

ABSTRACT BOOK

INTERNATIONAL
CONGRESS OF WATER
SUSTAINABILITY AND
TECHNOLOGY (IWAST)

COCHABAMBA, BOLIVIA

2025



Prologue

The International Congress on Water, Sustainability and Technology (IWaST) is an academic initiative of the Universidad Católica Boliviana “San Pablo” (UCB) and the Universitat Politècnica de Catalunya – BarcelonaTech (UPC). The congress took place from March 19 to 21, 2025, in the city of Cochabamba (Bolivia), a place globally recognized for its historical role in the defense of the right to water. This local context, marked by social mobilization and awareness, provides IWaST with a unique perspective on the global water crisis, rooted in lived experience.

Water is a vital but increasingly threatened resource. In Bolivia and across Latin America, water-related challenges include unequal access, pollution from mining and agriculture, conflicts over water use, and growing vulnerability to climate change. These issues are compounded by weak infrastructure, limited investment in innovation, and gaps in governance. Globally, water is at the heart of major environmental, social, and economic challenges, linked to food security, energy systems, health, migration, and biodiversity loss. The complexity of these interconnected issues demands inter- and transdisciplinary, cross-sectoral, international, and locally grounded responses.

As an academic effort to contribute to solving these complex water challenges, the IWaST congress was conceived as a platform to foster collaboration among researchers, professionals, policymakers, civil society, and students from diverse fields and countries. Its mission is to advance sustainable and integrated water management by fostering dialogue, sharing scientific knowledge, and supporting the development of innovative solutions. The congress also seeks to strengthen academic networks, promote the development of water-related technologies, and contribute to evidence-based policy-making at local, national, and international levels.

The IWaST congress is structured around five thematic axes: (1) Water Security, (2) Water Pollution and One Health, (3) Water Management and Treatment, (4) Water Sustainability and Life Cycle Assessment, and (5) Water Education. These themes reflect the complexity of water issues and the need for holistic responses.

This proceedings book presents the scientific and technical contributions shared during the IWaST congress, offering a rich overview of current research, case studies, and proposals for action. It reflects our collective commitment to rethinking our relationship with water, promoting resilience, and building a more sustainable future.

We thank all participants, contributors, and partners for making this congress possible and for joining us in this shared effort to advance knowledge and collaboration across borders.

Paul d’Abzac

IWaST Steering Committee
Universidad católica Boliviana “San Pablo”

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What is IWaST?

The partnership between the Universidad Católica Boliviana San Pablo and the Universidad Politécnica de Cataluña · Barcelona Tech leads to the creation of the International Congress of Water Sustainability and Technology (IWaST) to be held in Cochabamba, Bolivia from 19 to 21 March 2025. This high-level academic event will allow the presentation of communications and posters in hybrid, in-person, and online modes. Keynote presentations will enrich our thematic areas that will open up debate and exchange of knowledge. The congress will have a book of abstracts and the best communications will have the opportunity to be published in high-impact journals allied to the congress.

The IWaST congress is born from the brotherhood of two recognized international congresses: the International Congress of Integrated Water Management (Universidad Católica Boliviana San Pablo – Bolivia) and the International Congress of Water and Sustainability (Universidad Politécnica de Cataluña · Barcelona Tech – Spain). The IWaST is a new event that seeks to contribute to the area of water management and sustainability and its wide range of topics.

➤ Congress Purpose

Due to the constant and crucial need to recover and strengthen spaces to talk and relate to water as a common good, it is necessary to establish specific scenarios in which space is given to the development of studies and strategies related to the topic, at the local, national and global level.

➤ Objective

Disseminate the results of scientific research carried out by researchers around water management, and sustainability in order to encourage, promote, and generate synergies between research centers, public, and private organizations.

Themes



Water Security

Water Security can be understood in different ways: (1) As a development process, which is primarily referred to in terms of securing water for humans, (2) As a process of collective security, and (3) As a process of the ecosystem or the entire planet Earth. All these dimensions can overlap depending on the contexts. “Water Security is the ability to guarantee a population sustainable access to adequate quantities of water of acceptable quality to sustain livelihoods, human well-being and socio-economic environments, to ensure protection against pollution and water-related disasters. water, and to preserve ecosystems in a climate of peace and political stability” (UN – WATER, 2013).



Water Pollution and One Health

Seeing water as a resource, but also as a common good of human populations and as a support for aquatic and terrestrial ecosystems, leads to treating “water quality” as something relative and that is important not only if it is related to its use. The “natural quality” of water depends on the physical, chemical and biological characteristics, given by the geological and climatic conditions of the place where they are found. This condition, however, is being rapidly altered by anthropogenic activity, caused by accelerated population growth and economic activities that make intensive use of it, causing a process of disturbance and degradation of water sources and aquatic ecosystems. Thus, “One Health is an integrated and unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It is recognized that the health of humans, domestic and wild animals, plants and the wider environment (including ecosystems) are closely linked and interdependent” (WHO).



Water Management and Treatment

This line includes, on one hand, all the most cutting-edge scientific-technical experiences related to purification, water treatments, waste treatment and environmental analysis.

On the other hand, it includes all the aspects that refer to water management models, taking into account all the relevant elements in public/private water transition processes, as well as the strengths and weaknesses.



Water Sustainability and Life Cycle Assessment (LCA)

This line of work encompasses a comprehensive approach to sustainability, collecting and analyzing sustainable experiences in various areas. One of the fundamental pillars is the evaluation of indicators, which provides a clear and quantitative vision of the impact of the actions and policies implemented. In addition, a life cycle analysis (LCA) is carried out, which allows to understand the environmental impact of a product or service throughout all stages of its life, from the extraction of raw materials to its final disposal.

In addition to these technical approaches, an analysis is also carried out on the perception of sustainability, which considers the opinions, attitudes and behaviors of different actors involved. This analysis provides valuable information on how sustainability is perceived and valued in society, which can influence the effectiveness of sustainable initiatives.

Together, this line of work integrates different perspectives and tools to understand, evaluate and promote sustainability in various contexts, thus contributing to the construction of a more equitable and environmentally friendly future.



Water Education

Along this theme, classroom experiences or success stories are sought, where implementations of case studies, challenging projects and practical challenges are carried out in collaboration with students. These projects carried out will be focused on water treatment, covering both the management of industrial and domestic wastewater and the purification of water. In this theme, systematized awareness-raising experiences and information transfer processes related to water management and sustainability are also contemplated.

IWaST 2025

From March 19 to 21, the Faculty of Theology of the Universidad Católica Boliviana (UCB) in Cochabamba hosted the International Congress of Water Sustainability and Technology (IWaST), an event of great relevance for water management at the global level. For three days, national and international experts shared knowledge, research and projects focused on water sustainability and the technologies associated with its management.

High-level speakers and presentations

The congress featured the participation of five keynote speakers, recognized for their experience in water management:

- Juan José Salas (Spain) - PhD in Chemistry from the University of Seville.
- Beatriz Amante (Spain) - Polytechnic University of Catalonia Barcelona Tech (UPC).
- Andrés Torres (Colombia) - Pontificia Universidad Javeriana.
- Lluc Canals (Spain) - Polytechnic University of Catalonia Barcelona Tech (UPC).
- Melina Balderrama (Bolivia) - Bolivia WATCH Program Coordinator.

A total of **36 presentations** were made, addressing five essential thematic axes.

The event brought together experts from Colombia, Peru, Brazil, Mexico, Germany and Bolivia, consolidating a space for academic and institutional collaboration.

An event of international scope

The congress not only stood out for its academic content, but also for its international character, bringing together representatives of prestigious universities and academic institutions from Bolivia and different parts of the world, among them:

Bolivian universities: UCB, EMI, UAGRM, UMSS (CASA), UNIVALLE, UMSA, UAJMS, San Francisco Xavier, Stockholm Environment Institute (SEI) among others.

International universities: UPC (Spain), Pontificia Universidad Javeriana (Colombia), Federal University of Bahia (Brazil), HafenCity Universität (Germany), Universidad Peruana de Ciencias Aplicadas (Peru).

Non-academic institutions: Autonomous Municipal Government of Santa Cruz de la Sierra, Bolivian Platform against Climate Change, Vice-Ministry of Potable Water and Sanitation, AGUATUYA, IWA Bolivia, ABIS, AECID.

Executive Summary

From March 19 to 21, the Faculty of Theology of the Catholic University of Bolivia in Cochabamba hosted the International Congress on Water Sustainability and Technology (IWaST), organized by the Catholic University of Bolivia through CICEI and the Polytechnic University of Catalonia. With the support of 8 international and national institutions. This event brought together national and international experts to share knowledge and experiences on sustainable water management in a context of climate change and water scarcity.

The congress included the participation of five keynote speakers recognized in the field of water management and addressed crucial issues such as water security, water pollution, water treatment and management, and water education. With a total of 77 participants, 36 oral presentations and 12 poster presentations.

The Congress stood out not only for its enriching academic content, but also for its international character, bringing together representatives from prestigious universities and academic institutions in Bolivia (Universidad Católica Boliviana, Escuela Militar de Ingeniería, Universidad Autónoma Gabriel René Moreno, Universidad Mayor de San Simón, Universidad del Valle, Universidad Mayor de San Andrés, Universidad Autónoma Juan Misael Saracho and Universidad San Francisco Xavier) and universities from different parts of the world, such as: Stockholm Environment Institute, Polytechnic University of Catalonia in Spain, Pontificia Universidad Javeriana in Colombia, Federal University of Bahia in Brazil, HafenCity University Hamburg in Germany, and Peruvian University of Applied Sciences in Peru. As well as non-academic institutions such as the Autonomous Municipal Government of Santa Cruz de la Sierra and the Bolivian Platform against Climate Change, Vice Ministry of Drinking Water and Sanitation, AGUATUYA, IWA Bolivia, ABIS, AECID, among others.

One of the highlights was the presentation of the IWaST 2025 Declaration, entitled "Water is Life", which reaffirms the collective commitment of all stakeholders to contribute to comprehensive and collaborative solutions in water management.

Finally, IWaST 2025 emphasized not only the need for proper water management, but also the importance of cooperation between the academic, civil and governmental sectors. Collaboration and dialogue were fundamental pillars of the congress, reaffirming the commitment to develop concrete solutions to meet the challenges of water management in the future. The University will continue to promote initiatives that integrate research and social action for the care of water and the environment. The next IWaST 2027 Congress will take place in Spain and will be hosted by the Polytechnic University of Catalonia.

Steering Committee

Paul d'Abzac

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He is a faculty member and researcher specialized in chemistry and water microbiology. He began his research career in France, collaborating on international projects related to water chemistry and treatment. Currently, he coordinates several projects focused on Integrated Water Management and the study of water contamination and its effects. Additionally, he leads the Center for Research in Exact Sciences and Engineering (CICEI), promoting the organization and visibility of research within the university.



Beatriz Amante García

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She obtained her PhD from École Nationale Supérieure des Télécommunications in Paris in 2002. She is currently an Associate Professor at the Polytechnic University of Catalonia (UPC) in the Department of Project and Construction Engineering. She leads the ENMA (Environmental Engineering) research group and serves as Deputy Director at INTEXTER (Institute for Textile Research and Industrial Cooperation) at UPC. Her research focuses on radar systems for driver assistance, life cycle analysis, and business models in the automotive sector. Additionally, she develops humanitarian projects and social innovation initiatives in Burkina Faso, Colombia, and Panamá, primarily in wastewater treatment.

Scientific Committee

Paola Alvizuri

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Scientific committee coordinator

She is a faculty researcher at the Research Center for Water, Energy, and Sustainability (CINAES) at the Universidad Católica Boliviana (UCB). She has been recognized twice with the UCB Eureka Award, in 2022 and 2024, in the “Researcher of the Year” category. In addition, in 2022, she won first place in the Plurinational Science, Technology, and Innovation Award. In 2023, she was awarded the OWSD Early Career Fellowship, granted by UNESCO. Her research focuses on the development of sustainable water treatment technologies, water resource quality, and integrated water management.



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Professor at Universitat Politècnica de València, specializing in project management, innovation, and environmental engineering. With extensive experience in sustainability assessment, she has led research on urban waste and water management, carbon footprint analysis, and smart cities. She is a member of PRINS at UPV and serves on the Board of Directors of AEIPRO IPMA Spain. Her work integrates academic research with applied solutions, fostering interdisciplinary collaboration to enhance sustainable development and project efficiency.





Lluc Canals Casals

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Industrial engineer and Doctor by the UPC. Since 2020 professor at the UPC at the Projects and Construction Department. He was a volunteer and board member of Engineers Without Borders fighting for the human right for water. All his research is focussed in improving circular economy streams. Since 2025 he is the director of the Hydrogen Resarch Center at UPC (CER-H2).

Patricia Kay Llanos Torrico

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With a Cum Laude Ph.D. from the University of Jaén and master's degrees in remote sensing and geography, brings over 15 years of expertise in GIS and remote sensing. She has collaborated with OPS-OMS, PMA, ABT Bolivia, and Humanitarian OpenStreetMap, developing geospatial solutions and risk analysis. A researcher at UMSA and real-time translator for UN Volunteers Bolivia, had worked as a mentors in international programs with the U.S. Embassy.



Nury Gineth Infante González

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Has dedicated her academic and research career to the generation and transfer of knowledge on nature-based solutions (NBS) and bioremediation technologies as emergency responses to mitigate and adapt to emerging global challenges in sustainable water management. Her current line of work aligns with the European Commission's vision of a Water Smart Society, fostering leadership in the promotion of a new water culture. Additionally, she has contributed to the development of biotechnological applications for wastewater treatment, achieving improved water quality suitable for reuse in agricultural irrigation, industry, and urban services.



Jaime Lora Garcia

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Ph.D. in Industrial Engineering from the Universitat Politècnica de València (UPV Spain). Currently, he is a Professor of Chemical Engineering at UPV, with over 40 years of teaching experience. He has delivered more than 100 postgraduate courses and supervised over 50 master theses. His research focuses on membrane separation technology, with over 100 articles and 200 conference presentations. He has supervised 17 doctoral theses, holds 2 patents, and has participated in 40 funded projects and 50 industrial research and transfer contracts.

Liliana Cáceres Sánchez

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Biologist with a specialization in ecotoxicology and environmental health, currently pursuing a PhD in Biological Sciences at Hasselt University (Belgium), researching the effects of micro and nanoplastics on planarian regeneration. She holds a Master's degree in Science, Technology, and Health from the University of Tours (France) and has teaching and research experience at Bolivian universities. Her research experience includes studies on animal reproduction, behavior, and toxicity analysis in environmental settings. She has contributed to scientific knowledge through publications on male fertility, insect ecology, and air pollution. Her work aims to comprehensively understand the impact of pollution on both human and environmental health.



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Chemical Engineer with a master's degree in environmental engineering and a PhD in Chemical, Environmental, and Process Engineering from the University of Valencia, Spain. During her doctoral research, she specialized in wastewater treatment and resource recovery, focusing on electrochemical systems, particularly electrodialysis and bioelectrochemical cells for resource recovery from urban wastewater. Throughout her time at the university, she collaborated on several science communication projects. She has been a member of the International Water Association Young Water Professionals-Spain (IWA YWP-Spain) since 2019, actively participating in various national and international conferences. In the past year, she contributed to the organization of the 4th YWP Spain Conference in Bilbao-Spain, as part of the training area of the YWP Spain network. Currently, she works as a Project Technician at AINIA Technology Center, specializing in wastewater treatment and reuse.

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Full Professor and Director of the Javeriana Water Institute (Instituto Javeriano del Agua) at Pontificia Universidad Javeriana (PUJ). Civil Engineer and Specialist in Engineering Management Systems from PUJ; MSc and PhD in Urban Hydrology from INSA-Lyon, France. Member of the Water and Environmental Science and Engineering Research Group, professor in the Civil Engineering program, the Master's in Hydrosystems, and the Doctorate in Engineering at PUJ. Senior Researcher at MinCiencias, with over 70 scientific articles, 6 books, and 7 book chapters published.





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An environmental engineer who was granted with the Japanese Government Scholarship MEXT and for the last years she has been doing research in water treatment using ecological engineering. She has wide-range experience in teaching at different universities. She gained knowledge in resolution of environmental issues in international organizations and NGOs. Currently she is Chair of the Governing Members of the International Water Association (IWA-BOLIVIA) and Director of Graduate School of Chemical Engineering.

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He is a Professor of Environmental Technology in the Bachelor's Degree in Chemical Engineering and the Master's Degree in Environmental Engineering at the Universitat Politècnica de València (UPV). He is also the Director of the Environmental and Chemical Process Simulation Diploma (SiPAQ). He holds a Ph.D. in Chemical Sciences from UPV (1995) and has been a professor and researcher at UPV since 2000. He is a member of the Department of Chemical and Nuclear Engineering and the ISIRYM Research Institute. His research focuses on Water Treatment, Environmental Management, and Life Cycle Assessment. He has had academic stays abroad at Universidad Católica Boliviana San Pablo, Hamk University (Finland), and the Colorado School of Mines (USA). He was a member of the Board of Directors of the Escola Politècnica Superior d'Alcoy (EPSA-UPV) from 2007 to 2020 and served as an Advisor from 2015 to 2020.



Organizing Committee

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She is a biologist specialized in spatial analysis and monitoring, with a master's degree in Water Resource Surveying. With 24 years of professional experience and 22 years as an educator, she led the Environmental Engineering program at UCB from 2016 to 2024 and coordinated several environmental research projects. She is currently a faculty researcher at the Center for Research in Exact Sciences and Engineering (CICEI) at UCB. Additionally, she chaired the Organizing Committee of the International Congress on Integrated Water Management (CIGIA) in its first two editions.



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Social communicator from the Universidad Católica Boliviana "San Pablo" with work experience in NGOs focused on rural development. She currently works as a communications officer at the Center for Research in Exact Sciences and Engineering (CICEI), where she spearheads strategic communication initiatives and helps disseminate scientific research.



Editorial Board



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Keynote Speakers

Water is a source of energy

Presented by: Lluc Canals Casals and Beatriz Amante García

Historically, water has been used in countless energy applications: as a means of transportation via currents and canals, as a source of energy to power mills for grain grinding, and even to generate electricity by driving turbines. However, recently, significant research has been focused on separating the water molecule to produce hydrogen, the energy carrier expected to shape the future.

This presentation introduces the MESH project, which utilizes water from a wastewater effluent from the textile industry to recover hydrogen through an electrochemical treatment. It will also present the research conducted by the UPC through the Specific Hydrogen Center.



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The CIIDAR in Oruro (Bolivia): studying the behavior of the wastewater treatments at high altitudes.

The Centro Internacional de Investigación y Desarrollo en Aguas Residuales (CIIDAR) is a research and development center in Bolivia, designed to enhance the competitiveness of the sanitation sector, develop standards aligned with international guidelines, and improve social acceptance of wastewater treatment plants. Located at nearly 4,000 meters above sea level, it will feature nine treatment lines with varying capacities and include laboratories, classrooms, and a meteorological station. Currently under construction and expected to open in 2025, it is part of a larger program supported by the Spanish Cooperation Agency (AECID) and the European Union to improve water and sewage access in Bolivia's peri-urban areas.



Isabel

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Programa Bolivia WATCH
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Keynote Speakers



Andrés Torres

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Urban Hydrology and Sustainable Drainage: Towards Water Resilience

This presentation will showcase the research activities conducted over more than 20 years in the field of urban hydrology, in his role as a professor at the Pontificia Universidad Javeriana. A brief overview of his research experience in various topics related to urban hydrology will be provided, including water quality meteorology, rainwater harvesting, sediment management in runoff, and asset management in urban drainage systems. The connection between these topics and the development of Sustainable Drainage Systems (SuDS) will be highlighted, with a particular focus on their role as key multipurpose infrastructure for the efficient capture of rainwater. At the end of the presentation, his current research on SuDS in contexts of high uncertainty will be presented, with an emphasis on scenarios related to climate change, demographic shifts, and urbanization.



Juan José Salas

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“The challenges of strategic planning and governance of water resources in Bolivia: territorial planning, contribution to emission reduction, and risk management”.

Industrial Engineer with a PhD in Chemistry and Chemical Engineering, and extensive experience in water management since 2010. She has served as Director of the Environmental Engineering Department and Coordinator of Special Projects at UCB. She has led international projects in collaboration with organizations such as the UNDP, funded by institutions like the EU, Germany, and Sweden. Currently, she coordinates the Bolivia WATCH program, focused on managing watersheds and water resources with key stakeholders such as the Ministry of Environment and Water. She is also a co-author of the book on Bolivia's energy transition (2024).

HIDROGEODÍA – First Edition in Bolivia

In partnership with the International Association of Hydrogeologists – Spanish Group, the IWaST pre-conference event HIDROGEODÍA was held. This day was dedicated to scientific outreach, transforming science into an engaging experience. Together with experts, participants visited the Jacha Jahuira (La Paz) and San José de Chiquitos (Santa Cruz) watersheds, where topics related to water management and the importance of water sources were addressed. This international event was held for the first time in Bolivia.



Photo: UCB Santa Cruz, 2025



Photo: UCB Santa Cruz, 2025



Photo: UCB Santa Cruz, 2025



Hydrogeody in San José de Chiquitos. The Hidrogeodía 2025 in Santa Cruz, Bolivia, was carried out thanks to the initiative of the IHDR Research Group of the Civil Engineering Career of the Catholic University of Bolivia, with the collaboration of institutions and experts committed to sustainable water management in the region. }It began at the UCPN Santa Cruz la Vieja, where UCB Civil Engineering students, researchers, representatives of various organizations and volunteers actively participated in the exploration of water sources and analysis of aquifers through groundwater monitoring and piezometers.

Among the organizations present were the Autonomous Departmental Government of Santa Cruz, CREA, PRODECO Foundation and Probioma. We were also accompanied by the TCO Norte and Comayo indigenous communities, the Abayoy volunteer firefighters and local councilors.

This event reaffirms UCB's commitment to academic training, research and social responsibility, promoting learning spaces that have a positive impact on the community.



Photo: UCB Santa Cruz, 2025



Photo: UCB Santa Cruz, 2025

IWaST – Technological Innovations in the Water Sector

The International Water Association (IWA) Bolivia organized an exclusive series of webinars on technological innovations in the water sector. During these sessions, national and international experts shared innovative approaches, discussed current challenges, and explored opportunities to improve the sustainable management of water resources. This event provided an invaluable platform for knowledge exchange and advancing sustainable water management on a global scale.

IWA BOLIVIA
the international water association

IWaST
International Congress of
Water Sustainability
and Technology

EVENTO PRE-CONGRESO IWAST
WEBINARS
INNOVACIONES EN EL
SECTOR HÍDRICO
10 - 17 DE MARZO

LUNES 10 DE MARZO
NANOTECNOLOGÍA PARA EL TRATAMIENTO DE AGUAS

Ph.D. Allen Blanco
Tecnológico de Estudios Superiores de Tlanguistenco

Ph.D. Pabel Cervantes Avilés
Tecnológico de Monterrey

MARTES 11 DE MARZO
AGUA SUBTERRÁNEA PARA CIUDADES RESILIENTES

Ph.D. Ricardo Hirata
Universidad de São Paulo

MIÉRCOLES 12 DE MARZO
RETROCESO DE GLACIARES Y SEGURIDAD HÍDRICA

Ph.D. (c) Juan Pablo Fuchs Arce
Instituto de Hidráulica e Hidrología, UHSA y Universidad de Canterbury, Nueva Zelanda

Ph.D. Alvaro Soruco
Instituto de Investigaciones Geológicas y del Medio Ambiente, UHSA

LUNES 17 DE MARZO
SIEMBRA Y COSECHA DE AGUA

Ph.D. Sergio Martos Rosillo
Instituto Geológico y Minero de España

¡RESERVA TU LUGAR AHORA! ESCANEA EL CÓDIGO QR Y ASEGURA TU PARTICIPACIÓN.

CUPOS LIMITADOS
Costos:
Miembros IWA y/o Inscritos IWaST: Gratis
Profesionales: 70bs | Estudiantes: 30bs

IWaST 2025 Pre-Congress Fair

Guardians of Water: Young People Leading Change

On March 18, 2025, the Environmental Engineering career of the Universidad Católica Boliviana (UCB) organized the first IWaST 2025 Pre-Congress Fair under the theme “Guardians of Water: Young People Leading Change.” This event was held at UCB Cochabamba in commemoration of World Water Day. Its objective was to highlight the role of youth in the integral management of water resources by promoting their conservation and sustainable use through dynamic and educational activities.

More than 80 students and teachers from San Agustín, German Federico Froebel, American Institute, and Tiquipaya schools participated in this fair. The event was structured in three main sections: an interactive fair, a discussion, and a hands-on engagement workshop.



Pre-Congress Attendees



Special Guests – Fundación Abril

During the interactive fair, attendees visited ten stands organized by various institutions, where UCB students and alumni participated. Among them, Cervecería Nacional Boliviana explained the industrial processes involved in the reuse and purification of water; Agrecol Andes Foundation used models to explain the hydrological cycle; the Gaia Pacha Foundation encouraged student participation in a water contest and promoted scientific research from an early age; and the Abril Foundation presented informative materials on water management projects.



In addition, environmental engineering students set up four booths where they conducted hands-on experiments on the water cycle, the quality of water resources, and natural purification processes using both laboratory equipment and simple materials. Therefore, visitors were able to experience the world of environmental research firsthand. The Center for Research in Exact Sciences (CICEI) presented some of the many studies related to the care and protection of water carried out by the Center and the Environmental Engineering career.

Later, the representatives from each school poured water from their communities into a common container and shared what this resource means to them with the dynamic "Water is one". This was followed by a discussion, moderated by Gaia Pacha and the Scientific Society of Environmental Engineering, in which five young leaders shared their experiences and projects focused on water conservation. Finally, an express workshop was held in which the students came up with practical commitments to be implemented in their communities. These personal commitments were reflected in a collaborative mural. The event closed with an invitation to 'sow water', symbolically handing over a plant to the students to represent water care.



Volunteer Team



Special Guests – Fundación Gaia Pacha



Environmental Engineering Team UCB



Volunteer Team IWaST

Awards and Recognitions



The congress concluded with an award ceremony honoring outstanding presenters and posters. In the oral presentation category, the winners in the **five thematic areas** of the Congress were:

» Water Security

Lucia Alejandra Mercado Terrazas

» Water Pollution and "One Health"

Luisa María Almanza / Fidson Vesga

Nabor Moya

» Water Management and Treatment

Guillermo Díaz Martínez

» Water Sustainability and Life Cycle Assessment (LCA):

Mauricio Bernardo Claure Salinas

» Education and Water:

Lluc Canals Casals

» In the poster category, the winner was:

Carlos Ramos

» In the category for posters by young researchers, the winner was:

Ángela Cecilia Matienzo Flores

As a form of recognition for the best presentation, the winners of this edition were given the opportunity **to participate in the second edition of the congress.**

Water Governance in Bolivia

As part of the IWAST 2025 congress program, the roundtable discussion "Water Governance in Bolivia: Towards an Integrated and Participatory Management Model" was held on March 20, 2025. The event began promptly at 4:00 p.m. with opening remarks and a presentation of the event's objectives by the moderator, Dr. Paul d'Abzac, the head of the Center for Research in Exact Sciences and Engineering (CICEI) at the Bolivian Catholic University (UCB).

Next, Dr. Javier Prudencio, the National Administrator of Research, Development, and Innovation at the UCB, presented a diagnosis of the current state of water governance in Bolivia. He highlighted the structural challenges, regulatory weaknesses, and institutional weaknesses. He also discussed the country's recent efforts to strengthen water resource management.

This was followed by a guest panel where leading specialists addressed key questions related to:

- The challenges and regulatory gaps in water governance;
- the participation of communities, the private sector, and international actors;
- strategies to address climate change and urban growth.

The invited panelists were:

- Eng. Verónica Rodríguez, Water and Sanitation Specialist at UCP-PAAP and Vice Minister of Drinking Water and Basic Sanitation at the Ministry of Environment and Water;
- María Dolores Castello Francesch, Ph.D., Head of Water and Sanitation Programs at the Spanish Agency for International Cooperation and Development (AECID).
- Iván Antonio Irazoque Tobías: National President of the Bolivian Association of Sanitary and Environmental Engineering (ABIS).
- Cecilia Soto, Ph.D., president of the Bolivian section of the International Water Association (IWA Bolivia).
- Melina Balderrama Durán, Ph.D., is the national director of Bolivia WACH, an affiliate of the Stockholm Environment Institute (SEI).
- Alejandro Levy is the representative of Fundación Agua Tuya.

The open discussion allowed attendees to actively participate by asking questions and sharing comments with the panelists, generating a rich exchange of ideas and experiences. Dr. Paul d'Abzac, the moderator, promoted a fluid dialogue between the different participants.

Finally, a synthesis of the main points discussed was made, as well as preliminary agreements to explore future collaborative actions.

Conclusions of the event:

- 1. Shared Diagnosis:** It was agreed that Bolivia faces critical water governance challenges, including regulatory gaps, weak institutional coordination, and limited local stakeholder participation.
- 2. Need for Reforms:** Panelists stressed the importance of regulatory adjustments to strengthen integrated water resources management and improve intersectoral coordination mechanisms.
- 3. Inclusive Participation:** Ensuring equitable and sustainable access to water requires strengthening the participation of community, private sector, and international actors.
- 4. Adaptation to climate change:** Specific strategies to improve water security in the face of climate change were discussed, emphasizing the importance of integrating resilience approaches into public policies.
- 5. Commitment to Action:** The event concluded with a commitment to continue promoting spaces for dialogue and collaboration between the state, civil society, academia, and private entities. This will consolidate a multisectoral network that allows progress toward an integrated, participatory water management model in Bolivia.



Invited panelists-Roundtable

COMPENDIUM OF

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SECURITY

ABSTRACTS



Governance and institutional continuity: why continuity of ‘human agency’ is needed

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ABSTRACT

Sustainable Development Goal (SDG) 6, water and sanitation, in the climate change scenario, requires high efficiency in institutional and inter-institutional management at different levels (international, national, regional and local).

However, it is observed that the potential capacities of institutions to invest in urban water systems (supply, sanitation, storm drainage) are delayed or not even implemented, missing opportunities to improve water services. This is partly due to technological issues, but also to governance issues: inefficiencies in the institutions' own management.

This paper addresses, from a systemic methodological perspective, the role of water management institutions. It argues that these ‘institutional complexes’ include both individual agents (persons), collective agents (teams) and all the material elements necessary for management. However, the institutions themselves sometimes seem to ignore the value of the continuity of ‘human agency’ by not taking into account the dynamics (spatial and temporal) of the individual and collective agents that generate, maintain and renew the immaterial culture (epistemological, methodological, axiological and ethical) of the institution.

It analyses the problem of discontinuity (or rupture of the institutional continuum) on governance and its negative impact on institutional management.

It shows how care for ‘institutional human agency’ can guarantee institutional continuity, the resilience of the institutional complex and improve the efficiency of management itself, as an authentic institutional function.

Keywords: governance, urban water systems, institutional discontinuity

Implementation of a strategic Water Balance Model (WEAP) for Water Resources Planning: Case study of the Lake Poopó Basin, Oruro - Bolivia

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ABSTRACT

Lake Poopó represents an essential part of the water resources in the southeastern region of the Andean in Bolivia, part of the TDPS (Water System of Titicaca, Desaguadero, Poopó and Coipasa Salt Flat), and undoubtedly this is one of the many lakes affected by Global Warming. On the other hand, Hydrological models help in the analysis of the effects of climate change in the time and on the water balance, since with the information provided it is possible to determine strategies for water resource management both now and in the future. “Hydrological studies” are a primary requirement for the formulation and development of sustainable projects to understand the possible variation of water resources and its availability. Therefore, the strategic implementation of a water balance model is essential for proper planning of water resources in a region with high levels of water stress, as is the case of the Lake Poopó basin.

The present study shows the implementation of a water balance model based on the application of various tools, using the Water Evaluation and Planning System (WEAP) model. The main results of the monthly hydrological modeling of a mountain basin located in the southwestern region of Bolivia, which is very important for the development of the region and the preservation of the environment in the region and in the basin as such. The modeling included the use of a semi-distributed code, Water Evaluation And Planning System Model, and the analysis of (a) the simulation quality of the observed flows; and (b) the congruence of the hydrological simulation of each of the existing land covers in the study area.

Keywords: Lake Poopó, Hydrological modeling, Water balance, Water resources planning, climate change, WEAP, TDPS Water System, Google Earth Engine.

Mapping and analysis of flooded areas using Sentinel S1A IW-GRDH satellite imagery in the minor lake of Titicaca, Bolivia and Perú

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ABSTRACT

Lake Titicaca, whose water resources are essential to ensure water and food security in the area, is the most affected region as a result of climate change and seasonal variations in the hydrological cycle. Given that every year the water mirror undergoes changes, due to the growth or decrease of saturated or flooded areas, especially in this region of Titicaca, a methodology is proposed that allows the mapping of the behavior of flooded areas, the time it takes to reduce these areas and their monitoring based on the analysis of Sentinel S1A IW-GRDH satellite images, under the SNAP software platform.

These satellite images are freely available and are reported every 7 days according to their temporal resolution, however, a sequence must be followed in order to make corrections and adjustments in SNAP, starting with atmospheric corrections, re-sampling, applying a filter and reducing noise, then applying an interpolation method, followed by cropping of the study area (Sentinel scenes cover a fairly large space).

For the mapping of the flooded areas, the threshold value is determined in logarithmic scale, in order to verify the values of the spectrum corresponding to the flooded areas by creating a Boolean model, thus generating a mask that can be displayed in Google Earth Pro and compared with past events to determine the growth (flooded areas) or decrease (dry areas). Everything generated can be validated by drawing line transects that capture a significant sample in relation to the area covered by the Sentinel satellite image. Finally, this methodology can be replicated in different areas of the country, especially those that suffer permanent flooding in the Bolivian Amazon.

Keywords: Lake Titicaca, Sentinel S1A satellite image, SNAP, water bodies, flooded areas, water security.

Environmental university network focused on water security case study EMI La Paz

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ABSTRACT

The issue of water security is today a global concern of great importance, since it is essential to guarantee sustainable development. In order to strengthen water security in universities by generating environmental awareness, a case study is presented within the Military School of Engineering institution (EMI) and the creation of the Environmental University Network (RUA). Its main objective is to implement different strategies focused on networking, workshops, conferences and new sustainable technologies for the efficient management of water and the promotion of the rational use of the resource and technological innovation. A survey showed the principal needs that RUA would help to improve. Strategies were established not only to optimize water management in university environments, but also generate replicable models in other institutions. This university model of water security is presented as an adaptable and scalable proposal, contributing to the fulfillment of the Sustainable Development Goals (SDG) and serving as a reference for other universities in the region.

Keywords: networking, water security, university education

Identification of Groundwater Recharge Zones Using the EARLI Model: Katari Basin, Bolivia

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ABSTRACT

Groundwater recharge zone identification is a critical step toward sustainable water resource management, particularly in arid and semi-arid regions like Bolivia, where aquifers supply most of the water for domestic and agricultural use. The lack of comprehensive hydrogeological data, a common challenge in developing countries, severely limits effective groundwater management. This research addresses this gap by applying the Enhanced Algorithm for Recharge based on Land-cover and Precipitation (EARLI) model, a simplified yet robust tool designed to identify groundwater recharge zones using six weighted variables in raster format.

A core innovation of this study is the integration of an iterative adjustment methodology for precipitation mapping focused on hydrological units, combining the CHIRPS satellite precipitation product with localized rain gauge data from SENAMHI. This approach ensures high-resolution spatial accuracy, overcoming limitations associated with traditional data sources. The methodology was implemented in the Katari Basin and Minor Lake of Titicaca, a region of critical importance for water security in Bolivia.

Results revealed spatially explicit potential groundwater recharge zones, which align strongly with those identified using conventional methods. The iterative precipitation adjustment methodology not only enhances the reliability of the EARLI model but also demonstrates its scalability for application in other data-scarce regions. These findings highlight the model's potential to become a national tool for groundwater recharge management in Bolivia.

This research underscores the importance of integrating innovative methodologies in groundwater studies to bridge data gaps, promote sustainable resource use, and inform policy decisions in regions facing increasing water scarcity.

Keywords: Groundwater recharge, EARLI model, combined precipitation, satellite-based products, Katari Basin, groundwater management

From Water Security to Food Security: Socio-Environmental Challenges of Aggregate Mining in Communities of the Bolivian Altiplano

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ABSTRACT

This study examines the socio-environmental impacts of aggregate extraction on water and food security in Catacora, a rural community in the Bolivian Altiplano. Using an interdisciplinary mixed-methods approach, we conducted 20 semi-structured interviews, a gender-specific focus groups, and field campaigns measuring water pollution, and focused on arsenic and iron concentrations in river sediments. Analytical results revealed arsenic levels of up to 48 mg/kg and iron concentrations exceeding 61,000 mg/kg in the Khullu Cachi River, surpassing international contamination thresholds by more than double. These results are in line with monitoring campaigns conducted by Water related institutions. Community interviews highlighted declines in water availability and quality, with traditional irrigation systems rendered non-functional due to riverbed excavation lowering water levels by 6 meters. These changes have disrupted agricultural productivity and heightened food insecurity, particularly affecting staple crops such as potatoes and beans. Women in the community reported increased burdens in water collection and noted their exclusion from decision-making processes, reflecting systemic gender inequities. Although local adaptations, including rainwater harvesting and communal water management, are in place, they remain insufficient against the scale of the challenges. This study emphasizes the urgent need to strengthen community governance and resilience to mitigate the socio-environmental impacts of aggregate extraction, contributing to the understanding of the intersection between water pollution, food security, and rural livelihoods in Andean regions.

Keywords: Water pollution, aggregate mining, food security, water governance, gender equity, Andean region

Adapting Water-Sensitive Approach in Cliza, Bolivia Urban Potential for Water Harvesting and Infiltration

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ABSTRACT

In recent years, the municipality of Cliza in Cochabamba, Bolivia, has faced critical challenges in managing water resources, particularly during the dry season. Unsustainable practices, such as excessive drilling of wells for human consumption and irrigation, have led to groundwater depletion and a decline in water availability. These issues are compounded by unplanned urban expansion, irregular rainfall patterns, and the effects of climate change.

This research evaluates the potential of Water Sensitive Urban Design (WSUD) technologies in Cliza to enhance rainwater harvesting and infiltration. A Conceptual Design compares three scenarios: the current state, interventions in public areas, and interventions in both public and private areas. Additionally, WSUD feasibility is assessed within the local urban planning framework. Successful practices and guidelines are compiled into a "WaterGuide" to facilitate the adoption of WSUD in Cliza.

The results highlight the capacity of WSUD strategies to improve urban soil permeability, optimize rainwater use, and promote sustainable planning. Implementing these strategies could enhance water resilience by integrating innovative technologies into Cliza's urban framework. Moreover, this approach supports collaboration across disciplines and governance levels, strengthening institutional capacity and aligning solutions with local conditions. Despite constraints such as limited data availability and the inability to conduct site visits, the findings demonstrate that WSUD can address critical water challenges in Cliza, offering a pathway toward sustainable urban development and water conservation.

Keywords: Water Sensitive Urban Design, Rainwater Harvesting, Urban Resilience

Agricultural Drought in the Bolivian Altiplano: A Systematic Review of Monitoring Methods in Data-Limited Contexts

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ABSTRACT

The Bolivian Altiplano, a region deeply impacted by the intensification of climate change, faces an increasing frequency and severity of droughts, jeopardizing family farming, the main economic livelihood of rural communities. These dynamics exacerbate food insecurity and create socioeconomic vulnerabilities in an already challenging environment. This study addresses the critical challenge of generating actionable, high-resolution information on agricultural droughts in contexts with limited data availability. Employing a comprehensive systematic review guided by the PRISMA protocol, we evaluate approaches for drought monitoring that leverage diverse and complementary data sources to overcome the limitations posed by scarce in situ weather information, focusing on contexts analogous to Bolivia. The results reveal the effectiveness of integrating remote sensing methodologies with advanced interpolation models and machine learning to capture the spatiotemporal variability of droughts. Additionally, the study highlights the potential of incorporating multidimensional indices that combine climatic, hydrological, and vegetation data with high resolution land cover datasets, like MapBiomass Water, to analyze water body dynamics and land changes. This approach not only facilitates the assessment of long-term trends but also identifies critical areas for adaptive interventions. Finally, the study underscores the need to integrate socio-ecological approaches and local data to design adaptation strategies aimed at enhancing agricultural resilience to climate change. The proposed recommendations include using combined models to predict the impact of droughts on agricultural production and water security, as well as developing accessible tools for decision-making in rural communities.

Keywords: Agricultural drought monitoring, data-scarce context, remote sensing, machine learning, Bolivian Altiplano.

Monitoring flow conditions in the intermittent stream networks of the upper Río Chico basin, Chuquisaca, Potosí, Bolivia

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ABSTRACT

Intermittent rivers refer to waterways presenting frequent periods of flow cessation, leading to the formation of disconnected pools or to the complete drying of riverbeds. Every river networks comprise intermittent rivers, which make up over half of global river length. Moreover, they tend to increase in space and time due to climate change, water use, and other human activities. This study monitored the temporal and spatial flow conditions (flowing, isolated pools, or dry) at 22 sites in the Upper Río Chico Basin, Chuquisaca, Potosí from 2021 to 2023, using various methods, including visual observations, water level loggers installed at three sites in the basin, photo-traps at two intermittent sites, and the DRYRIVERS app. Our results show that dry months ranged from 0 to 8 in 2021–2022, with October being the driest, and from 0 to 11 in 2023, with October and November being the driest. First-order headwater streams were the driest compared to downstream, second, third and fourth order rivers. Interannual flow variability indicated that 2021 had the lowest basin-wide intermittence (28% of sites were completely dry or retained disconnected pools), while 2023 showed the highest intermittence (up to 40%), attributed principally to the El Niño phenomenon that year. These findings are crucial, as intermittent rivers contribute to ecological integrity, river functioning, and the provision of goods and services, such as the supply of drinking water to Sucre City. Therefore, conserving these ecosystems and their biodiversity is vital for addressing climate change.

Keywords: river drying, climate change, non-perennial rivers, Río Chico, Bolivia.

COMPENDIUM OF

WATER POLLUTION **AND ONE HEALTH**

ABSTRACTS

Macroinvertebrate-based multimetric predictive models for evaluating the human impact on biotic condition of Bolivian streams

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ABSTRACT

We developed and validated a single multimetric index, based on predictive models, that could evaluate anthropogenic disturbances in streams of three disparate ecoregions of Bolivia. To do so, we examined 45 candidate metrics reflecting different aspects of macroinvertebrate assemblage structure and function gleaned from available literature and for their potential to indicate degradation. More importantly, we integrated functional trait metrics to improve the sensitivity of our index. To quantify possible deviation from reference conditions, we first established and validated statistical models describing metric responses to natural environmental differences in the absence of any significant anthropogenic disturbance. We considered that the residual distributions of these models described the response range of each metric, independently of natural environmental influence. After testing the sensitivity of these residuals to a gradient of anthropogenic disturbance, we retained 8 metrics that were used in the final assemblage index, four metrics based on richness and composition and four metrics based on biological traits. Our index performed well in discriminating between reference and disturbed sites, giving a significant negative linear response to a gradient of physical and chemical anthropogenic disturbances. After employing a probability survey design and sampling a relatively small number of sites throughout all major ecoregions of Bolivia, we believe our methodology can be used to develop a monitoring tool to evaluate status and trends in biological condition for streams of the entire country despite its complex and heterogeneous geology and climate.

Keywords: Multimetric index, macroinvertebrates, biological traits, anthropogenic disturbances, Neotropical streams

Current situation of groundwater contamination in the municipality of Santa Cruz de la Sierra

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ABSTRACT

The City of Santa Cruz in recent years has grown exponentially both in population and in urban expansion, consolidating itself as the city in Bolivia with the largest number of inhabitants. The population is supplied with groundwater through wells, and managed by cooperatives that are responsible for supplying drinking water and sanitary sewerage. Studies have been carried out on the quality of the water consumed and the results showed contamination of chloride, nitrates and coliform, and one of the most up-to-date studies shows that this contamination situation has not changed.

One of the most relevant studies showed that there are three types of groundwater circulation: local, regional and adjacent to Pirai River. This data can be related to the depths of the wells, as well as the contamination of the wells. There can be many causes of water pollution, among which we can note the disorderly settlement of the population without taking into account the infiltration capacity of the soil, the lack of sanitary sewerage in areas where there is consolidation, and the incorrect construction of cesspools, to this we can add the lack of control and supervision of the institutions that by competence are obliged to ensure water security.

Santa Cruz is a city that does not stop growing and this is accompanied by the provision of basic services, that is, it is a critical point to make a decision to start with the work of eliminating the contamination of groundwater, the hidden gold of this thriving city.

Keywords: contamination, groundwater, urban expansion

Plant-Based Solutions from Urban Parks as a Strategy for Intelligent Adaptation Systems to Address Sanitation and Water Scarcity in Catalonia

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ABSTRACT

The persistent drought affecting Catalonia over the past three years has significantly reduced surface and groundwater availability, with direct consequences for productive sectors, ecosystem services, and an increased risk of cascading climate-related disasters impacting food, energy, urban, and environmental systems. This study aims to address these challenges by evaluating the antibacterial and coagulant properties of crude seed extracts from plant species in Parc Sant Jordi, Terrassa, Catalonia, for potential biotechnological applications in sustainable water management, aligning with the European Union's "Water Smart Society" vision. The research unfolds in three phases: first, the physicochemical and microbiological characterization of water quality from five representative urban parks in Catalonia, monitored across four climatic seasons. Second, the identification and evaluation of plant species for their coagulation-flocculation and antimicrobial properties, supported by a municipal database from Terrassa. Third, the investigation of plants-based coagulant and their integration into sustainable water management practices. 44 plant species were studied in Parc Sant Jordi, aqueous seed extracts from 14 species demonstrated significant coagulant and antimicrobial activities, effectively targeting waterborne pathogenic bacteria, including antibiotic-resistant strains such as *Escherichia coli* and *Staphylococcus aureus*. These findings highlight the potential of urban park and their vegetation for biotechnological applications in water purification, offering sustainable and scalable solutions for regions facing water scarcity. This work underscores the critical role of urban biodiversity in addressing global water challenges while promoting ecosystem resilience and resource sustainability.

Keywords: water scarcity; sustainable water management; plant-based coagulant; antibacterial properties; water smart society

Microplastics and Nanoplastics in Drinking Water: A Bibliometric Review

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ABSTRACT

Microplastics and nanoplastics are emerging and complex topics linked to significant challenges and potential impacts on human health, the environment, analytical and treatment standardization, and legislation. Drinking water, encompassing both tap and bottled water, has been identified as a potential source of contamination. Bibliometric analysis serves as a valuable tool for mapping the scientific landscape and identifying research trends. The objective of this study is to analyze the scientific production on microplastics, nanoplastics, and drinking water, providing insights into research trends and identifying gaps in the literature. Using the Web of Science database, 637 articles published in English between 2017 and 2024 were identified. Preliminary results indicate that 452 (71.1%) of the publications were produced between 2022 and 2024, reflecting the topic's growing relevance. China (38.1%), the United States/Canada (19.9%), and Germany (6.3%) lead in research output. Main research areas include Environmental Sciences/Ecology 422 (66.2%) and Engineering 205 (32.1%), with smaller contributions from Toxicology 38 (5.9%) and Public/Environmental/Occupational Health 29 (4.5%). Content analysis revealed 129 (20.3%) articles focused on toxicological research, 181 (28.4%) investigated occurrence, and 107 (16.8%) addressed specific locations. Additionally, 30 (4.7%) studies focused on tap water, 36 (5.7%) on bottled water, 75 (11.8%) included water sources, and 72 (11.3%) examined water treatment plants. Most studies 372 (58.3%) addressed treatment or analysis techniques. This research enhances understanding of the academic landscape, identifies knowledge gaps, and highlights the need for further investigations to inform water quality and public health strategies.

Keywords: microplastics; nanoplastics; drinking water; bibliometrics; water treatment; toxicology.

Parasitosis secondary to the water problem in the city of El Alto, La Paz-Bolivia, 2023***Carrasco Chambi M. B.****Universidad Privada del Valle, Bolivia, ORCID: 0009-0009-9629-0455.*

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ABSTRACT

The presence of parasitosis in Bolivia is due to several factors, such as the distribution of water and where the analyzed population resides; the most affected are children and older adults who may have an additional factor in their mortality. This is a systematized review of 2023; the data collection obtained was from medical and non-medical journals, in addition to population data centers such as the National Institute of Statistics (INE) and the Public University of El Alto. Of the 910 376 people in El Alto, 4 5% do not have access to home drinking water, of which 50,4 % are male; 71 % contracted some intestinal parasitosis in the last year; 63% of this population prefers to self-medicate and only 52% choose to go to a health center. Many people who live in remote places, such as in rural areas, may have more parasites, associated with lack of access to water and low-income people, where they may consume contaminated water; in this way, it is vital to generate national programs focused on adequate management and access to water.

Keywords: Intestinal parasitosis, poverty, sanitation, urban area, water pollution

Toxic effects of microplastic-like particles present in the Rocha River on planarians

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ABSTRACT

The presence of microplastics in surface water bodies has generated interest in their impacts on aquatic organisms. The Rocha River, which flows through the metropolitan axis of Cochabamba (Bolivia), has been identified as containing microplastic-like (MP-like) particles in its water and sediments. This study aimed to evaluate the toxic effects of these MP-like particles on local planarians (*Girardia* sp.), used as bioindicators. Quantification of MP-like particles in the Rocha River revealed concentrations ranging from 2,500 to 25,000 particles/L. Toxicological bioassays were conducted by exposing planarians to two concentrations: the baseline environmental level and a simulated high-exposure level ten times greater, representing low-flow conditions. The planarians exposed to MP-like particles exhibited progressive epithelial damage and particle accumulation in their tissues. Furthermore, the impact on regenerative capacity was assessed. Exposed planarians showed a significant delay in blastema growth compared to the control group. This effect is hypothesized to result from oxidative stress and disruption of cellular processes essential for regeneration, both induced by microplastic exposure. These findings highlight the potential ecological risks associated with microplastic contamination in aquatic ecosystems and underscore the need for further research to understand their long-term effects on biodiversity and ecosystem health.

Keywords: Microplastic-like particles; Planarians; Toxicological tests; Regeneration

Evaluation of the adsorption capacity of microplastic-biofilm complexes to the main metals present in the Rocha River in Cochabamba-Bolivia

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ABSTRACT

Microplastics (MPs) are plastic particles smaller than 5 mm, that can be vectors of other pollutants in aquatic ecosystems adsorbing molecules such as heavy metals and microorganisms. The Rocha River in Cochabamba, Bolivia, is highly contaminated with MPs and heavy metals like lead (Pb) and zinc (Zn). The aim of this work was to evaluate the adsorption capacity of polyethylene terephthalate (PET) microplastics associated with native biofilms from the river. Water samples were collected from two points of the river (Abra and Aeropuerto) to form the MPs-biofilm complexes (C1 and C2, respectively). First, 18 bacterial strains were isolated, of which Gram-negative bacteria predominate, identifying 12 pathogenic genera such as *Escherichia coli*, *Shigella* sp. and *Acinetobacter calcoaceticus*. Adsorption experiments were performed at concentrations of 2.5 ppm for Pb and Zn with PET particles from 300 to 600 μm . The results show that the C2 complex presents higher Pb adsorption capacity ($q = 0.0838 \text{ mg/g}$) compared to C1 ($q = 0.0291 \text{ mg/g}$) and PET without biofilm. Statistical analysis using t-test and Kruskal-Wallis confirmed significant differences in adsorption capacity between complexes and PET. Zn adsorption was similar in both complexes. The adsorption kinetic analysis showed that the pseudo-second-order model provided the best fit for lead ($R^2 = 0.98$) and zinc ($R^2 = 0.92$), while the Elovich model indicated higher initial adsorption rates for C2, and the intraparticle diffusion model suggested diffusion limitations, especially for lead. The results indicate that the biofilm present in MPs could allow a greater adsorption of metals such as Pb and Zn, raising the feasibility of future research as adsorption experiments in microplastic-biofilm complexes.

Keywords: PET, microplastics, biofilms, adsorption, metals, Rocha River

Women and water: Impact of the Microbiological Quality of Water on the Health of Women in Barbacoas, Nariño, Colombia

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ABSTRACT

Rural women have developed strong connections with water because traditional gender roles have predetermined that they are responsible for domestic and community activities related to water management. However, when water sources are affected by pollutants coming mostly from mining activities, women become exposed to waterborne diseases, a situation primarily observed in rural areas where access to basic sanitation systems and drinking water is limited. Therefore, thinking about one health must go beyond the relationship between water, human and ecosystems health and highlighted the different impacts that polluted water might have based on gender differences.

For this reason, this project aims to identify the impacts of water's microbiological quality on the health of women in the municipality of Barbacoas, located in the department of Nariño, Colombia. This will be carried out through three phases: characterizing daily activities related to water, conducting a microbiological analysis of the water quality in Barbacoas, and assessing women's health in relation to waterborne diseases.

Based on the current state of the water management and distribution system, the microbiological quality of water is unsuitable for consumption, directly affecting mostly women's health, reducing their capacity to participate in economic activities, and also the health of ecosystems, which have also been impacted by mining activities. Therefore, it is necessary to strengthen local water management systems to improve water quality and reduce women's exposure to contaminated resources. Additionally, diagnosing waterborne diseases will help establish specific pathways for women to access effective treatments.

Keywords: Microbiological quality, women's health, waterborne diseases, gender roles.

COMPENDIUM OF

WATER MANAGEMENT **AND TREATMENT**

ABSTRACTS

The CIIDAR in Oruro (Bolivia): studying the behavior of the wastewater treatments at high altitudes

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ABSTRACT

The Centro Internacional de Investigación y Desarrollo en Aguas Residuales (CIIDAR) was designed with the objectives of: increasing the competitiveness of the sanitation sector in Bolivia; developing sanitation standards and policies in line with international standards; and improving the social acceptance of wastewater treatment plants by undertaking research projects and providing practical training for technicians and operators. It is the first center of its kind located at an altitude of nearly 4,000m above sea level. Its design prioritizes: the implementation of a wide range of technologies based on the "Guía Técnica para la Selección y Diseño de Líneas de Tratamiento de Aguas Residuales" (MMAyA/Bolivia, 2021); providing operational flexibility for the different treatment lines; the inclusion of various sludge treatment methods; and the reuse of treated water and excess sludge for agricultural purposes. The CIIDAR will include nine treatment lines: Stabilization Ponds, Wetlands, Upflow Anaerobic Filters, Upflow Anaerobic Reactors, Vermifilters, Trickling Filters, Rotating Biological Contactors, and Extended Aeration, with treatment capacities ranging from 10 to 60 m³/day. It will also include laboratories, training classrooms, offices, and a meteorological station. Currently, it is under construction and expected to become operational in 2025. The aim of this ambitious project is to establish the CIIDAR as a global reference center for wastewater treatment at high altitudes. This initiative is part of a bigger program founded and executed by the Spanish Cooperation Agency (AECID) and the European Union, in collaboration with MMAyA, to improve access to water and sewage systems in peri-urban areas of Bolivia.

Keywords: wastewater treatment; research and development; altitude

Constructed Wetland Ecomodel as Nature based Solution for a Japanese Garden in La Paz city, Bolivia

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ABSTRACT

The Japanese Garden in La Paz city receives domestic wastewater to fill its lagoon. Organic contamination has increased and must be treated with alternatives that do not alter its natural balance. Wetlands are multifunctional systems performing as nature-based solutions (NBS) that reduce organic pollutants by different physical, chemical, and biological processes developed between vegetation, soil/growth substrate, and water. This study characterized the current state of pollution in the lagoon to determine its trophic state. During the dry season, maximum values of pH = 9 were observed. Other parameters did not exceed the permissible limit in Bolivian Law. Phosphate concentration during the dry season were 1 mg/l and COD between 59-116 mg/l. According to the data, in dry season and wet season, a mesotrophic trophic state was established. To establish the potential macrophyte plants an identification of species was carried out by comparing specimens from the collection of the National Herbarium of Bolivia (LPB) and ornamental plants publications. From this study 142 species were identified and three different macrophyte species: *Cyperus involucratus*, *Azolla filiculoides* and *Eichhornia* sp. *Cyperus involucratus* was selected due to its availability for the wetland. The design suggests horizontal subsurface for a flow rate of 0.86 m³ /day, retention time of 2 days and a surface area of 7.25 m². The artificial wetland was presented to the Japanese Society of La Paz taking into account Japanese architecture and socio-environmental characteristics to become an ecomodel for other urban areas.

Keywords: wetland, NBS, organic contaminants

Adaptive Management of SuDS in the Face of Climate Change: Lessons from a University Campus

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ABSTRACT

Accelerated urbanization and climate change, coupled with climate variability, have intensified extreme rainfall events and prolonged dry periods, significantly impacting water availability for various urban uses and threatening urban ecosystems. This study proposes strategies to enhance the environmental management of the Sustainable Urban Drainage System (SuDS) on the campus of Pontificia Universidad Javeriana in Bogotá. The approach integrates analyses of future climate and campus development scenarios to anticipate impacts on SuDS functionality, infrastructure, and vegetation.

The research focuses on the Constructed Wetland/Regulating Tank System (HCTR) located on campus, utilizing historical daily precipitation data from the San Luis 1 and 2 pluviographic stations managed by Bogotá's Water Utility, located near the study site. Through hydrological balances, the system was characterized based on its functionality, with an emphasis on evaluating irrigation needs for adjacent green areas. Analyses based on climate change projections were conducted to estimate the threats posed by extreme climate events and their variability on the plant species used in the system.

Key action lines were identified regarding the adaptation of irrigation schemes, selection of more resilient plant species, and improvements in system management to address extreme climate events. The project results will strengthen strategic, informed decision-making aimed at enhancing campus environmental sustainability within a context of climate change and variability.

Keywords: climate change, sustainable urban drainage systems (SuDS), environmental management, green infrastructure, university campus, extreme weather events.

Assessment of the vulnerability of water resources to climate change in the Cirminuelas Sub-central, prioritising adaptation and mitigation measures

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ABSTRACT

Knowing the level of vulnerability of each region in different climate change scenarios is very necessary to analyze risks and seek possible solutions; and this is achieved with the characterization of indicators such as threat, sensitivity and adaptive capacity. In the case of water resources, scarcity or drought, floods, heat waves and frost are identified. In the Municipality of Tarija, within the framework of the European Union's LAIF program -AFD-CAF- a technical analysis was carried out, agreed upon by key actors, which serves as a reference for further analysis in regions of interest. For the CReA project, the Subproject 2 Contribution to Integrated Water Management and in the study area in Tarija: Cirminuelas Sub-central. It's essential to have this sectorized information, even more so when the communities that belong to this region have been identified as vulnerable communities in social, economic and environmental aspects by the other Subprojects. Therefore, this study aims to generate information on the current situation of water resources and identify the main vulnerabilities to climate change that they face, to propose comprehensive, multidisciplinary and transdisciplinary solutions. The methodology used for the vulnerability analysis, a quantitative approach has been used, including climate models and scenarios, cartography and geographic information systems, as well as socio-geographic approaches, with consultations with the community through key stakeholders. The results indicate that the communities of the Cirminuelas are at high risk, especially from frost and forest fires, with high sensitivity and adaptive capacity; finally, an average risk rate that may increase in the medium and long term if adaptation measures are not implemented.

Keywords: vulnerability, risks, climate change, climate change, water resources, adaptation measures.

Contribution of centuries-old Ancestral Hydraulic Techniques (AHT) to 21st century Sustainable Urban Drainage Systems (SUDS) techniques

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ABSTRACT

Research on Pre-Inca and Inca Ancestral Hydraulic Techniques (AHTs) has revealed beyond doubt that they are highly eco-efficient and sustainable. Over the centuries, they have demonstrated their ability to solve problems related to water management, agriculture, geotechnics and hydraulics, ensuring the long-term viability of traditional livelihood patterns and practices.

The most notable Pre-Inca and Inca AHTs combine hydraulic processes in a masterful way, such as: the infiltration of rainwater (amunas and andenes); the retention of rainwater (represas altoandinas) and phreatic water (cochas); the collection of groundwater (puquios); and the flows between the unsaturated zone and the phreatic (waru waru), including with rainwater and river waters (suka kollu).

It is a fact that AHTs have emerged as a response to ancient human adaptation to natural and rural environments. On the other hand, it is a reality that the techniques of Sustainable Urban Drainage Systems (tSUDS) have done so, in recent decades, in urban environments, even highly urbanized ones.

It is observed that Ancestral Hydraulic Techniques, which have been subjected to rigorous tests in the 'laboratory' of rural areas, can be fruitful for generating new designs, optimizing processes and guaranteeing the long-term maintenance of equivalent families of SUDS techniques.

The communication presented explores and confidently presents some of the possibilities that the AHT experience offers to the challenge of techniques for the sustainability of urban drainage and, more generally, to the water-sensitive urban development model. This is of particular relevance for urban areas expanding on pre-existing rural territories, as is currently the case in Bolivia.

Keywords: Ancestral Hydraulic Techniques (AHTs), Pre-Inca and Inca, Sustainable Urban Drainage Systems (SUDS)

Determination of cytotoxic activity of treated potable and wastewater in lettuce seeds (*Lactuca sativa*)

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ABSTRACT

This research aimed to evaluate the cytotoxicity of four water sources: purified water, drinking water from La Paz and El Alto, and water from the Choqueyapu River on the germination and growth of seeds from two lettuce varieties *Lactuca sativa* and *Batavia*. The study sought to determine their impact on seed viability and plant development identifying potential contaminants or environmental risks associated with water quality. Using bioassays with progressive dilutions in duplicate (12.5%, 25%, 50%, and 100%), pH measurement, and hardness determination, the effects of water on germination and hypocotyl and radicle elongation were analyzed. Results indicated that purified water promoted optimal development, while urban and river water sources showed cytotoxic effects, attributed to heavy metals and high hardness levels. River water exhibited a dose-dependent response, stimulating growth at low concentrations and displaying toxicity at higher concentrations. Lettuce seeds proved to be sensitive bioindicators. It was concluded that contaminated water sources negatively impact agricultural development. The results demonstrated the need to improve water source management and treatment in urban and suburban areas, emphasizing the risks of toxic substance accumulation in crops and their impact on public health. For optimal results, tests such as chloride and nitrate determination, other physicochemical analyses, and microbiological and morphological assays should be conducted.

Keywords: Water pollution, *Lactuca sativa*, cytotoxicity, germination, bioindicator, hardness

Ripples of reciprocity: Navigating trust and collective governance in hydrosocial territories

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ABSTRACT

This study examines the role of trust and reciprocity in the effectiveness of collective governance systems in hydrosocial territories, focusing on water associations managed by indigenous Aymara communities in the Bolivian Altiplano. Using path analysis and experimental economics, we measure the interplay between trust and reciprocity and cooperative behavior among 100 Aymara community members. Our results suggest that while trust is a critical factor in fostering cooperation, reciprocity is equally important in supporting the cooperation needed to establish effective collective governance in hydrosocial territories. We find that reciprocity is particularly low in the associations studied. Our results show that the initial acts of trust were not reciprocated, making cooperation within the governance system more difficult. Although communities exhibited prosocial behavior, this lack of reciprocity compromised trust between members of different communities, leading to ineffective functioning of collective governance of water resources. More generally, our findings highlight the vulnerability of collective governance in hydrosocial territories when collaboration relies heavily on negative reciprocal paradigms and is increasingly dependent on extrinsic motivations. To address the internal causes of ineffective collective governance, a nuanced exploration of ways to foster intrinsic motivation and positive reciprocal interactions is needed and seems to require joint efforts of communities and political actors.

Keywords: Bolivia, Collective governance, Hydrosocial, Reciprocity, Trust, Water

Fruit waste: Source of natural coagulants for surface water treatment as an alternative to inorganic chemicals

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ABSTRACT

The provision of adequate clean water to communities is a problem throughout the world, particularly in areas where populations rely on surface water from rivers, dams, and streams for domestic use, which may contain pathogen microorganisms or other organic and inorganic contaminants. As a result, water from most surface water sources must be treated to meet drinking water standards. Coagulation-flocculation is one of the processes that is widely used in drinking water treatment plants, using large quantities of inorganic coagulants and flocculants that cause environmental problems and adverse effects on human health. On the other hand, fruit waste, which is estimated to be more than 50% of the fruit produced, is a very serious problem with social, economic and environmental implications.

A viable alternative to solve these problems is the use of natural coagulants obtained from fruit waste which are safe for human health, non-polluting and biodegradable in comparison to synthetic chemicals. In this work, natural coagulants obtained from the nopal (*Opuntia ficus-indica*), banana (*Musa paradisiaca*) and papaya (*Carica papaya*) are evaluated using jar tests for surface synthetic water treatment, compared with the aluminum sulfate, obtaining efficiencies of removal of turbidity and total suspended solids above 90%. An analysis FTIR of the natural coagulants shows the functional groups present that explain the coagulation and flocculation capacity.

The proposed solution not only provides a viable alternative for surface water treatment but also to fruit waste use, a significant global issue with economic, environmental, and social implications.

Keywords: Coagulation and flocculation, surface water treatment, aluminum sulfate, natural coagulant, fruit waste

Application of the phase inversion method for the manufacture of ultrafiltration membranes

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ABSTRACT

Membrane processes are increasingly important in environmental protection, particularly in drinking water production. Despite their significance, the manufacturing of these membranes remains predominantly concentrated in developed nations, resulting in elevated acquisition costs and limiting their widespread application globally. This research aims to reintroduce the classical phase inversion technique for fabricating polysulfone-based ultrafiltration membranes. The performance of the fabricated membranes was assessed in terms of permeate flux, and the pore size distribution was meticulously characterized, obtaining a permeated flux of 73,16 L/h*m²*bar and pore size under the ultrafiltration range. Understanding the relationship between permeate flux and pore size is crucial for determining the efficacy of ultrafiltration membranes and their potential applications in water treatment. Furthermore, a detailed description of the fabrication method and optimization of manufacturing conditions could provide a valuable opportunity for developing countries to advance water treatment technologies tailored to local challenges.

Keywords: phase inversion method, ultrafiltration, permeate flux, cut-off essay

Sustainable Rainwater Management in Urban Environments: Institutional Experiences in Bolivia

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ABSTRACT

It is broadly recognised that a change is required in the management of rainwater within urban environments. Cities must evolve and grow in a ‘water-sensitive’ way. It is necessary to integrate new principles, strategies and techniques of rainwater management in order to establish ‘sustainable urban drainage systems’ (SUDS).

The Vice-Ministry of Water and Environment of the Bolivian State, with a holistic perspective on water resources management, prioritizes the development of innovative approaches and mechanisms for urban stormwater drainage planning and implementation.

In 2021, the Vice-Ministry, with the support of the Spanish Cooperation Office (AECID), under the BOL-006-B and 018/SPE/000400019 programs), in collaboration with GEAMA of the University of Coruña, launched two ambitious actions in the sustainable urban storm drainage sector. These actions included the development of pilot master plans in 4 Bolivian cities, and the construction of 3 pilot units of SUDS techniques. The selection of the pilot cities was based on the specific biogeographical characteristics of each region.

The plans for Cobija and Trinidad have already been completed, while those for Sucre and Oruro are set to be launched shortly. The SUDS pilot units are currently in the design and tender phase, with construction slated in 2025.

This presentation will outline the methodological frameworks underpinning the plans, as well as the objectives and key lessons learned during the development of actions related to the sustainable management of water resources. The discussion will also address the challenges of operating within a complex governance environment involving multiple stakeholders.

Keywords: Master plans, SUDS, governance, drainage systems, pilot units

COMPENDIUM OF

WATER SUSTAINABILITY AND LIFE
CYCLE ASSESSMENT (LCA)
ABSTRACTS

Sustainable water management and use in Chocaya, Bolivia***Alfaro Denus G.****Universidad Católica Boliviana San Pablo, CIDA-UAS, Bolivia.*

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ABSTRACT

UAS-UCB (Universidad Católica Boliviana San Pablo) and VOSERDEM (Voluntarios al Servicio de los Demás) have implemented its Integral-Sustainable-Development (DIS) model in 70 hectares of Ecocampo-Chocaya, located on the southern slope of the Tunari National Park, in the municipality of Quillacollo. This project aims to reverse issues such as abandonment, deforestation, desertification, recurrent forest fires, erosion, reduction of shrub layers, undervaluation of native species, invasions, and the area's unproductive. In partnerships with the Chocaya Community, the municipality, and various regional, national and international institutions, significant progress has been made. Four water reservoirs were constructed in the upper area (two semi-buried with capacities of 400,000 L and 650,000 L; one with a geomembrane of 1,000,000 L; and another earthen reservoir of 200,000 L) for gravity and sprinkler irrigation across at least 80 agroforestry plots (85% implemented; 550 m² each). Additionally, politubo connections were installed for irrigation and fire prevention. Eight infiltration ponds were created, some containing carp fish, and 6,000 native trees (including cedar, alder, pepper tree (molle), kewiña, among others) were planted to protect riverbanks, roads, and water sources. In the lower area, a 50,000 L reservoir for drinking water was established along with a cactus barrier against fires and an ecotourism unit with a kitchen, restaurant, and operational bathrooms. A fire brigade equipped with five personnel was trained. The community manages Ecocampo under ancestral practices while working on ecological and water footprint indicators to monitor LCA and EIA, and optimize impact by replicating the model in other areas.

Keywords: Sustainability, management, water, Chocaya Community

Mapping and analysis of flooded areas using Sentinel S1A IW-GRDH satellite imagery in the minor lake of Titicaca, Bolivia and Perú

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ABSTRACT

The expansion of hydropower projects in Bolivia is essential for meeting the country's growing energy demands and promoting sustainable development. However, these projects generate complex environmental and social impacts, requiring comprehensive assessment methodologies. This study presents a Multicriteria Analysis (MCA) framework for Integrated Environmental and Social Impact Assessment (IESIA) in hydropower projects, incorporating diverse criteria to ensure balanced decision-making. The methodology involves an extensive literature review, expert consultations, and participatory workshops to identify and prioritize key evaluation parameters. MCA methods such as AHP, PROMETHEE, ELECTRE, and TOPSIS were applied, considering critical factors including biodiversity, land use changes, noise pollution, greenhouse gas reductions, affected area, prior consultation processes, and indigenous community rights. Results indicate that MCA provides a structured and transparent approach to assessing trade-offs between hydropower benefits and potential environmental costs. Sensitivity analyses confirm the robustness of the model by testing different weighting scenarios, demonstrating its adaptability to diverse decision-making contexts. The findings highlight MCA's ability to enhance impact assessment methodologies, supporting more sustainable and socially responsible hydropower planning in Bolivia. This research contributes to improving Life Cycle Assessment (LCA) applications in water sustainability by integrating multidimensional criteria, fostering more resilient water resource management, and promoting informed policy-making for hydropower development.

Keywords: multicriteria analysis, hydropower sustainability, water resource management, integrated impact assessment.

A Proposal to Improve Irrigation Water Efficiency in Urban Parks of Chaclacayo, East Lima, Perú

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ABSTRACT

Chaclacayo is a district in the eastern side of Lima, featuring thirty-three public parks. While these parks allocate 6.1 hectares for lawns, 1.7 hectares remain barren. We analyzed the relationship between park lawn coverage and factors such as watering frequency, type of water source and its distance. The analysis considered water and soil quality requirements of *Stenotaphrum secundatum*, the sole grass species used in the district parks. Eleven parks presented less than 50% coverage, parks closer to the river watered by flood irrigation presented higher coverage, whereas those farther from the river, watered by tanker trucks, exhibited the lowest coverage. Inefficient flood irrigation methods and the high-water demand of *S. secundatum* contribute to an estimated water demand of 675 cubic meters per day which is sourced from river, well and tap water. Implementing drip irrigation and using xeric vegetation could reduce this water footprint by up to 1100 cubic meters per day, or up to 401,500 cubic meters per year, an 82% improvement compared to the current baseline. We recommend a combination of water management practices and xeric vegetation to provide full green coverage in Chaclacayo parks, while reducing the current water usage.

Keywords: lawn, water use efficiency, urban parks, xeric vegetation

Sustainability of small drinking water systems

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ABSTRACT

Drinking water systems sustainability correspond to diverse factors which can be measured using contextualized sustainability indicators. The sustainability of small systems (less than 2000 inhabitants) face difficulties and challenges that need to be identified in order to find mechanisms to improve the level of service and its sustainability in a long term. The actual Investigation was developed in a small local drinking water system to identify key sustainability factors applying tools to measure indicators having then as a result a sustainability index (1-10). The tools used included technical visits, water analysis, interviews to water association staff and surveys to users. The results of the research can be used as a baseline and a guide to implement actions towards the enhancement of the sustainability index of the small drinking water system studied.

Keywords: Sustainability index, small water system, indicators

Validation of prototypes of solar-thermal beekeeping drinking troughs, with focus on climate change, for context of bolivian Chaco, 2024

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ABSTRACT

Global warming caused by burning of fossil fuels and expansion of agricultural frontier through clearing, is needed to analyze and develop technologies for water provision in apiaries, which use non-conventional sources of energy, such as solar-thermal, which also improves productivity in obtaining derivatives from the hive, in situations of water stress with a decrease in rainfall by 16% in Bolivian Chaco compared to the last 50 years. OBJECTIVE was to validate the behavior of prototypes of solar thermal beekeeping drinking troughs with focus on climate change, to adapt to effects of climate change and mitigate them. HYPOTHESIS "applying prototypes allows improving productivity in the water supply". METHODOLOGY is quasi-experimental without manipulation of independent variables such as maximum and minimum temperatures, relative humidity, wind speed, atmospheric pressure and ultraviolet radiation; comparing the operation of 3 prototypes compared to a control drinker, with 2 repetitions, until control drinker is completely emptied by evaporation. RESULTS established pumping greater than 93% of the prototypes and evaporation less than 3% accumulated, compared to 99% evaporation from the core. In CONCLUSION, i) theoretical foundations of operation of the prototypes as thermal machines that works according to Carnot cycle were understood; (ii) daily flow of about 3% (between 100 and 400 [mL/day]) and a total flow between 93 and 97% iii) daily loss of less than 0.26% compared to the daily control loss of 3.82%; and the control presented a total evaporation loss of 99%. Which means that prototypes improve productivity in obtaining derivatives from the hive.

Keywords: water-stress, drinking-fountain, beekeeping, solar-thermal, Climate-Change, productivity

The water situation in Bolivia (2000-2024)*Vargas Solá E.**Plataforma Boliviana frente al Cambio Climático, Bolivia, ORCID: 0009-0000-9507-4704.*

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ABSTRACT

The water crisis of 2023 motivated the debate on water in Bolivia, where one of the demands was to re-take the construction of the new Water Law (the current one dates from 1906). For this purpose, the Bolivian Platform against Climate Change (PBFCC) proposed to carry out an study on the State of Water Situation in Bolivia for the period 2000-2024, with the aim of contributing to the debate and proposals for a new regulatory framework. The methodology of the study was qualitative with an historical perspective, based mainly on the review of secondary information (studies, scientific articles, news, etc.) and some interviews.

The main results show that there are weaknesses in the territorial water governance with repercussions on the water crisis. These weaknesses are manifested in the institutionality and regulatory framework. Although, after the water war of 2000 in Bolivia, there were regulatory advances (New constitution, drinking water law, irrigation) and policies such as the implementation of the Integral Water Resource Management and the Integral Watershed Management (IWRM-IWM), at the same time, there were policies that have promoted extractivism. As a consequence, there is severe environmental problems (deforestation, fires, pollution) with direct effects on water scarcity. On the other hand, there is a sectoralized water institutionality, with weaknesses in intra-governmental coordination, and the absence of a multi-actor entity that counterbalances the state dominance in decision-making about water. Likewise, there is not a new water law that controls and regulates the use and preservation of water with an integral view.

These weaknesses in governance reinforce Bolivia's vulnerability to droughts and floods and climate change. This is why civil society proposals for a Water Law point to a new institutional framework and the reestablishment of the natural water cycle that guarantees “water for all.”

Keywords: Water governance, water crisis, water law

COMPENDIUM OF

WATER

EDUCATION

ABSTRACTS

Divulgación científica en el aula, alternativas lúdicas para el aprendizaje y la apropiación de la ciencia

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ABSTRACT

Un equipo de investigación en ingeniería de la Universidad Católica Boliviana San Pablo, desarrolló un "Kit de análisis de agua de riego a bajo costo" con la comunidad agrícola de la Maica en Cochabamba, Bolivia. Sin embargo, debido a factores de comunicación, la comunidad no hizo uso del material escrito, por lo que la transferencia de conocimiento se vio limitada y no se consideró efectiva. Ante esto, las organizaciones involucradas propusieron adaptar el contenido a un público más joven. Así, se gestionó un proceso de co-creación de material de divulgación científica con la Unidad Educativa "Bolivia B" de la Maica Quenamari basado en dicho manual. Para ello se adoptó un enfoque participativo y lúdico pedagógico para generar interés y facilitar el desarrollo de capacidades vinculadas a la vida cotidiana e intereses de los estudiantes. Quiénes fueron colaboradores activos en la toma de decisiones y producción de material divulgativo. Las tareas se dieron a partir de un diagnóstico de necesidades y conocimientos, concluyendo en el desarrollo de un juego educativo de mesa "Doña Maica en acción: reto agua para el huerto", talleres de audiovisual y producción de clips de video. Las actividades realizadas fueron trabajadas, evaluadas y validadas con los estudiantes. Como resultado, se generó un espacio de expresión sobre el proceso de enseñanza-aprendizaje en ciencias exactas de la UE, se desarrollaron nuevas capacidades en torno a las TIC y se logró la asimilación de nuevas nociones sobre la química y la calidad del agua de riego en los estudiantes.

Keywords: Divulgación científica, calidad del agua, participación estudiantil, comunicación para el cambio social, recursos educativos, evaluación participativa

Enriching Industrial Engineering Education through Water and International Cooperation

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ABSTRACT

Historically, industrial engineering studies have been presented in a technocentric manner, where technology is seen as a tool to solve all kinds of problems. Technology is often presented as a universal solution, with applications indifferent to the environment.

However, the reality is far from this simplistic vision, requiring an approach centered on human development considering social, cultural, and environmental needs for technology to be accepted and useful in each new context.

In this direction, the ETSEIB (Escola Tècnica Superior d'Enginyeria Industrial de Barcelona), from the Universitat Politècnica de Catalunya- BarcelonaTech, takes advantage of the revalidation of the Master's Degree in Industrial Engineering to incorporate a vision of sustainability and international cooperation in the fields of energy and water through the LESIE project (Live, Experience, and Share Industrial Engineering).

The project, launched in September 2024, begins with the identification of those master's subjects already incorporating this vision through examples or study cases. At the same time, LESIE analyzes, based on existing examples at other universities and cooperation projects with related entities, the subjects and types of exercises allowing to expand this critical perspective on technology application.

This situational map is useful to identify where to focus the efforts so that students in the degree in industrial technologies engineering and the master's program in industrial engineering progressively understand the importance of placing people and the environment at the forefront throughout their studies, based on a few well-conceptualized cooperation projects.

Keywords: industrial Engineering Education, International Cooperation, Water education.

A Journey in Science Outreach: Milestones of the Ibero American "Sowing and Harvesting" Research Network

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ABSTRACT

In certain regions of Ibero America, local and Indigenous communities have carried forward time honored traditions that draw on their deep ecological knowledge. One outstanding example is the practice known as Water Sowing and Harvesting, called Siembra y Cosecha de Agua, or SyCA, introduced in Peru. Through these enduring techniques, communities capture runoff from snowmelt or rainfall and guide it into aquifers, sowing the water underground. After a period within the aquifer, the water can then be drawn out and harvested, emerging as a steady supply of groundwater throughout the year. From 2019 to 2023, the Water Sowing and Harvesting in Protected Natural Areas Research Network, also known as Red SyCA, brought together 87 researchers from seven countries under the auspices of the Ibero American Program of Science and Technology for Development (CYTED). Their collaborative efforts not only helped to document and promote this ancestral approach to water management, but also integrated it into research and educational initiatives. Through the network's collective work, communities, educators, and learners alike can gain a richer understanding of how traditional wisdom and scientific insight combine to create more sustainable and resilient water resources for present and future generations.

Keywords: water Sowing and Harvesting, recharge, Nature-Based Solutions

Implementation of a multi-level collaborative teaching-learning strategy in water quality research projects

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ABSTRACT

The Universidad Católica Boliviana has adopted the teaching-learning strategy in the training process. Collaborative teaching-learning is a way of learning as a team, where the members have similar knowledge and skills to carry out an assigned task together. The application of this methodology can be extended to research processes. This study carried out a pilot experience of a binational academic team (Bolivia and France) within a research project. The team members were 8 and had different levels of training as undergraduate students, Master students, doctoral students, and doctors. The team's objective was to carry out a diagnosis of the pollution in Lake Titicaca, for which they had to propose how to carry out field and laboratory work together within a set period and with an established budget. Participatory workshops were held to co-construct the work strategy. As a monitoring and evaluation instrument, surveys were implemented to understand the evolution of the process of each team member, from the formation of the team to the conclusion of the assigned task. The evaluation of the experience was 100% positive, and the team members stated that they strengthened their individual soft and technical skills as well as their teamwork. Furthermore, this initiative enriched the training of future professionals while simultaneously providing ongoing feedback to the academic supervisors. This feedback contributed to the continuous improvement of the research project's execution, fostering a dynamic and iterative learning process.

Keywords: multi-level collaborative teaching-learning, soft skills, continuous improvement

COMPENDIUM OF
SCIENTIFIC
POSTERS

Effective coffee wastewater treatment using taro***Rojas Vilca K. Y.¹, Silva Guerrero G. M.², Achata Böttger J. A.²****¹Universidad Peruana de Ciencias Aplicadas, Perú, ORCID: 0009-0009-3291-6033**²Universidad Peruana de Ciencias Aplicadas, Perú.*

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ABSTRACT

Coffee is a major agricultural export product in Peru, the wet process generates wastewater high in solids, chemical and biochemical oxygen demand. These wastewaters are often discharged without prior treatment, polluting small water courses. Constructed wetlands are now widely used in Peru to treat process wastewater (PWW), but their efficacy can be improved combining them with phytoremediation. We evaluated the viability of using taro (*Colocasia esculenta*), an edible plant, to reduce the PWW contaminant load in a constructed wetland at a coffee farm in San Juan de Pueblo Libre, Junín, Peru. The PWW supported taro plant growth adequately, despite the high contaminant load. Two subsurface flow wetlands were constructed, one was planted with ten taro plants, and the other was left empty as control. After four days, biological and chemical oxygen demand were reduced in 95% and 89.49% respectively. Over 80% of total suspended and settleable solids were reduced as well, and the effluent met discharge standards. Although further assays are currently underway, these initial results are encouraging towards the implementation of this low cost, appropriable solution at small coffee farms.

Keywords: coffee processing, wastewater, constructed wetlands, phytodepuration, taro

Effective coffee wastewater treatment using taro

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INTRODUCTION

Coffee is one of Peru's main agricultural exports, and Junín is the second largest coffee production region (Senasa, 2021). The coffee wet process generates a wastewater with high solids content and chemical and biochemical oxygen demand. These wastewaters are frequently discharged without prior treatment, polluting small watercourses and generating anaerobic conditions that disrupt aquatic life. For example, along rivers in coffee-growing regions, pH levels below 4, low oxygen levels and high levels of organic content have been recorded (Tsigkou et al., 2025). Currently, no standard has been issued by the Peruvian Government to establishing the minimum water quality standards these effluents must meet to be discharged. Constructed wetlands are now widely used in Peru to treat wet process wastewater, but their effectiveness can be improved by combining them with phytoremediation. Taro (*Colocasia esculenta*) is an aquatic crop readily available throughout coffee producing regions in Peru. We evaluated the feasibility of using taro in a constructed wetland to reduce the pollutant load of coffee process wastewater at a coffee farm.



METHODS

Characterization of wastewater from the coffee wet milling process

- Water sampling
- Laboratory analysis (BOD₅, COD, pH, TSS, SS).



Taro biomass development in wastewater

- Addition of 300 ml of wastewater to the plant every 48 hours.
- Drying of corns in an oven at 75°C, until constant weight (Gonzales, 2008).
- Recording of mass using an analytical balance.



Construction of the artificial wetland

- Excavation and waterproofing.
- Installation of substrate.
- Setting up 10 *C. esculenta* plants.
- 60 L wastewater inlet.
- 4 days hydric residence.
- Removal of the hermetic seal.
- Outlet of decontaminated effluent.

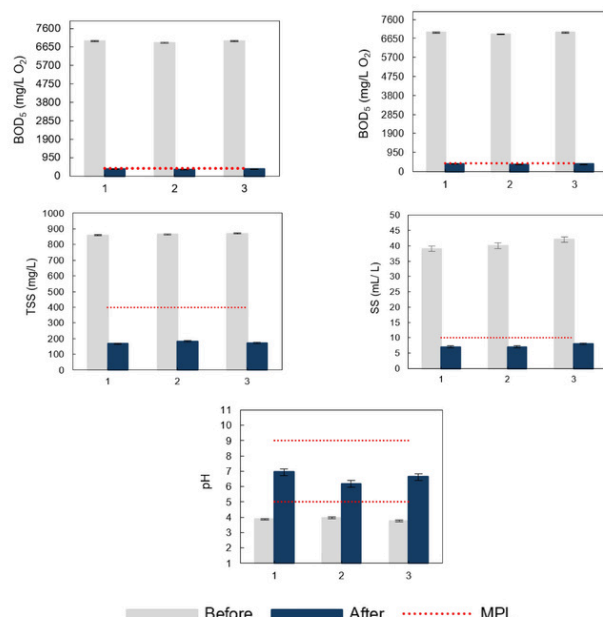


Characterization of wastewater from the coffee wet milling process after treatment

- Water sampling and laboratory analysis.
- Comparison of results with Colombian Resolution 0631 on Maximum Permissible Limits (MPLs).
- Treated effluent ready for discharge.

RESULTS

After treatment, the effluent effectively met the standards applicable to coffee wastewater from Colombia. In all three replicates, pH was neutralized, Biochemical Oxygen Demand over five days (BOD₅) was reduced from 7152.86 to 356.1 mg/L O₂ (95% reduction). Chemical Oxygen Demand (COD) was reduced almost tenfold, from 5086.1 to 534.4 mg/L O₂. Regarding suspended solids, Total Suspended Solids (TSS) were reduced in 80.80%, from 907 to 174.2 mg/l, while Settleable Solids (SS) were reduced 82.11%, from 41 to 7.3 mg/l.

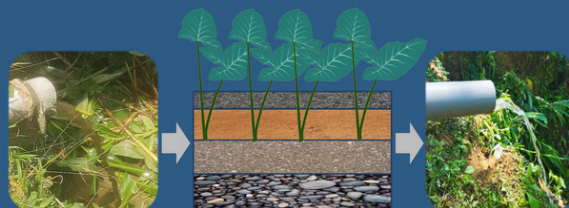


CONCLUSIONS

The system effectively treated coffee process wastewater, improving water quality and meeting the MPLs established in Colombian regulation to safely discharge treated wastewater into water bodies.

Taro represents a potential tool for wastewater treatment as it is sturdy enough to grow in coffee wastewater and improve its quality while doing it so.

This technology could be implemented in coffee farms smaller than 5 ha, which represent 85% of coffee production in Peru, and thus contribute to a sustainable coffee production.



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Regeneration of treated wastewaters by nanofiltration and reverse osmosis for agricultural purposes

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ABSTRACT

Nowadays, human kind is facing extreme water scarcity scenarios. Thus, conventional water sources (rivers and lakes) are not enough to satisfy current requirements. Novel water sources should be exploited to achieve a sustainable growth. In this sense, treated wastewater waters could allow a more efficient management of water resources and permit water reuse to move forward a circular economy approach in this sector. Membrane-based technologies, mainly as nanofiltration (NF) and reverse osmosis (RO), allow disinfection and removal of anions and cations. These facts are key to produce reclaimed water, permitting several uses of the produced stream, such as agricultural irrigation, industrial and environmental (aquifer recharge).

The main objective of this study was the evaluation of different NF and RO membranes (NF90, NF270 and SW30 from Dupont) and operational pressures (6, 10, 14 and 20 bar) to achieve the valorisation of a synthetic wastewater, mimicking an effluent of an urban wastewater treatment plant (WWTP).

Obtained results showed that the higher the operational pressure, higher reclaim water production. Besides, membrane performance (in terms of removals of conductivity, organic matter and nutrients) was related to the applied membrane and operational pressure. NF270 achieved the highest reclaimed water production, however, the lowest removals. SW30 accomplished the highest removals; but, the lowest reclaimed water production were obtained.

Membrane based technology is a sustainable way to valorise treated urban wastewaters and defined membrane and operational conditions can be applied to scale-up the technology for application of the produced reclaimed water.

Keywords: reclaimed water, membranes, nanofiltration, reverse osmosis, circular economy

Regeneration of treated wastewaters by nanofiltration and reverse osmosis for agricultural purposes

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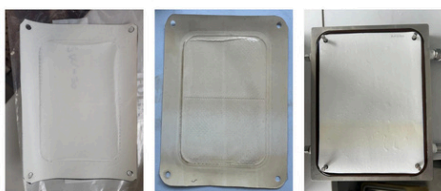
INTRODUCTION



METHODS



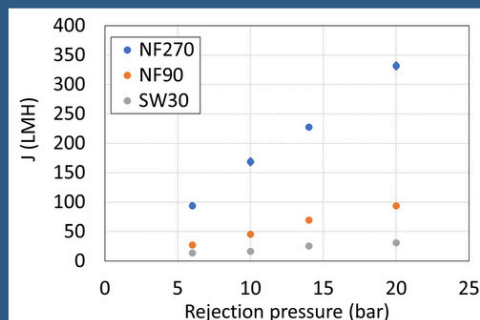
Flat-sheet membrane cells ($A = 0.01 \text{ m}^2$)



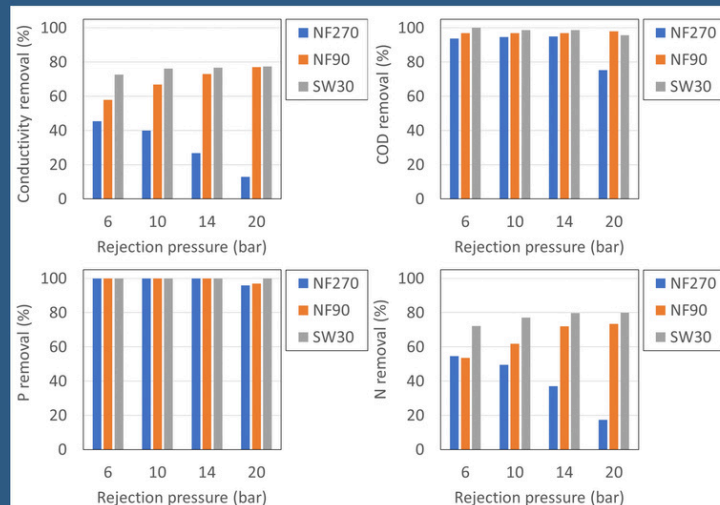
Membranes (NF90, NF270 and SW30 from Dupont)

Parameter	Value	Units
Conductivity	2.0	mS cm^{-1}
Chemical oxygen demand	100	mg N L^{-1}
Ammonium	10.0	mg N L^{-1}
Phosphate	1.0	mg P L^{-1}

RESULTS



- The higher the operational pressure, higher reclaim water production
- Membrane performance (in terms of removals of conductivity, organic matter and nutrients) was related to the applied membrane and operational pressure.



- NF270 achieved the highest reclaimed water production, but with the lowest quality.
- SW30 achieved the lowest reclaimed water production, but with the highest quality.
- Independent of the applied membrane, produced reclaimed water achieved the minimum quality standards established by the EU water reuse regulation (EU) 2020/741 for agricultural irrigation.

CONCLUSIONS

Membrane based technology is a sustainable way to valorize treated urban wastewaters and defined membrane and operational conditions can be applied to scale-up the technology for application of the produced reclaimed water.



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UdG

Bajo la lupa: calidad del agua de consumo en 3 comunidades del trópico de Cochabamba (puerto aurora, 18 de agosto y 15 de junio)

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ABSTRACT

In Chimoré, municipality of Cochabamba, the quality of water for human consumption is uncertain in several areas, representing a sanitary risk. This study evaluated the microbiological and physicochemical quality of water in the communities of Puerto Aurora, 18 de Agosto and 15 de Junio. Considering the influence of the Chapare River as a source of supply to the communities. Between August and December 2024, the analyses revealed variations in the presence of total and fecal coliforms: Puerto Aurora showed low or no microbiological contamination, while 18 de Agosto and 15 de Junio showed higher levels, indicating moderate and persistent fecal contamination; as for the physicochemical analyses, definitive results are not yet available. The Chapare river showed high levels of coliforms, related to agricultural activities in the area, such as cattle raising and coca cultivation. In December, increased bacterial counts were detected, possibly due to water treatment or distribution failures. Although *Pseudomonas aeruginosa* was not identified, *Ascaris* sp. eggs (parasites) were found in some samples, evidencing occasional fecal contamination. The results underscore the need to improve water treatment and monitoring systems in these communities to prevent human health risks.

Keywords: Drinking water, self-managed wells, coliforms, parasites, contamination, agricultural.

Greenhouse Gas Emissions Estimation in Hydroelectric Reservoirs***Luján Pérez.¹, Mercedes Zurita M.²***

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ABSTRACT

In Chimoré, municipality of Cochabamba, the quality of water for human consumption is uncertain in several areas, representing a sanitary risk. This study evaluated the microbiological and physicochemical quality of water in the communities of Puerto Aurora, 18 de Agosto and 15 de Junio. Considering the influence of the Chapare River as a source of supply to the communities. Between August and December 2024, the analyses revealed variations in the presence of total and fecal coliforms: Puerto Aurora showed low or no microbiological contamination, while 18 de Agosto and 15 de Junio showed higher levels, indicating moderate and persistent fecal contamination; as for the physicochemical analyses, definitive results are not yet available. The Chapare river showed high levels of coliforms, related to agricultural activities in the area, such as cattle raising and coca cultivation. In December, increased bacterial counts were detected, possibly due to water treatment or distribution failures. Although *Pseudomonas aeruginosa* was not identified, *Ascaris* sp. eggs (parasites) were found in some samples, evidencing occasional fecal contamination. The results underscore the need to improve water treatment and monitoring systems in these communities to prevent human health risks.

Keywords: Drinking water, self-managed wells, coliforms, parasites, contamination, agricultural.

Greenhouse Gas Emissions Estimation in Hydroelectric Reservoirs

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INTRODUCTION

Climate Crisis & Energy Transition: Bolivia is transitioning to hydroelectric energy as a primary source to combat climate change and replace other sources of non renewable energy sources . The country has an estimated potential of 40 GW, but current capacity is only 0.75 GW, therefore hydroelectric energy might become the main primary source of primary energy in Bolivia, but care must be taken in selecting the sites for building a reservoir for hydroelectric purposes.

Hydroelectric Reservoirs & GHG Emissions: Reservoirs are significant sources of greenhouse gases (GHGs), particularly CO₂ and CH₄, due to the decomposition of organic matter. The debate continues on whether hydroelectric reservoirs are carbon-neutral.

Objective: This study estimates GHG emissions in three Bolivian hydroelectric projects (Ivirizu, Miguillas, and Misicuni) using the G-res Tool to assess their environmental sustainability.

METHODS

G-res Tool: Selected for its ability to estimate GHG emissions over a 100-year lifecycle, considering biogenic emissions, construction emissions, and net GHG footprint.

Data Collection:
Field Visits: To collect and verify data from the projects.
Documentary Analysis: Review of Environmental Impact Assessments, Mitigation Plans, and Annual Monitoring Reports.

Key Variables:
Power Density: Power generated per unit of flooded area.
Specific Emissions: GHG emissions per unit of energy generated.

Projects Analyzed:
Ivirizu: Located in a temperate zone with dense forest cover.
Miguillas: Situated in a temperate area with wetlands.
Misicuni: Located in a cold mountain climate with grasslands.



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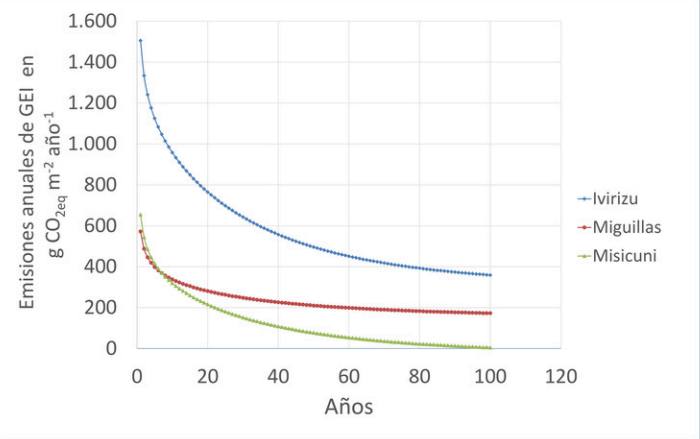
RESULTS

GHG Emissions:

Ivirizu: Biogenic emissions: 374 t CO₂eq/year.
Construction emissions: 664,664 t CO₂eq.
Net GHG footprint: 711,506 t CO₂eq.
Specific emissions: 6.13 g CO₂eq/kWh.

Miguillas: Biogenic emissions: 239 t CO₂eq/year.
Construction emissions: 412,654 t CO₂eq.
Specific emissions: 4.14 g CO₂eq/kWh.

Misicuni: Biogenic emissions: 299 t CO₂eq/year.
Construction emissions: 974,448 t CO₂eq.
Specific emissions: 6.95 g CO₂eq/kWh.



Key Findings:

- Construction emissions significantly exceed biogenic emissions.
- Ivirizu has the highest biogenic emissions due to its dense forest and higher temperatures.
- Misicuni, despite its cold climate, has significant CH₄ emissions due to agricultural activities in the area.

CONCLUSIONS

Environmental Sustainability: All three projects have specific emissions below 80 g CO₂eq/kWh, considered the threshold for sustainable hydroelectric projects.

Construction Impact: GHG emissions during construction are significantly higher than those from reservoir flooding.

Climate & Altitude Influence: Projects at lower altitudes (e.g., Ivirizu) tend to have higher GHG emissions compared to those at higher altitudes (e.g., Misicuni).

Recommendations:

- Focus on reducing construction-related emissions.
- Consider altitude and climate in future project planning to minimize GHG emissions.

Development of bioremediation workshops as an educational strategy in rural areas of Colombia



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INTRODUCTION

As a consequence of global challenges related to pollution, the mismanagement of natural resources, and water scarcity, a collaborative effort has emerged among various social actors in Colombia. In order to present this work, the main objective is to show those efforts which have been oriented to a) knowledge transfer, b) intercultural dialogue, and c) collaborative educational strategies aimed at implementing water bioremediation technologies in rural areas affected by climate change.



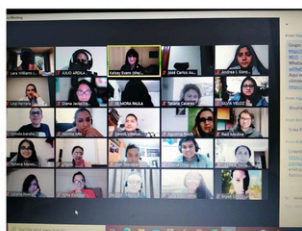
First workshop on Carmen de Apicalá, Colombia (January, 2020)



Third workshop on Boyaca, Colombia (June-July, 2022)

METHODS

Three in-person and virtual workshops were conducted in various locations across the country (Carmen de Apicalá, Tolima and Duitama, Boyacá) focusing on water treatment, quality, and management. These workshops involved communities and researchers from Mexico, Brazil, Spain, and Colombia, who shared their experiences related to bioremediation, biotechnology, and bioeconomy, offering alternative approaches to water treatment.



Second virtual workshop (January, 2021)



Third workshop on Boyaca, Colombia (June-July, 2022)

We can observe in figure 1 that there are three principal focuses: Academy, community and research. Results are given by the participation inside the workshops so as to the assistance in a remote way (+400 assistants on YouTube). The scope includes different invitations to participate on projects with a transfer knowledge.

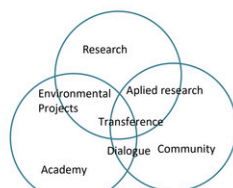


Figure 1. Diverse focuses are involved into the workshops done

RESULTS

The workshops yielded several outcomes: i) Increased community participation in rural areas, encouraging intercultural dialogue and knowledge transfer on water technologies, particularly in regions facing water scarcity; ii) Recognition of the value of traditional techniques for water acquisition and the development of innovative entrepreneurial activities; iii) Scientific and academic collaboration that fostered the development of projects incorporating diverse social methodologies; iv) A positive community response to the appropriation and management of local resources; and v) Promotion of water conservation through regenerative practices.



First workshop on Carmen de Apicalá, Colombia (January, 2020)



Third workshop on Boyaca, Colombia (June-July, 2022)



Third workshop on Boyaca, Colombia (June-July, 2022)

CONCLUSIONS

The active participation of communities and the implementation of bioremediation technologies are key components of the bioeconomic transition, contributing to the achievement of the SDGs related to the conservation of water systems.

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Biorremediación (15 de enero del 2021) Segundo Taller de Biorremediación disponible en https://www.youtube.com/watch?v=jqmD6p-x_k



Diagnosis of the presence of pharmaceutical contaminants in the Seke River, El Alto – Bolivia.



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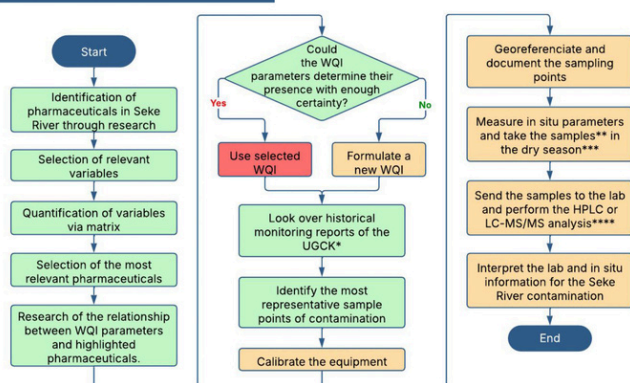
INTRODUCTION

Pharmaceutical contaminants, also considered as Emerging Contaminants (EC), are characterized by their complex chemical composition and their possible negative impacts on the natural environment and human health (Quintana et al., 2005). It's an area of increasing research due to concerns about the little-known environmental effects and possible risks to flora and fauna in aquatic ecosystems, as well as to humans (Aissaoui et al., 2016). Pharmaceutical compounds are continuously released into sewage systems. Most of these compounds can pass through wastewater treatment plants and reach soils, water bodies, and even the drinking water supply, either in their original form or as products of chemical and biological transformations (Huerta et al., 2012).

In the city of El Alto, various sources of contamination have been identified in surface waters, such as industries, hospital waste, urban wastewater, agricultural discharges, solid waste leachates, etc. All liquid discharges from El Alto flow into the Seke and Seco rivers, thus contributing to the contamination of the Katari Basin, which is an important tributary of Lake Titicaca (Tarqui, 2022). The water of the Seke River is used to irrigate crops in different communities, so it's necessary to know if the quality of the water and their ecotoxicological risks.

Through this investigation, it is intended to obtain a diagnosis of the presence and spatial distribution of a drug with a high ecotoxicological risk in the Seke River. This will expose areas of the Seke River with water unsuitable for consumption or irrigation in order to take immediate actions to reduce the existing ecotoxicological risk.

METHODS



Notes: * UGCK is the Katari Basin Management Unit and "UGCK" is used for its initials in Spanish.

** The sampling will follow the protocols established in ISO 5667-6:2014.

*** We selected the dry season because it is easier to detect less diluted pollutants in water as well as the sources of contamination.

**** This analysis is going to be performed by an external laboratory to the university.

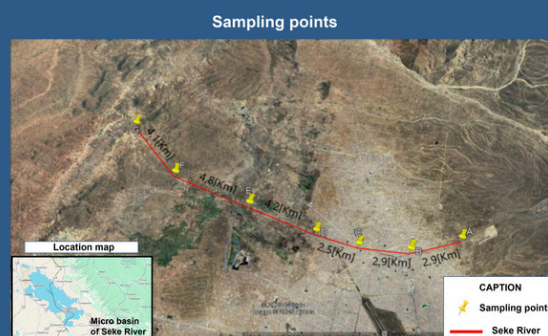
Preliminary matrix of selection:

Pharmaceutical	Measured concentration (ng/L)	Mortality for humans		Measured Concentration /PNEC>1		Biodegradable	Persistent	Bioaccumulative	Hierarchy by maximum total
		No 0/Yes 1	No 0/Yes 1	No 0/Yes 1	No 0/Yes 1				
Caffeine	23900	0	0	0	0	1	1	1	5
Carbamazepine	226	1	0	1	1	1	0	0	3
Ivermectin	NM	0	-	0	0	1	1	0	5
Metformin	32700	0	1	0	1	1	0	0	4
Naproxen	990	1	1	1	1	1	1	1	1
Nicotine	453	0	0	0	0	0	0	0	7
Paracetamol	227000	0	1	0	0	0	0	0	6
Ranitidine	991	0	1	1	1	1	0	0	2
Sulfamethoxazole	6550	0	1	1	1	1	0	0	2
Trimethoprim	2730	0	0	1	1	1	0	0	6

Note: The matrix shown is not the complete one and just highlights some important variables that are in it.

RESULTS

The result is a first diagnosis of the presence and spatial distribution of emerging contaminants of pharmaceutical origin in the Seke River. This will help to expose areas of the Seke River where the water is not suitable for irrigation and to take immediate actions to reduce the existing ecotoxicological risk. The sampling points are shown on the map below, additionally to three points that were added by equidistance, which will also be monitored in future sampling trips.



The desired impact is to expose the presence of significant pharmaceuticals with high ecotoxicological potential in an important river of the Katari Basin, in order to call upon the authorities in charge of the basin to promote the monitoring of these and other emerging contaminants of pharmaceutical origin in the rivers used for irrigation in the Katari Basin.

CONCLUSIONS

The evaluation of pharmaceutical compounds is expected to identify the pharmaceuticals posing the highest ecotoxicological risks for the region. The diagnostic will delineate the spatial distribution of these contaminants, allowing identification of areas in the river that may be affected by these compounds.

Through this analysis, a modified Water Quality Index (WQI) is expected to be proposed, incorporating specific methods to detect these pharmaceutical contaminants. This will enable a more accurate assessment of the environmental impact. The study's results will provide recommendations on mitigating the associated ecotoxicological risks and improving water management in the region. The impact of pharmaceuticals on aquatic life affects the behavior and reproduction of species and can also influence biogeochemical cycles.

This research marks the beginning of a deeper investigation that will, in the future, allow for the implementation of appropriate monitoring and treatment policies, protecting both human health and the ecosystem.



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Detection and quantification of textile microplastics emitted to the environment using Deep Learning tools: FIDEL Project



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INTRODUCTION

The abundance in the environment of synthetic polymer waste of less than 5 mm, called microplastics, is currently recognized as a major pollution problem worldwide [1]. Their wide variety in terms of shapes, sizes, and materials makes them an intrinsically hazardous pollutant. Synthetic textiles represent an important part of these anthropogenic pollutants, since, due to their structure and composition, they release synthetic microfibers (MFs) in the pre- and post-consumer stages of the sector [2]. The eco-toxicology of microplastics highlights the urgent need for the development of regulatory measurement analysis [3].

Traditional MFs quantification relies on visual counting (prone to human error) and gravimetric methods (susceptible to interferences). For this reason, the FIDEL project aims to develop a Deep Learning based procedure for the identification and quantification of MFs, using a Convolutional Neural Network (CNN) model for the segmentation of images obtained by microscopy; and the processing of hyperspectral images for the segmentation of MFs based on their composition.

METHODS

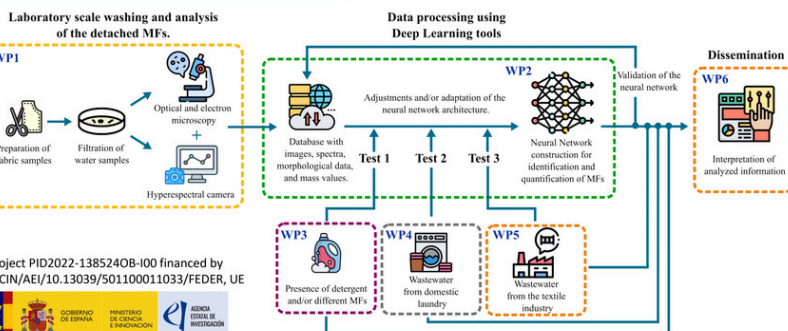


Fig. 1. Block diagram of the MFs identification and quantification method.

The project is divided into 6 Work Package (WPs) (Fig.1), beginning with textile preparation, washing processes, sample filtration, image collection (Figs. 2 and 3), dataset creation, programming, training and evaluation of the neural network. As a result, a system for the identification and quantification of MFs will be developed.

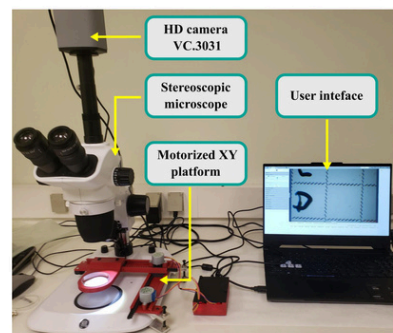


Fig. 2. Automated system for imaging MFs by integrating a motorized XY platform and optical microscopy.

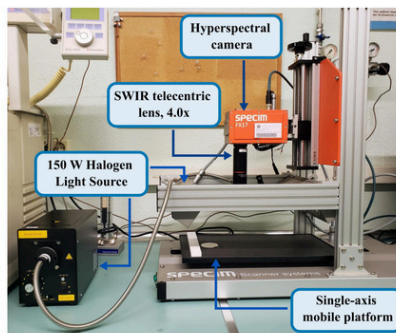


Fig. 3. Hyperspectral imaging acquisition system with SWIR telecentric lens and halogen light source.

RESULTS

• CNN for the segmentation of images obtained by microscopy

The system (Fig. 2) automates a sequence (Fig. 4) that captures a total of 364 photographs, each with a resolution of 1024 x 576 pixels, allowing the complete reconstruction of the filter with good resolution.

Each of these images is processed using a pretrained Mask R-CNN model [4], which combines object detection and instance segmentation, enabling not only the detection of MFs, but also the delineation of their boundaries at the pixel level.

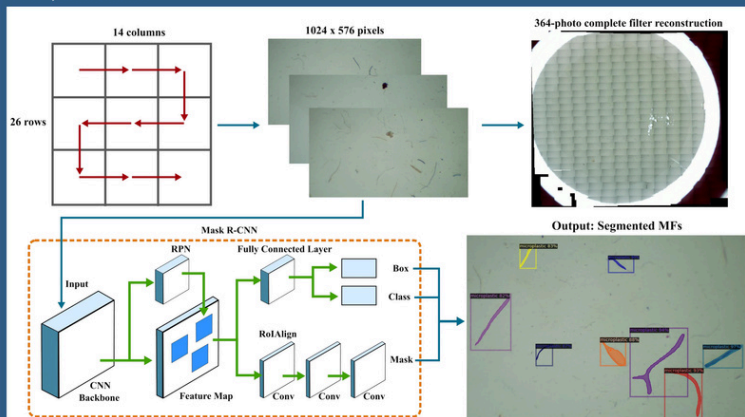


Fig. 4. Sequence for photograph collection and segmentation of MFs using Mask R-CNN.

• Analysis of material composition by hyperspectral imaging.

Data from textile samples are collected using the hyperspectral system (Fig. 3), and the characteristic spectrum of the material (Fig. 5) is analyzed at the pixel level. This process generates a database that serves as a reference for analyzing the reflectance response in samples with low material density, such as MFs.

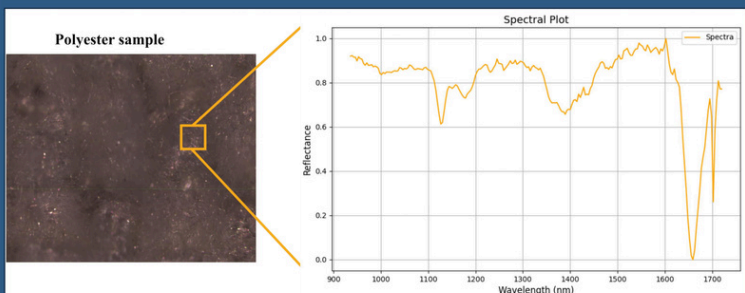


Fig. 5. Hyperspectral analysis of a polyester sample.

CONCLUSIONS

The microscopy and hyperspectral image acquisition procedure represents the initial phase of the FIDEL project. This methodology ensures a systematic and automated data collection process, which will enable the generation of larger datasets in the future to enhance the training of models (Mask R-CNN or other approaches) for identifying MFs based on their morphology or composition.

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Evaluation of the toxicity of heavy metals in the Katari Basin through bioassays with *Daphnia pulicaria*.



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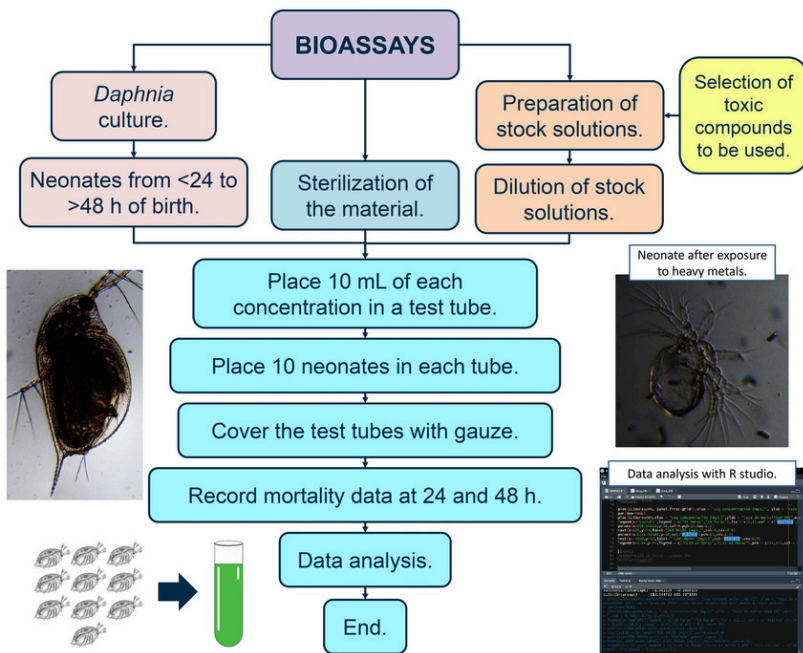
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INTRODUCTION

Water pollution due to industrial and mining activities represents a significant threat to aquatic ecosystems and human health. In the Katari Basin (El Alto, Bolivia), water bodies receive discharges with high concentrations of heavy metals, whose toxic effects have not been comprehensively evaluated. Current monitoring methods focus on physicochemical analyses, without considering the direct impact of these pollutants on aquatic organisms. To address this problem, the present study aims to evaluate the toxicity of the heavy metals Cr(VI), Cd, Pb, Al and Cu by acute toxicity bioassays with *Daphnia pulicaria* as test organisms. The determination of the LC50 for each metal will provide key information for future ecotoxicological studies and contribute to the monitoring and management of water quality in the basin.

METHODS

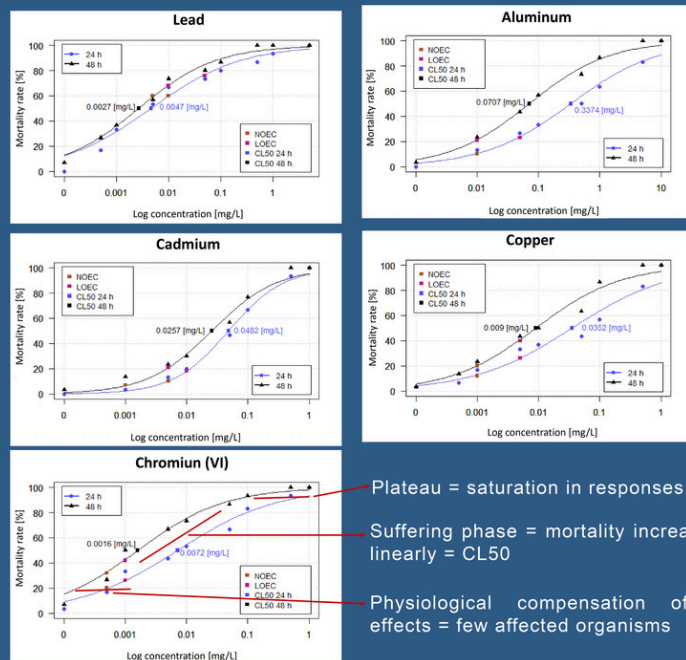
To evaluate the acute toxicity of heavy metals, the following diagram summarizes the stages of the study, from the performance of the bioassays to the analysis of the results.



- The toxic compounds used were: Pb, Al, Cd, Cu and Cr (VI).
- The bioassays were performed in triplicate and with negative controls.
- Data analysis was performed with R studio software, specifically the "drc" (dose - response curves) package, which includes a 4 - parameter log-logistic model.
- The LC50, the NOEC and LOEC values were determined.

RESULTS

The following graphs were obtained using R studio:



Plateau = saturation in responses

Suffering phase = mortality increases linearly = CL50

Physiological compensation of effects = few affected organisms

- The dose-response curves show the mortality of *Daphnia pulicaria* at different concentrations of the metals over 24 and 48 hours.
- Variations in LC50 between 24 and 48 hours suggest time - dependent toxicity effects.

Toxic compound	LC50 [mg/L] 24h	LC50 [mg/L] 48h	Limits RMCH	Limits WHO	Limits USEPA
Pb	0,0047	0,0027	0,05	0,01	0,015
Al	0,3374	0,0707	0,2	0,2	0,2
Cd	0,0482	0,0257	0,005	0,003	0,005
Cu	0,0352	0,0090	0,05	2	1,3
Cr (VI)	0,0072	0,0016	0,05	0,05	0,01

- The LC50 values were compared with reference limits. Only Al and Cd exceeded these thresholds, indicating potential ecotoxicological risk

CONCLUSIONS

- Daphnia longispina* showed **consistent responses** to the metals.
- Sensitivity was determined through **LC50, NOEC, and LOEC values**, providing a comprehensive toxicity assessment.
- Daphnia longispina* was validated as a **reliable local bioindicator** for water toxicity.
- The study contributes to water quality monitoring, human health protection, and ecosystem conservation.
- The use of this bioindicator is recommended for future research and monitoring programs.

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Design of a semi -industrial electrochemical reactor for wastewater treatment with simultaneous hydrogen recovery

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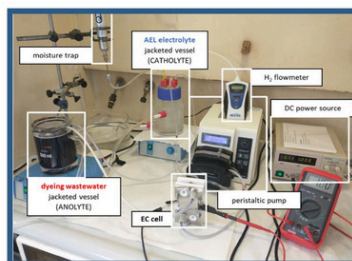


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INTRODUCTION

Electrochemical technology has been proven effective for the treatment of high-conductivity wastewater from various industrial sectors (textile, chemical, pharmaceutical). Water electrolysis simultaneously generates hydrogen, which can be used as a substitute for natural gas.

At the laboratory scale, an electrochemical cell with separation of compartments and an electrode surface area of 10 cm² has been developed. The anode oxidizes the organic matter in the wastewater, while the cathode generates hydrogen with a purity higher than 98%.



METHODS

Optimal current density was determined at laboratory scale, taking into account the treatment time and current density required.

A multicriteria method simplified from the AHP was applied, the resulting unitless vectors that consider time and energy consumption for each treatment are presented below. The most appropriate current density is determined by that alternative achieving lower values of these unitless vectors.

The optimal current density has been determined to be **150 mA/cm²**, corresponding to a hydrogen production rate of **1.1 mL H₂·cm² electrode/min.**

Alkali	Current density (mA/cm ²)		
	100	150	300
NaOH	0.79	0.62	0.70
Na ₂ CO ₃	0.69	0.57	0.81

The objective of this study is to select the components required to design a semi-industrial-scale electrochemical reactor.

RESULTS

Based on the optimal operating parameters obtained at the laboratory scale, the system is scaled up by a factor of 67, resulting in a reactor with an electrode surface area of 670 cm².

MAIN COMPONENTS OF THE SEMI-INDUSTRIAL REACTOR:

Electrochemical Cell:

Model: Electro Syn Cell

Electrode surface: 670 cm²

Electrode materials:

Anode: Ti-PtOx or BDD

Cathode: Ni



DC Power Supply:

Model: ATO-JK60150K

Maximum current: 150A

Maximum voltage: 60V



H2 Flowmeter:

Model: Avator

H₂ flow rate range: from

0,1 to 10 L H₂/min



Other Components:

Two 500-liter tanks to supply the anode and cathode

Dehumidifier to separate water vapor from the H₂

CONCLUSIONS

The construction of this semi-industrial electrochemical reactor will allow the treatment of **500 liters** of wastewater in a time ranging from 3 to 18 hours, depending on the characteristics of the water to be purified. During operation, the reactor will generate a constant hydrogen flow of **0.67 L/min**. This semi-industrial reactor will enable on-site demonstrations at textile, chemical, and pharmaceutical factory facilities.

ACKNOWLEDGEMENTS:

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DRINKING WATER QUALITY ANALYSIS IN THE COMMUNITIES OF BUENA VISTA AND THE ASOCIACIÓN DE USUARIOS DE LA LAGUNA LARATI (A.U.L.L)

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INTRODUCTION

The access to drinking water is a fundamental right that faces challenges in many rural and peri-urban communities in Bolivia, many of those communities rely on self-managed water systems that oversee catchment, storage and distribution of their drinking water. However, the lack of proper water treatment in some cases poses a risk to public health. To address this issue, our collective has implemented monitoring and capacity-building initiatives focused on water quality. This project aims to strengthen the capacity of self-managed water systems for human consumption in A.U.L.L. (Sacaba) and Buena Vista (Vinto). Through training community leaders in water sampling techniques, quality analysis, and resource management, we seek to assess physical, chemical, and biological parameters, ultimately improving both water quality and the efficient management of water resources.

METHODS

Two study areas were selected within the Cochabamba department; the Sindicato Agrario de Buena Vista, located in the municipality of Vinto, and the Asociación de Usuarios de la Laguna Larati (AULL), which consists of 12 neighborhoods in Sacaba. These two communities were chosen because they have self-managed water systems and have accessible representatives.

Three skill- building courses were conducted for the community representatives and plumbers to build their skills in water quality monitoring. The first course was purely theoretical, covering topics such as basin management, water quality, and drinking water regulations. Additionally, a mapping of the sampling points was conducted, identifying all water sources for human consumption, including wells, lakes, and springs.

In the practical course, participants were trained in water quality measurement using various analysis kits. Bacteriological testing was performed with a Palintest kit to identify thermotolerant and total coliforms. Physicochemical parameters were measured using a Lamotte kit, which assessed electrical conductivity, temperature, pH, alkalinity, and hardness. Turbidity was also determined with the Palintest kit, while the Exact iDip spectrophotometer was used for advanced chemical parameters such as iron, copper, manganese, nitrites, and nitrates.



Finally, in the results feedback and discussion course, the collected data was organized and compared to the limits established in NB 512, Bolivia's drinking water quality standard normative. A discussion followed, focusing on potential solutions to the specific issues identified in each community.

RESULTS

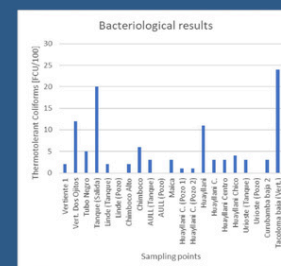
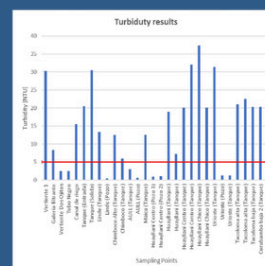
More than 25 people were trained as water monitors and watershed managers through certified courses accredited by the Ministry of Education of Bolivia. These individuals now have the knowledge and skills to conduct their own analyses, interpret the results, and request improvement projects from regional authorities.

The main issues of each sampling point were identified, with practical solutions proposed for community leaders. Special consideration was given to ensuring that these techniques and technologies do not significantly increase the system's operational costs, thus keeping service fees affordable. Additionally, residents were made aware of the importance of monitoring their water sources to improve their quality of life.

The main issues are the presence of coliforms and high turbidity. This is primarily due to the use of open distribution channels, which are highly susceptible to contamination. Additionally, the infrequent or nonexistent cleaning of storage tanks increases the problem.

Thanks to these courses, community members have initiated maintenance activities and started projects to improve their water collection sources, demonstrating that the training went beyond theoretical knowledge and led to tangible actions.

Figure 1 presents the turbidity results for each point and the limit of this parameter, also when the values exceeded the regulatory limits. Figure 2 displays the bacteriological results for each sampling point where the bacteriological test was made, also where the regulatory limits were exceeded.



CONCLUSIONS

The community was successfully made aware of the importance of monitoring and maintaining their water sources. Residents are now capable of handling physicochemical water quality analysis kits and interpreting the results.

A second phase of sampling is planned for 2025 to identify changes following community-led actions.

Local leaders are now aware of their situation and are seeking to adopt technologies to improve their self-managed water systems. Their goal is to maintain optimal water quality without significantly increasing operational costs, ensuring that service fees remain largely unchanged.

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STUDY PROPOSAL FOR A PROTOCOL FOR THE IDENTIFICATION OF MICROPLASTICS IN WATER BODIES

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INTRODUCTION

This study outlines a protocol for detecting microplastics in Bolivian water bodies using international guidelines (ECHA). Lab tests identified microscopy and FTIR as optimal methods. The five-step protocol (sampling, pretreatment, filtration, microscopy, FTIR) enables effective monitoring. Key recommendations: stakeholder collaboration, institutional capacity-building, and public awareness to protect health and ecosystems.

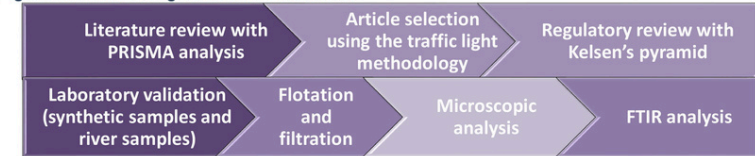
Figure 1. Definition of microplastic.

DIMENSIONS	ORIGIN
0.1 µm and 5 mm	Microplastics can originate from primary sources, such as microbeads in cosmetic products, or secondary sources, resulting from the fragmentation of larger plastic items like bottles and packaging. These pathways highlight the diverse origins of microplastic pollution, emphasizing the need for comprehensive strategies to address both production and waste management.
POLYMERIC MATERIALS	

METHODS

The methodology of this study is based on:

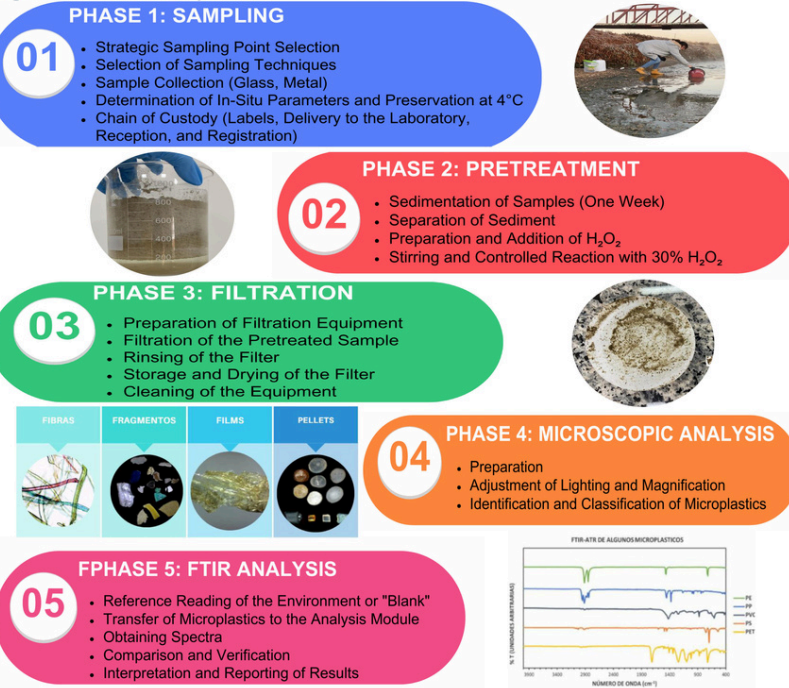
Figure 2. Methodologies used in research



RESULTS

This study proposed a structured five-phase protocol for identifying microplastics in water bodies in Bolivia, based on a comprehensive review of internationally validated laboratory methodologies and techniques.

Figure 3. Phases of the protocol.

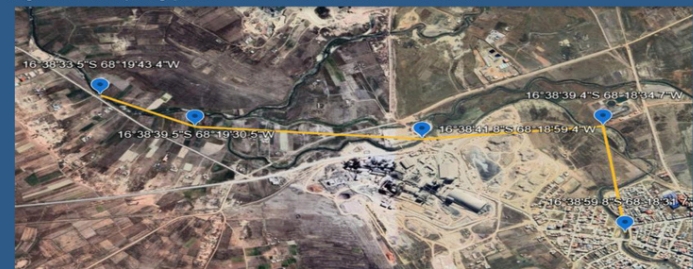


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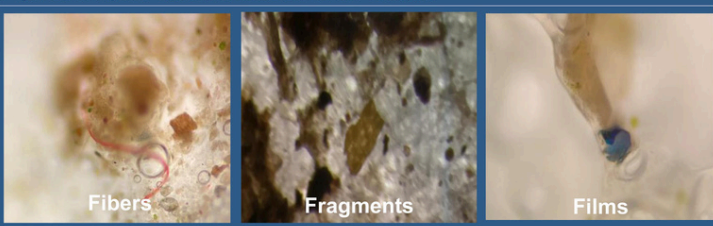
Four sampling points were identified along the Pallina River, selected based on their proximity to potential contamination sources and water currents.

Figure 4. Sampling points of the Pallina River – Viacha.



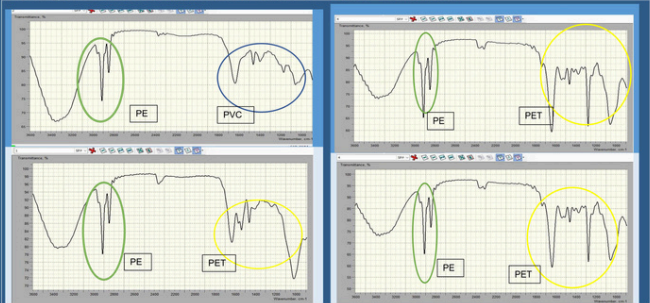
Microplastic fragments, fibers, and films were identified in all analyzed samples.

Figure 5. Polymer Spectra Identified in the Sample.



FTIR spectroscopy confirmed the presence of polymers such as PE (polyethylene), PET (polyethylene terephthalate) and PVC (polyvinyl chloride).

Figure 6. Types of Microplastics Found in Water Samples.



CONCLUSIONS

International methodologies like filtration, flotation, and FTIR spectroscopy are effective for identifying microplastics in water, as demonstrated in the Pallina River study. However, Bolivia lacks regulations for monitoring microplastics, hindering action against this pollutant. A five-phase protocol (Sampling, Pretreatment, Filtration, Microscopic Analysis, FTIR Spectroscopy) is proposed to systematically monitor microplastics, providing reliable data for decision-making. Microplastics pose significant risks to both the environment and human health, as they can accumulate in the food chain and enter the human body through water and food consumption causing inflammation, oxidative stress, and long-term health issues. This initiative aims to address these risks, raise awareness, and strengthen Bolivia's capacity to combat this emerging threat.



Evaluation of physicochemical exchanges between surface water of the Rocha River and groundwater in the Maica area (Cochabamba, Bolivia)



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INTRODUCTION

Currently, one of the main threats to the deterioration of aquifers is the decline in the quality of surface water. Interactions between surface water bodies, which receive wastewater discharges without prior treatment, and groundwater, lead to their contamination. Recently, it has been determined that there is a hydrodynamic interaction between the water of the Rocha River, a highly polluted urban river in Cochabamba (Bolivia) and the groundwater in the Maica area. Based on this evidence, the present study seeks to identify physicochemical exchanges between the surface water of the Rocha River and the groundwater of the Maica area in the dry season.

METHODS

The methodology used consists of three stages:

a) Characterization of the study area: 10 accessible wells were selected and geologically characterized. All of these wells were equipped with submersible pumps, allowing sampling of a continuous flow and three surface water points in three sections along the Rocha River, with potential changes in quantity and quality.

b) Hydrogeochemical characterization of the water bodies: Sampling and laboratory analysis were performed to determine the concentrations of cations: Ca^{2+} , Mg^{2+} , Na^{+} , K^{+} , and anions: HCO_3^{-} , SO_4^{2-} , Cl^{-} , NO_3^{-} , and NO_2^{-} . An ion balance was subsequently performed, discarding four points for being outside the $\pm 10\%$ error range.

c) Determination of physicochemical exchanges: Piper diagrams were used to identify the types of water according to their hydrogeochemical facies, and Stiff diagrams were used to classify the determined facies by color and plot them on a map along with the geographic position of the point that each one represented, to observe the proximity of these facies due to a possible physicochemical exchange between the water of the Rocha River and the groundwater.

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RESULTS

The study area is located on fluviolacustrine and current fluvial deposits, primarily composed of clay with high ionic activity. Additionally, the influence of water flow direction on the infiltration process is observed, with an increase in conductivity from SE to NW in the northern zone of the Rocha River and from NW to SE in the southern zone. Subsequently, the ionic content of groundwater and surface water samples (previously analyzed in the laboratory) was represented in Piper diagrams (Figures 1 and 2), where sampling points were classified according to their corresponding hydrochemical facies.

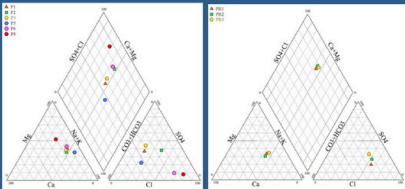


Figure 1 y 2. Piper diagram of the chemical composition of groundwater surface water

The identified facies at different points include calcium-sodium chloride bicarbonates (resulting from interaction with the geological environment), calcium-sodium chlorides, and calcium chlorides. The presence of chlorides is uncommon and may be attributed to anthropogenic factors, primarily due to the irrigation of agricultural areas with water from the Rocha River.

This hydrogeochemical map allowed for the visualization of water body mineralization and the spatial distribution of hydrogeochemical facies, enabling the correlation of physicochemical exchange with the similarity and proximity of the facies.

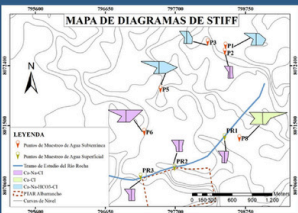


Figure 3. Stiff diagram map corresponding to the sampling points

CONCLUSIONS

The spatial distribution of the three identified hydrochemical facies provided evidence of physicochemical exchanges between surface and groundwater. Groundwater sampling points near the Rocha River exhibit the same hydrochemical facies as surface water sampling points. This information on existing physicochemical exchanges between both water bodies will support decision-making for efficient water management in the department. Furthermore, these results integrate groundwater resources into the management plans of the Rocha River basin to minimize and/or manage the impact of contamination transfer from surface water to groundwater.



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INTRODUCTION

Lithium is crucial for the global energy transition, but its extraction in salt flats like Uyuni in Bolivia involves a **critical water footprint**, due to the high water consumption in evaporation and purification processes, exacerbating scarcity in an arid region.¹

Additionally, the **carbon footprint** varies depending on the technologies used, posing challenges in salt flats with adverse climatic conditions. Bolivia, with the world's largest lithium reserves, faces unique challenges in Uyuni, such as a high magnesium-lithium ratio and intense rainfall, which hinder its competitiveness compared to salt flats in Argentina and Chile.² To position itself, Bolivia must adopt sustainable technologies and policies that minimize environmental impacts, especially on water resources.²

METHODS

For the analysis of the process of obtaining $\text{Li}_2\text{CO}_3\cdot\text{Se}$ OpenLCA 1.11 software was used for the modeling of the LCA. And the ecoinvent 3.9.1 database, with specific emission factors.³ And the AWARE Method, to assess water stress in the region. Life Cycle Assessment (LCA) Steps

Step 1: Defining Objectives and Scope Functional unit: 1 kg of Li_2CO_3 (99.5% purity). System limits: "From cradle to door" (extraction to the final product).

Step 2: Life Cycle Inventory (LCI) Data was collected on: Energy consumption (electricity and natural gas), use of fresh water and brine at each stage of the process.

Step 3: Life Cycle Impact Assessment (LCIA) Carbon footprint based on input and energy emission factors. Water footprint using specific AWARE coefficients for Uyuni.

Step 4: Interpreting Results The results were compared with those of other salt flats (Atacama, Hombre Muerto) and possible improvements in the process were analyzed.³

Table 1. Life Cycle Inventory of Salt Flats

Input	Atacama	Hombre Muerto	Uyuni (Calculate)	Uyuni EDL (Schenker)
Electricity [kWh]	0,4	0.8	1,7	3.9
Heat [MJ]	19	14	17	241
Water [kg]	38	43	81,17	336

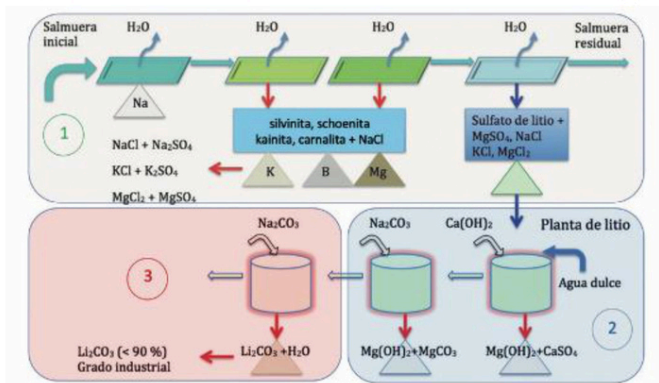


Figure 1. Li_2CO_3 Obtaining Process in Uyuni Source: (Sanjinés, 2022).⁴

RESULTS

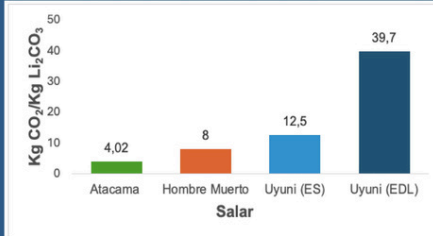


Figure 2. Carbon footprint of salt flats

This difference is due to: Low lithium concentration: Requires a larger volume of brine. High Mg/Li ratio: Elevates use of chemical reagents, Adverse weather: They decrease the efficiency of solar evaporation.⁵

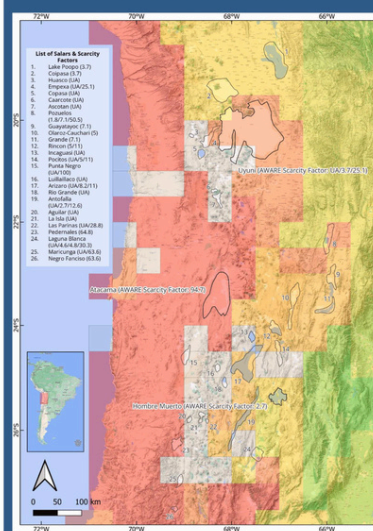


Figura 3. Lithium Triangle and their respective AWARE Fresh Water Scarcity Factors (SFs). Fuente: (Halkes, 2024).

Fuente: (Halkes, 2024)

Table 2. Volume of salt mixture and process water required by the Li_2CO_3 plant in Uyuni

No.	Type of input	t/h	m ³ /h	m ³ /d	m ³ /month	m ³ /year
1	Saturated brine	18,67	15,3	357,2	11.016,00	134.028,00
2	Process water	22,66	22,66	543,74	15.312,32	198.466,56
Total		41,32	37,96	910,94	27.328,32	332.494,56

Tabla 3. Water Footprint Analysis of Uyuni

WF	22,17 m³/t
AWARE_{CF}	25,1
WSF	8.345.613,46 m³eq. world/yea
WSF_{Specific}	556,37 m³eq. world/t

CONCLUSIONS

The Salar de Uyuni production process has a carbon footprint of 12.5 kg CO₂/kg Li₂CO₃, for 15,000 tons of Li₂CO₃. This is much higher than Atacama (4.02 kg CO₂/kg) and Hombre Muerto (8.0 kg CO₂/kg), due to low lithium concentration (0.035%), a high Mg/Li ratio (18.6), and harsh local conditions.

The water scarcity footprint is 556.37 m³ world eq./t Li₂CO₃, with a high AWARE factor (25.1), stressing water resource pressure and the need for more sustainable extraction technologies.

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“Water is Life”

Declaration of the 1st International Congress on Water Sustainability and Technology (IWaST).

The IWaST reaffirms the commitment of all participants in the search for comprehensive and collaborative solutions to climate change and water scarcity. From the IWaST, we emphasize the importance of the collective effort of society to raise awareness among current and future generations about the care of water resources and the need for good integrated water management, from the particularities of each context, in a common language accessible to all. The IWaST contributes its grain of sand to local and global collaborations to generate proposals for concrete, planned and coordinated solutions, leaving no one behind. It affirms the commitment of all actors involved in the search for comprehensive and collaborative solutions to climate change and water scarcity. From the IWaST, we emphasize the importance of the collective effort of the actors of society to raise awareness of current and future generations about the care of water resources and the need for good integrated water management, from the particularities of each context, in a common language accessible to all. The IWaST contributes its grain of sand to local and global collaborations to generate proposals for concrete, planned and coordinated solutions, leaving no one behind.

At the IWaST we have had the privilege of having the participation of researchers, civil society organizations, public and private entities, and non-governmental organizations, who have given us their views on the current state of integrated water management and the possible technologies, methodologies and analysis typologies that will allow us to find solutions to ensure water sustainability in the future.

“It is time to walk together towards a comprehensive and participatory solution to achieve sustainable water management”.

Conclusions

Conclusions and commitments for the future

IWaST 2025 highlighted the urgent need for adequate water management, underlining international and local cooperation to ensure the availability and sustainable use of water. The event strengthened the exchange of knowledge, presented innovative methodologies and reaffirmed the commitment of the academic and scientific community to the development of concrete solutions for the future of water.

The Universidad Católica Boliviana “San Pablo” reaffirms its commitment to research and care for the Common Home, promoting initiatives such as IWaST 2025, as spaces for dialogue and knowledge generation, where academia, civil society and institutions work together to address the challenges of climate change.



Congress participants on the last day of IWaST 2025



Acknowledgements

This event was made possible by the combined efforts and dedication of the committees involved. On behalf of the IWaST Board of Directors, we would like to express our sincere gratitude to all the people and institutions that made this initiative possible.

We would like to express our special gratitude to Father Manuel for generously opening the doors of the Faculty of Theology to us, as well as to his team, whose collaboration has been fundamental from the earliest stages of organization.

We are grateful for the valuable support of the team of volunteers and the audiovisual team of UCB SECRAD, whose dedication made it possible to capture and share the most important moments of the event.

We thank the Bolivian universities that participated and supported this activity: UCB, EMI, UAGRM, UMSS (CASA), UNIVALLE, UMSA, UAJMS, San Francisco Xavier and the Stockholm Environment Institute (SEI), among others.

At the international level, we are grateful for the collaboration of Universitat Politècnica de Catalunya (Spain), Pontificia Universidad Javeriana (Colombia), Federal University of Bahia (Brazil), HafenCity Universität (Germany), and Universidad Peruana de Ciencias Aplicadas (Perú)

We also greatly appreciate the support of non-academic institutions, including: The Autonomous Municipality of Santa Cruz de la Sierra, the Bolivian Platform against Climate Change, the Vice Ministry of Drinking Water and Sanitation, AGUATUYA, IWA Bolivia, ABIS and AECID.

To all of you, thank you for being part of this collective construction around water management, research and capacity building to face current and future challenges.

Together, we will continue to work for the sustainable, equitable and conscious management of water, a vital resource that unites and commits us.

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