become important criteria for institutional competitiveness, international reputation and sustainable development. This study examines the integration of ESG mechanisms into university internationalization management, focusing on the higher education system of Uzbekistan. The main objective is to develop a theoretical and methodological framework for assessing, managing and improving internationalization processes through sustainability-oriented institutional strategies.

The research combines SWOT and PEST analyses, statistical and comparative methods, expert assessments, benchmarking and a national survey involving 103 representatives of higher education institutions. A three-stage ESG integration model is proposed, progressing from reactive adaptation to active integration and transformational leadership. The methodological framework introduces a Pentagonal Integrated Model (PIM), extending traditional ESG principles by incorporating academic capacity and international integration. A Dynamic Equilibrium Coefficient (DEC) matrix is developed to examine interactions among these five dimensions. Additionally, a multi-criteria Input–Process–Output (IPO) assessment system and a composite ESG-XI index, based on twelve weighted indicators, are proposed to evaluate institutional sustainability and internationalization performance.

The empirical findings reveal significant differences between public and private universities in Uzbekistan regarding sustainability integration, highlighting the importance of financial incentives, regulatory frameworks and institutional leadership. The proposed assessment methodology is applied to Bukhara State University, illustrating its practical applicability and supporting the analysis of institutional performance, including improvements in international sustainability rankings. Forecasting scenarios extending to 2030 are also presented to guide strategic planning and institutional development.

The study provides practical recommendations for integrating ESG indicators into university accreditation, strengthening institutional monitoring systems and promoting sustainability-oriented international cooperation. The proposed framework offers a structured approach to aligning internationalization strategies with sustainable development objectives and improving the global competitiveness of higher education institutions.

Keywords: ESG-based university management; higher education internationalization; sustainability assessment; institutional governance.

Integrated Assessment of Climate and Environmental Stress in the Turkistan Region Based on the Dynamics of Ambient Air Quality, River Discharge, And Surface Water Status

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Abstract. The article presents a comprehensive assessment of climatic and environmental stress in the Turkestan region based on an interconnected analysis of climatic indicators, atmospheric air, river runoff and surface water quality. The purpose of the study was to identify changes in the natural and ecological components of the region and to assess the role of climatic factors in the formation of water and environmental risk. The information base was made up of official data from Kazhydromet RSE for 2021-2025, which included air and soil surface temperature, precipitation, humidity, cloud cover, wind speed, duration of sunshine and snow cover, as well as information on atmospheric impurities, river runoff and the hydrochemical state of water bodies. Additionally, long-term data on the outflow of the Aral-Syrdarya basin for 1940-2024 were used. Descriptive statistics, Friedman's criterion, Kendall's concordance coefficient, Wilcoxon's paired criterion with Holm correction, correlation and comparative analysis were used for data processing. Statistically significant interannual differences in air temperature have been established ($x^2 = 39.93$, $p < 0.001$, $W = 0.832$) and precipitation ($x^2 = 43.47$, $p < 0.001$, $W = 0.906$); changes in wind speed were characterized by a weak effect ($x^2 = 10.11$, $p < 0.039$, $W = 0.211$). With the standard flow rate of the Aral-Syrdarya basin of 21.42 km^3/year, a long-term trend towards a decrease in water content has been revealed. The average scenario estimates of runoff for 2022-2050 were 23.0, 25.2, and 26.2 km^3 for RCP2.6, RCP4.5 and RCP8.5 respectively. The results show that warming, increased evaporation losses and intensive irreversible water withdrawal increase seasonal water scarcity and the risk of deterioration of surface waters. The scientific novelty of the research lies in the integration of climatic, atmospheric, hydrological and hydrochemical indicators into a single system of regional environmental assessment.

Keywords: climate change; environmental stress; river runoff; atmospheric air; surface waters, Aral-Syrdarya basin; Turkestan region; Kazhydromet

Integrating Circular Economy Principles in the Agri-Food Supply Chain: A Systematic Literature Review of Pathways for Sustainable Resource Utilization

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Abstract. The global food industry is a primary driver of resource depletion and environmental degradation; however, the transition from linear "take-make-dispose" models to circular frameworks remains fragmented. This study aims to bridge the gap between theoretical circular economy (CE) principles and operational implementation by synthesizing high-impact pathways for resource utilization and waste reduction in the food sector.

This research employs a PRISMA-compliant systematic literature review, analyzing peer-reviewed studies published between 2018 and 2026. The methodology involves a thematic analysis of 120+ scholarly articles across Scopus, Web of Science, and PubMed, focusing on the intersection of industrial symbiosis, waste valorization, and supply chain digitalization.

The study identifies four critical pathways for circular transformation: (1) high-value waste valorization into bio-based materials and bioenergy; (2) the integration of industrial symbiosis in food-processing clusters; (3) the deployment of Industry 4.0 technologies for closed-loop supply chain management; and (4) the adoption of biodegradable, multi-functional packaging. Key barriers identified include regulatory inconsistencies in by-product classification and significant initial capital requirements for recovery technologies.

While the study provides a comprehensive global framework, the findings highlight that regional variations in waste management infrastructure and policy support remain significant determinants of CE success.

This paper contributes a novel "Integrated Circularity Framework" that maps specific technical pathways (e.g., nutrient recovery, bio-refining) directly to Sustainable Development Goals (SDG 12 and 13). It provides a strategic roadmap for researchers and practitioners to move beyond waste management toward holistic, value-generating food systems.

Keywords: circular economy; agri-food supply chain; waste valorization; sustainable resource management.

Mapping the Changes in the Coastline of the Chirchik River Based on Remote Sensing Data, Using the Cartographic Research Method

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Abstract. In recent decades, the Earth's surface has been intensively studied from space using a range of remote sensing methods: from photography and television imaging to radar and laser sensing. Space-based methods hold great promise for river shorelines. Photographic and television imaging can be used to monitor changes in shorelines. Large-scale maps are compiled from space photographs, and the dynamic position of river shorelines is tracked.

Space images taken in different years clearly show the dynamics of anthropogenic changes in rivers (resulting from water harvesting from irrigated lands). This allows for the assessment and refinement of river water resources. Remote sensing data allows for observations over large areas, promptly receiving and updating information. In addition to changes in river shorelines, imagery can be used to monitor riverbank pollution, identify waste disposal sites through which wastewater flows into the reservoir (and establish this fact not probabilistically, but in reality), and identify illegal riverbed use (sand and gravel mining), which causes irreparable damage to the river. In addition to remote sensing, we also use mapping to monitor the shoreline.

The Chirchik River, including the system of canals that draw water from it, is a vital source of drinking, municipal, industrial, and agricultural water for the Tashkent region and the city of Tashkent, as well as for the neighboring Republic of Kazakhstan. Therefore, studying the formation of its water quality is of not only national but also international significance.

The Chirchik is formed by the confluence of several major rivers: the Chatkal, Koksu, Pskem, and Ugam. The longest of these is the Chatkal River (400 km), which flows primarily through Kyrgyzstan. The Charvak Reservoir was created at the confluence of the Chatkal, Koksu, and Pskem rivers.

Keywords: remote sensing; riverbank erosion; shoreline change detection; cartographic analysis.

Microplastics in Kazakhstan's Wastewater: Technological Challenges and Toxicological Risks

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Abstract. A critical analysis of microplastic (MP) removal efficiency at Kazakhstan's wastewater treatment plants (WWTPs) was performed in comparison with global data. The findings indicate that a deficit in tertiary treatment stages combined with outdated sludge management practices converts wastewater systems into active point sources of MP release into the hydrosphere. To evaluate the resulting public health threats, a comprehensive trans-taxon assessment and mathematical forecasting of toxic risks were conducted for aqueous extracts of commercial polymers—polyethylene terephthalate (PET), polypropylene (PP), and polyethylene (PE) – as a function of extraction temperature (25, 37, 60°C) and particle size fractions (0.175-3.0 mm). The bioassay battery comprised evaluation of systemic phytotoxicity (germination index, GI), target reproductive toxicity in mammalian cells (sperm motility decline, Dev), and in vivo dermal irritation. For integrated risk management, an additive Total Risk Index (TRI) model was compared against the categorical worst-case scenario constraint. To ensure reliable biotesting, a validated two-stage algorithm is proposed, wherein the continuous TRI index is applied for the global macro-modeling of trends, while the categorical limiting-factor filter serves as a mandatory hygienic barrier to identify acute, specific hazards.

The findings underscore the critical need for upgrading Kazakhstan's WWTPs by implementing tertiary treatment technologies. Integrating the proposed two-stage algorithm into the national hygienic regulatory framework will provide a robust foundation for ecotoxicological monitoring and preventive risk management of latent public health threats.

Keywords: microplastics; wastewater treatment plants; toxicological risk assessment; bioassay battery; hygienic regulation

Model Coefficient Estimation Using the Stochastic Approximation Method

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Abstract. The article presents adaptive identification algorithms that are integral components of adaptive control systems. Characteristic features of such systems include their ability to operate even under uncertain or changing conditions, continuously receive information about the conditions during the work process, and immediately utilize this information to modify their behavior. When employing these algorithms, fulfilling the convergence condition plays a crucial role. The algorithm under consideration can be applied for identifying stationary processes and even for the initial calibration of model coefficients.

Keywords: stochastic approximation; adaptive identification; model coefficient estimation; algorithm convergence.

Monitoring and Analysis of Agricultural Land Resource Degradation Using Remote Sensing Technologies (on Case Study of the Fergana Region)

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Abstract. Sustainable management of agricultural land resources is critically important in regions experiencing intensive land use and environmental pressure, such as the Fergana Valley. This study focuses on the monitoring and analysis of agricultural land degradation using remote sensing technologies, with a case study of the Fergana region. The research aims to identify spatial and temporal patterns of land degradation and assess its driving factors through geospatial analysis. Multi-temporal satellite imagery, including Landsat and Sentinel data, was utilized to evaluate changes in vegetation cover, soil salinity, and land productivity over a defined period. Key remote sensing indices such as the Normalized Difference Vegetation Index (NDVI), Soil Adjusted Vegetation Index (SAVI), and salinity indices were applied to detect and quantify degradation processes. Geographic Information System (GIS) tools were employed to integrate, visualize, and analyze spatial data, enabling the identification of degradation hotspots and trends. The results indicate a noticeable decline in vegetation health and an expansion of saline and degraded lands in certain parts of the region, largely driven by unsustainable irrigation practices, soil salinization, and climate variability. The study demonstrates the effectiveness of remote sensing technologies in providing timely, cost-efficient, and large-scale monitoring of land degradation. This research contributes to improved decision-making for sustainable land management by offering a methodological framework for continuous monitoring and assessment of agricultural land conditions. The findings can support policymakers and stakeholders in developing targeted strategies to mitigate land degradation and enhance agricultural productivity in the Fergana region.

Keywords: agricultural land degradation; remote sensing technologies; soil salinization; sustainable land management.

Participatory Hydrological Monitoring for Sustainable Land and Water Management: A Community-Based Approach to Flood Risk Reduction

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Abstract. This work presents the initial results of the HIDROANDES project, involving the participatory installation of rainfall and streamflow monitoring stations in indigenous and rural communities of the Mulato River sub-basin (Mocoa, Colombia). Precipitation and water level measurements constitute the foundation for the development of an integrated early warning system aimed at reducing vulnerability to rapid-onset flooding events.

Keywords: community-based monitoring; early warning systems; participatory hydrology; rapid-response basins; flood risk management.

Smart Agriculture for Advancing Sustainable Development Goals: Leveraging Digital Innovation to Improve Food Security and Climate Resilience in Africa

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Abstract. Agriculture continues to play a vital role in Ghana's economy by providing employment, supporting livelihoods, and contributing to national food security. However, the sector is increasingly affected by climate change, land degradation, rising production costs, and low levels of technology adoption. These challenges highlight the need for practical and innovative solutions that can improve productivity while ensuring the sustainable use of natural resources.

This paper examines how smart agricultural practices can contribute to the achievement of the Sustainable Development Goals (SDGs), particularly those related to ending hunger, promoting sustainable economic growth, and protecting the environment. It discusses the use of technologies such as precision farming, drone-assisted monitoring, digital farm management systems, and data-driven decision-making to improve agricultural efficiency and resilience.

The paper further explores the current state of smart agriculture in Ghana, identifying both the opportunities and the barriers to wider adoption. While increasing mobile connectivity and government support have created favourable conditions for digital agriculture, challenges such as limited access to finance, inadequate technical skills, and poor rural infrastructure continue to slow progress.

Drawing on recent developments and practical examples, the paper argues that sustainable agricultural transformation requires collaboration between government institutions, research organisations, private sector stakeholders, and farming communities. Investments in digital infrastructure, farmer education, and agricultural innovation will be essential to achieving long-term food security and environmental sustainability.

The study concludes that smart agriculture offers a practical pathway for improving productivity, strengthening climate resilience, and supporting inclusive rural development. Its successful adoption can significantly contribute to the achievement of the Sustainable Development Goals while creating a more competitive and sustainable agricultural sector in Ghana and across Africa.

Keywords: smart agriculture; digital agricultural innovation; food security; climate resilience.

Structural and Seismic Resilience: Research Activities at ICITECH

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Abstract. Structural and seismic resilience is a fundamental requirement for ensuring the safety, durability and sustainability of buildings and infrastructure, particularly in regions exposed to earthquake hazards. Understanding the interaction between structural and non-structural elements is essential for improving seismic performance, reducing structural damage and developing innovative construction solutions. This contribution presents an overview of research activities conducted at the Institute of Concrete Science and Technology (ICITECH) of the Universitat Politècnica de València (Spain), with particular emphasis on seismic engineering, structural behaviour, innovative materials and sustainable construction technologies.

The research focuses on the seismic response of reinforced concrete buildings, particularly the interaction between structural frames and masonry infill walls. Observations from the 2011 Lorca earthquake in Spain illustrate how non-structural elements can significantly modify the dynamic behaviour of buildings, potentially generating structural irregularities, soft-storey mechanisms and unexpected damage. To address these challenges, ICITECH has developed and investigated innovative seismic isolation solutions designed to reduce adverse interactions between masonry partitions and structural frames.

Special attention is given to SISBRICK (Seismic Isolation System for Bricks), an innovative isolation system intended to improve the seismic performance of masonry infill walls while maintaining compatibility with conventional construction methods. The research combines experimental testing, material characterisation, structural analysis and cyclic loading experiments to evaluate different configurations and their influence on stiffness, deformation capacity, energy dissipation and structural response. Investigations include different masonry arrangements, façade enclosures, internal partitions and plasterboard systems, as well as applications to existing buildings.

The presentation also highlights the broader research priorities of ICITECH, including structural monitoring, maintenance, rehabilitation, new construction materials, industrialisation and sustainability. These activities contribute to developing safer and more resilient buildings, reducing earthquake-related damage and supporting more efficient use of construction resources. The research demonstrates the importance of integrating experimental evidence, innovative materials and improved structural design strategies to enhance seismic resilience and promote sustainable development in the built environment.

Keywords: seismic resilience; structural engineering; masonry infill walls; seismic isolation systems.

The Basin Approach as a Key Tool for Sustainable Water Resources Management in Central Asia

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Abstract. In the face of increasing water scarcity and climate change, the basin approach is considered a fundamental tool for sustainable water resources management in Central Asia. This paper analyzes the theoretical foundations and practical implementation of the basin approach, which ensures water resources management based on the hydrographic boundaries of river basins rather than administrative units. Particular attention is paid to the basins of the region's transboundary rivers—the Amudarya, Syrdarya, Ile, Shu, and Talas—where conflicts between countries reinforce the need for integrated cooperation mechanisms. This article examines the institutional and legal aspects of water resources management, including international conventions and regional agreements, as well as contemporary challenges such as increasing water consumption, ecosystem degradation, and social impacts. It is shown that a basin approach facilitates the development of an integrated system for monitoring, using, and protecting water resources, ensuring a balance between environmental, economic, and social interests. It is concluded that a basin approach is key to achieving sustainable development and preventing water conflicts in Central Asia.

Keywords: river basin; basin approach; Central Asia; transboundary rivers; Amudarya; Syrdarya; integrated water resources management; water security; climate change; monitoring; sustainable development; water diplomacy; basin organizations; ecosystem approach.

The ERASMUS+ GREENFUTURE Project: Sustainable and Resilience Indicators for Mongolia Universities Assessment

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Abstract. GREENFUTURE (Sustainable and Resilience Indicators for Mongolia Universities Assessment) is an Erasmus+ Capacity Building in Higher Education Strand 3 project coordinated by Universitat Politècnica de València. It aims to strengthen sustainability and resilience in Mongolian higher education by addressing gaps in institutional policies, evaluation frameworks and organisational capacities. The project brings together 12 partners from four countries, including universities, research institutions, quality assurance bodies and the Mongolian Ministry of Education.

The overall objective is to establish the institutional basis for Sustainability Offices in Mongolian universities and support their participation in the international UI GreenMetric sustainability ranking network. A framework adapted to the Mongolian context will connect sustainability indicators, policy recommendations and capacity building with university governance, evaluation and management. This approach aligns with Mongolia's Vision 2050, the United Nations Sustainable Development Goals and European Green Deal principles, integrating environmental sustainability with digital transformation and inclusion.

Keywords: university sustainability; institutional resilience; sustainability indicators; higher education capacity building.

The ERASMUS+ LESLIE Project: An Example of International Cooperation in Education and Research on Environmental Sustainability in Central Asia

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Abstract. The project entitled "Land Management, Environment and Solid Waste: Inside Education and Business in Central Asia (LESLIE)" is an ERASMUS+ CBHE action jointly organised by 14 organisations from 3 EU countries (Spain, Italy and Cyprus) and 2 Central Asian countries (Kazakhstan and Uzbekistan).

LESLIE focuses on developing new capacities that Central Asian Higher Education Institutions will use in their future educational programmes in Sustainable Land Management.

The project's overall objective is to design and produce a set of microcredentials and digital educational tools on Sustainable Land Management for introduction at Central Asian universities, updating their current Bachelor's and Master's programmes while meeting the needs of regulators and industry under the latest and most demanding international standards.

Keywords: sustainable land management; higher education capacity building; micro-credentials; international cooperation.

The ERASMUS+ SPECIAL Project: Sustainable Waste Management, Environmental Pollution and Circularity: Linking Education and Business in Latin America and the Caribbean

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Abstract. SPECIAL (Sustainable waste management, environmental Pollution and Circularity: Linking education and Business in Latin America and the Caribbean) is an ERASMUS+ Capacity Building in Higher Education project bringing together 11 partner institutions from Europe, Latin America and the Caribbean. Its central objective is to develop micro-credentials and digital educational tools in Sustainable Waste Management (SWM), updating Bachelor's and Master's programmes in response to regulatory and industry needs.

The project links an international stakeholder Hub, a Future Learning Incubator, a micro-credential catalogue and a shared online repository. Six work packages connect educational design with implementation, quality assurance and dissemination. The planned outputs address municipal and industrial waste, circular economy, recycling, water management, soil pollution and environmental risks.

Keywords: sustainable waste management; circular economy; micro-credentials; international cooperation.

The Role of Milk and Dairy Products in Ensuring Food Security and Sustainable Consumption in Uzbekistan: Evidence from Econometric Analysis and Implications for Central Asia

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Abstract. This study provides original econometric evidence on the relationship between dairy sector development and multidimensional food security outcomes in Uzbekistan using annual data for 2000–2023 (n = 24). A composite Food Security and Dietary Index (FSDI), integrating the prevalence of undernourishment, the Global Food Security Index, and dietary energy supply adequacy, is estimated using Ordinary Least Squares (OLS) with robust standard errors following Augmented Dickey-Fuller unit-root testing and Engle–Granger cointegration analysis. Three nested model specifications are estimated to assess the incremental contribution of the explanatory variables. The preferred full specification (Model III) achieves an R^2 of 0.956 and an adjusted R^2 of 0.938, while the Durbin-Watson statistic of 2.04 indicates no material evidence of first-order autocorrelation. Per capita dairy consumption (MKSUT) is the strongest dairy-specific predictor: a 1% increase is associated with a 0.347% increase in FSDI ($p < 0.001$). Household income ($\beta = 0.291$), agricultural investment ($\beta = 0.214$), and total milk production ($\beta = 0.184$) are positively associated with food security, whereas food price inflation ($\beta = -0.187$) and import dependency ($\beta = -0.031$) are negatively associated with FSDI. Between 2000 and 2023, Uzbekistan's milk production more than doubled to 8.75 million tonnes, while per capita dairy consumption increased from 138 to 255 kg per year and the import dependency ratio declined to below 1%. Forecast projections suggest average annual FSDI growth of 2.6% through 2028. A cross-country analysis of five Central Asian states indicates dairy-food security elasticities ranging from 0.294 in Kazakhstan to 0.412 in Tajikistan, suggesting larger potential gains from dairy-sector development in countries with greater food-security constraints. The findings provide policy implications for Uzbekistan and the wider Central Asian region.

Keywords: food security; dairy products; milk consumption; sustainable consumption; Uzbekistan; Central Asia; OLS regression; agricultural investment

The Solid Waste Management System in Valencia Metropolitan Area

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Abstract. Municipal solid waste (MSW) management represents a major environmental challenge for urban and metropolitan areas, particularly in relation to waste generation, resource recovery, environmental pollution and sustainable land use. Effective waste management requires integrated systems combining waste collection, separation, recycling, biological treatment and environmentally controlled disposal of residual materials. This contribution presents an overview of the municipal solid waste management system implemented in the Valencia Metropolitan Area (Spain), highlighting its organisational structure, treatment infrastructure, technological processes and associated environmental challenges.

The analysis focuses on the metropolitan waste management system coordinated by EMTRE (Metropolitan Entity for Waste Treatment), which serves approximately 1.5 million inhabitants and manages around 600,000 tonnes of municipal solid waste annually. Particular attention is given to the Los Hornillos and Manises recycling and composting plants, with treatment capacities of approximately 400,000 and 300,000 tonnes per year, respectively, and the Dos Aguas landfill, which receives residual materials from waste treatment operations. The main stages of waste processing are described, including reception, mechanical and manual sorting, trommel screening, ballistic separation, optical classification, recovery of recyclable materials and compost production.

The contribution also examines the environmental implications of landfill disposal, particularly leachate generation, groundwater contamination, greenhouse gas emissions and potential impacts on soil and water resources. Finally, the principal challenges facing municipal solid waste management in the European Union are discussed, including contamination of recyclable materials, infrastructure limitations, market fluctuations and the importance of public participation in waste separation.

The Valencia experience provides a practical example of integrated metropolitan waste management, illustrating how technological infrastructure, material recovery and appropriate disposal practices can contribute to reducing environmental impacts, improving resource efficiency and supporting the transition towards a circular economy.

Keywords: municipal solid waste management; waste treatment and recycling; landfill environmental impacts; circular economy.

Theoretical-methodological Foundations of Assessment of the Ecological Condition of Land Resources Based on GAT and Remote Sensing Data, Geomodeling and Cartographic Representation

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Abstract. Land resources, especially in arid and semi-arid regions such as Central Asia, are increasingly threatened by degradation, desertification and climate change. Effective monitoring and sustainable management of these resources require advanced geospatial technologies. This paper presents a theoretical and methodological framework for ecological assessment, geomodeling and cartographic visualization of land resources by integrating Geographic Information Systems (GIS) and Remote Sensing (RS) data.

The main objective is to develop a comprehensive theoretical and methodological framework that enables systematic assessment of the ecological state of the land, predictive geomodeling and effective cartographic visualization. The proposed approach combines multi-temporal and multi-spectral satellite images from the Landsat and Sentinel-2 missions with auxiliary geospatial data. The main methodological components include vegetation and environmental indices (NDVI, NDWI, SAVI, salinity indices), machine learning-based land cover classification, post-classification change detection, and multi-criteria decision analysis (MCDA) in a GIS environment. Spatio-temporal geomodeling techniques such as Cellular Automation and integrated models (e.g. MEDALUS, RUSLE) are used to simulate scenarios, while advanced cartographic techniques provide a multi-layered, interactive, and web-based representation of environmental conditions.

This study builds a structured integration framework that links theoretical concepts of GIS and remote sensing with practical methodological workflows, emphasizing accuracy assessment protocols, uncertainty management, and scale considerations. This framework demonstrates high potential for operational monitoring and supports evidence-based decision making for sustainable land resource management.

The developed methodological frameworks are of great importance for researchers, environmental managers, and policymakers in addressing land degradation issues and ensuring ecological sustainability in vulnerable regions.

Keywords: land ecological assessment; GIS and remote sensing; spatio-temporal geomodeling; sustainable land management.

Traditional Carpet Weaving in the Nurata Oasis: Historical, Ethnological, and Sustainable Perspectives on a Regional Textile Heritage

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Abstract. Traditional carpet weaving in the Nurata oasis constitutes one of the distinctive regional textile traditions of Central Asia, reflecting centuries of interaction among pastoral communities, regional craft practices, and ethnocultural processes. Despite its historical and artistic significance, this weaving tradition has received limited interdisciplinary attention within international scholarship. This study aims to investigate the historical development, ethnocultural characteristics, ornamental symbolism, and contemporary significance of traditional carpet weaving in the Nurata oasis within the framework of sustainable cultural heritage.

The research employs an interdisciplinary methodology combining historical-comparative analysis, ethnographic field observations, museum collection studies, semiotic interpretation of ornamental motifs, and comparative analysis of regional textile traditions. Historical written sources, museum collections, archival materials, and field data collected in the Nurata oasis were integrated to examine the evolution of weaving traditions and their relationship with regional embroidery, pastoral culture, and cultural identity.

The findings demonstrate that the Nurata carpet-weaving tradition represents an independent regional textile school distinguished by its characteristic ornamental vocabulary, symbolic medallions, geometric and zoomorphic motifs, weaving techniques, and close relationship with traditional embroidery. The study further reveals that this artistic tradition developed through long-term interaction among Uzbek-Turkmen pastoral communities, regional trade networks, and neighboring weaving traditions rather than within a single isolated ethnic group. Contemporary preservation strategies, including governmental support, digital documentation, sustainable production practices, and the traditional ustoz–shogird (master–apprentice) system, contribute to safeguarding this important element of Uzbekistan's intangible cultural heritage.

The study provides a comprehensive historical and ethnological interpretation of the Nurata carpet-weaving tradition and contributes to a broader understanding of the role of traditional textile crafts in preserving regional cultural identity and supporting sustainable cultural development.

Keywords: Nurata oasis; traditional carpet weaving; regional textile heritage; ethnocultural identity; ornamental symbolism; sustainable cultural heritage; historical ethnology; Uzbekistan.

Transforming Waste into Resource: Circular Economy Strategies for Remediating Contaminated Agricultural Lands

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Abstract. Agricultural land contamination from industrial effluents, excessive fertilizers, and solid waste dumping affects an estimated 25% of global farmland, reducing crop yields and threatening food security. Conventional remediation methods—soil excavation, chemical washing, or landfilling—are expensive, energy-intensive, and often displace pollution rather than eliminating it. This paper presents circular economy strategies that convert waste streams into remediation tools, restoring land while generating economic value.

Three circular interventions are analyzed: (1) Biochar from agricultural residues – pyrolyzed crop waste applied to contaminated soils adsorbs heavy metals (lead, cadmium, arsenic), improves water retention, and sequesters carbon. Field trials in China and Brazil show 50–70% reduction in plant uptake of heavy metals within one growing season. (2) Composting with industrial byproducts – combining food waste, manure, and lime-based industrial byproducts (e.g., fly ash, slag) neutralizes soil acidity and immobilizes contaminants while adding organic matter. (3) Mycoremediation using waste-grown fungi – oyster and shiitake mushrooms cultivated on cardboard or coffee waste break down petroleum hydrocarbons and pesticides into non-toxic compounds, with spent mushroom substrate serving as soil amendment.

Data from 12 pilot sites across Europe, Southeast Asia, and Latin America (2022–2026) demonstrate that circular remediation reduces cleanup costs by 40–60% compared to conventional methods, creates 2–3 times more local jobs per hectare, and produces marketable co-products (biochar, compost, mushrooms). Challenges include variable contamination profiles, lack of standardized testing protocols, and farmer access to technical support. Policy recommendations include certification systems for circular soil amendments, micro-grants for pilot projects, and integration of circular remediation into national land restoration programs. This research supports SDG 11 (Sustainable Cities), SDG 12 (Responsible Consumption), and SDG 15 (Life on Land).

Keywords: circular economy; contaminated agricultural land; waste valorization; sustainable soil remediation.

UPV Ecosystem on Environmental and Social Sustainability

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Abstract. The Universitat Politècnica de València (UPV) is committed to economic, social and environmental sustainability, meeting present needs without compromising the ability of future generations to meet their own needs.

In this presentation we will review some of the landmarks of the Technical University of Valencia (Universitat Politècnica de València, UPV) that show its special devotion to fulfil its social responsibility because of which it maintains close relations with industry and companies through various initiatives and programmes designed to promote the university-business cooperation. Among the most outstanding activities are Management of Internships in Companies, Information, Support and Advice to students and companies: Forum for Employment, organized to promote interaction between students and companies; Business Chairs which become Strategic alliances between the UPV and companies to collaborate in areas such as teaching, research, innovation and knowledge transfer; and Industrial doctorates with possibility for confidentiality clauses.

These activities not only benefit students but also contribute to the training of highly qualified, employment-ready professionals. The UPV strives to maintain a strong link with the business environment, ensuring that students have the opportunity to live and learn in a real environment. The Universitat Politècnica de València offers a variety of training programs in Corporate Responsibility and Sustainability, designed to prepare students and active professionals to face the current challenges in the business field.

Finally, we recall that GreenMetric, the leading university environmental ranking, has recognised the Universitat Politècnica de València as one of the 250 universities worldwide most committed to sustainability and the environment.

Keywords: UPV ecosystem; environmental sustainability; social sustainability

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