SUSTAINABILITY 2023-2024

COMMUNICATION ON ENGAGEMENT (COE)

13 CLIMATE ACTION

PUBLICATIONS TOWARD CLIMATE ACTION

In the past two years, university researchers have made notable strides in various areas related to SDG13, despite the challenges posed by Lebanon's financial crisis, the Beirut blast, and the post-COVID recovery period. In the realm of sustainable construction aterials, investigations were conducted on the impact of recycled waste on concrete elasticity, the characteristics of geopolymer concrete incorporating recycled steel slag and fly ash, and the performance of beams containing ceramic waste powder. Environmental and chemical engineering efforts included the ultrasound-assisted creation of catalysts for CO2 methanation and the production of bioethanol from biomass. Progress in electrochemistry and energy featured reviews of applied electrochemistry and evaluations of solar cooling systems. Climate and environmental research improved paleoclimate reconstructions and utilized geoinformation to monitor protected areas.
Innovative technology research focused on nanomaterials for hydrogen production and carbon nanomaterials derived from biogas reforming. Additionally, studies in sustainable development and finance discussed the development of improved cookstoves for sustainable household cooking. These efforts underscore a commitment to advancing knowledge and creating sustainable solutions across multiple disciplines.

1. Abdayem, J., Saba, M., & Aouad, G. (2023). **Elaboration of a sustainable bottom ash geopolymer material.** In E3S Web of Conferences. Open access.
2. Abou Rachied, T., Dbouk, F., Hamad, B.S., & Assaad, J.J. (2023). **Structural behavior of beams cast using normal and high strength concrete containing blends of ceramic waste powder and blast furnace slag.** Cleaner Materials. Open access.
3. Absi, J., Adgham, S.A., Sabalbal, G., Arairo, W., & Saba, M. (2023). **Sustainable approach in the restoration of historical monuments using geopolymer material.** In E3S Web of Conferences. Open access.
4. Ahıskalı, A., Ahıskalı, M., Bayraktar, O.Y., Kaplan, G., & Assaad, J.J. (2024). **Mechanical and durability properties of polymer fiber reinforced one-part foam geopolymer concrete: A sustainable strategy for the recycling of waste steel slag aggregate and fly ash.** Construction and Building Materials.
5. Anchukaitis, K.J., Touchan, R., Meko, D.M., Krcmaric, J., & Cook, B.I. (2024). **Enhancing spatiotemporal paleoclimate reconstructions of hydroclimate across the Mediterranean over the last millennium.** Climate Dynamics. Open access
6. Assaf, J.C., Mortada, Z., Rezzoug, S.A., Debs, E., & Louka, N. (2024). **Comparative Review on the Production and Purification of Bioethanol from Biomass: A Focus on Corn. Processes.** Open access.

7. Chaghouri, M., Younis, A., Ciotonea, C., Gennequin, C., & Abi-Aad, E. (2024). **Nanomaterials and biomass valorization for hydrogen production. In Hydrogen Technology: Fundamentals and Applications.**
8. El Hage, M., Louka, N., Rezzoug, S.A., Debs, E., & Maache-Rezzoug, Z. (2023). **Bioethanol Production from Woody Biomass: Recent Advances on the Effect of Pretreatments on the Bioconversion Process and Energy Yield Aspects.** Energies. Open access.
9. El Hassan, N., Jabbour, K., Fakeeha, A.H., Bader Alreshaidan, S., & Al-Fatesh, A.S.A. (2023). **Production of carbon nanomaterials and syngas from biogas reforming and decomposition on one-pot mesoporous nickel alumina catalysts.** Alexandria Engineering Journal. Open access.
10. El Mir, A., Fayad, E., Assaad, J.J., & El-Hassan, H. (2023). **Multi-Response Optimization of Semi-Lightweight Concrete Incorporating Expanded Polystyrene Beads.** Sustainability (Switzerland). Open access.
11. Gerges, N.N., Issa, C.A., Khalil, N.J., & Aintrazi, S. (2024). **Effects of recycled waste on the modulus of elasticity of structural concrete.** Scientific Reports. Open access.
12. Ghannoum, M., Assaad, J.J., Daaboul, M., & El Mir, A. (2024). **Deterministic and stochastic finite element modeling of reinforced concrete beams without stirrups containing plastic wastes.** International Journal of Building Pathology and Adaptation.
13. Kaneriya, Y., Dohare, D., & Khatib, M. (2024). **Reimagining Household Cooking: A Critical Assessment of Improved Cookstoves Implementation for Sustainable Development.** In Lecture Notes in Civil Engineering. Open access.
14. Khatib, J.M., ElKhatib, L.W., Assaad, J.J., & El Kordi, A.A. (2023). **Properties of mortar containing Phragmites Australis Ash.** Journal of Engineering, Design and Technology.
15. Lahoud, C., Brouche, M.E., Lahoud, C., & Hmadi, M. (2023). **Thermo-Economic Comparison of Solar Thermal Cooling and Solar Photovoltaic Cooling Systems for a Typical Residential Building - Lebanese Case Study.** In 2023 IEEE 4th International Multidisciplinary Conference on Engineering Technology, IMCET 2023.
16. Mitri, G.H., Bechara, J., Stephan, J.M., McKenna, M., & Choueiter, D. (2023). **Geoinformation applications for monitoring protected areas in Lebanon.** In Proceedings of SPIE - The International Society for Optical Engineering.
17. Nasr, Y., Zakhem, H.E., Hamami, A.E.A., El Bachawati, M., & Belarbi, R. (2023). **Comprehensive Review of Innovative Materials for Sustainable Buildings' Energy Performance.** Energies. Open access.
18. Obeid, M., Poupin, C., Labaki, M., Schnee, J., & Abi-Aad, E. (2024). **Influence of the ultrasound power density in the ultrasound-assisted synthesis of Ni-based LDH catalysts for CO2 methanation.** Journal of Environmental Chemical Engineering.
19. Obeid, M., Poupin, C., Labaki, M., Schnee, J., & Abi-Aad, E. (2023). **CO2 methanation over LDH derived NiMgAl and NiMgAlFe oxides: Improving activity at lower temperatures via an ultrasound-assisted preparation.** Chemical Engineering Journal. Open access.
20. Saba, M., Arairo, W., Sabalbal, G., El Bachawati, M., & Absi, J. (2023). **Use of aluminum powder for the development of a sustainable paste used in the restoration of historical monuments.** In E3S Web of Conferences. Open access.
21. Shantha Kumari, K.G., Jaheer Mukthar, K.P., & El Rahhani, G.N. (2024). **Green Finance in India: Driving Sustainable Development and Economic Growth.** In Studies in Systems, Decision and Control.

22. Yammine, P., El-Nakat, H., Kassab, R., Matar, Z., & Chmayssem, A. (2024). **Recent Advances in Applied Electrochemistry: A Review.** Chemistry (Switzerland). Open access.

2ND ANNUAL GEOHEALTH HUB CONFERENCE "CLIMATE CHANGE & HEALTH IN MENA"

The Public Health Department at the Faculty of Health and Sciences organized the 2nd Annual GeoHealth Hub Conference "Climate Change & Health in MENA" on the university's main campus in Koura. This conference aimed to bring together researchers, professionals, and climate change experts from around the world to exchange knowledge, ideas, and discussions on climate change issues and its impact on health in the Middle East and North Africa region.
The GeoHEalth Hub conference was attended by the Minister of Public Health, Dr. Firas Abiad, and the Director of the Land & Natural Resources Program at the Institute of Environment at UOB, Dr. Georges Mitri, representing the Minister of Environment, Dr. Nasser Yassin. Also present were the President of the University of Balamand, Dr. Elias Warrak, representatives from the World Health Organization (WHO), UNICEF, the United Nations Development Program, and the International Organization for Migration, as well as deans of the university, professors, and a number of students.

LAUNCH OF UOB'S CLIMATE ACTION PLAN

The University of Balamand's Climate Action Plan **(UOB-CAP33**) outlines a comprehensive strategy to address climate change and promote sustainability across its four campuses. The plan aligns with Sustainable Development Goal 13 and focuses on several priority sectors, including governance, energy, research, transportation, sustainable procurement, waste management, outreach, and water conservation. Key goals include institutionalizing
climate action, improving energy efficiency, diversifying renewable energy sources, supporting sustainable transportation, and promoting responsible water consumption. The plan also emphasizes the importance of research, community based climate actions, and capacity building. **UOB-CAP33** is overseen by various working groups, each dedicated to specific areas such as waste management, energy, and outreach, ensuring a coordinated and effective approach to sustainability.

UOB KOURA CAMPUS CARBON FOOTPRINT REPORT

The University of Balamand (UOB) has released its **Carbon Footprint Report** for the Koura Campus, conducted by the UOB Life Cycle Assessment (LCA) center within the Chemical Engineering Department. Under the supervision of Dr. Rima Manneh, the report reveals that in 2022, the campus generated a total of 3,764.03 tonnes of CO_2 equivalent (CO_2eq) emissions, with Scope 1 emissions (direct emissions) accounting for 3,524.88 tonnes and Scope 2 emissions (indirect emissions from purchased electricity) accounting for
239.16 tonnes. The gross area of the campus is 110,481.78 square meters, resulting in a carbon intensity of 34.07 kg CO_2eq per square meter. The university is committed to reducing its carbon footprint and aims to achieve net zero emissions by

IEEE GRAND TECH LEBANON

The Tripoli El Fayhaa Nursery was officially handed over to the Mayor of Tripoli, Dr. Eng. Ahmad Kamareddine, on behalf of the Municipality, in a ceremony attended by representatives from the German Embassy in Lebanon and the European Union to Lebanon. Amid challenging times for Lebanon, greenery production in the nursery will not only increase the amount of green space in the city but also enhance its appeal to tourists and provide recreational spaces for residents to exercise, meet, and socialize. This collaboration between the municipality of Tripoli and the Agricultural Value Chain Development Center (AVCDC) at the University of Balamand and the Local Development Programme for Urban Areas in North Lebanon (UDP_NL) exemplifies how joint efforts and a common vision can lead to remarkable achievements.

MOU BETWEEN UOB AND THE LEBANON GREEN BUILDING COUNCIL

The University of Balamand (UOB) and the Lebanon Green Building Council (LGBC) signed a Memorandum of Understanding (MOU) that aims at creating and executing a program that addresses the need for specialized technological skills in the green building sector in Lebanon. The MOU was signed by Dr. Elias Warrak, President of UOB and Engineer Pierre Dammous, President of LGBC, in presence of Dr. Elie Karam, Dean of Issam Fares Faculty of Technology at UOB. Both parties are aligned on the importance and the necessity of improving the prevailing building, energy, and environmental conditions in Lebanon. Towards this end, UOB and LGBC will be organizing activities to enhance green building practices and raise awareness in this field.

DR. MYRIAM MRAD'S LEADERSHIP IN CLIMATE-RELATED HEALTH INITIATIVES

Dr. Myriam Mrad, Chairperson of the Public Health Department, has been actively involved in various high-profile initiatives and meetings that underscore the department's commitment to tackling climate-related health issues. In February 2024, she participated in the International Human Exposome Network (IHEN) meeting in Brussels. As a WHO invitee, she contributed to the Alliance for Transformative Action on Climate and Health (ATACH) Global Meeting in Madrid, Spain, focusing on transforming health systems to address climate change. This meeting built upon the outcomes of COP26, COP27, and COP28, aiming to refine strategic directions and support countries in advancing climate and health implementation. Dr. Mrad also presented on climate change and health research at the Ministry of Environment in Lebanon, discussed air pollution and health effects in Beirut, and participated in consultations on climate and health research agendas. These activities highlight the Public Health Department's proactive role in addressing environmental health challenges and promoting sustainable health practices.

UOB LCA CENTER AND MATELEC S.A.L. COLLABORATION SUCCESS

The Life Cycle Assessment (LCA) Center at the University of Balamand (UOB), a pioneering entity in Lebanon and the MENA region, has partnered with Matelec S.A.L., a leading Lebanese contractor and manufacturer of electrical equipment. This collaboration aims to advance the UN Sustainable Development Goals through comprehensive environmental assessments. The LCA Center has conducted various projects for Matelec, including carbon footprint studies and environmental product declarations. This partnership highlights the importance of sustainable practices and aims to inspire further industry collaborations.

GIS PROJECTS FOR CLIMATE ACTION

GIS Course Projects Overview - Remote Sensing and GIS for Climate Action:

- Sustainable Urban Development and Green Infrastructure Planning: Map urban hazards and develop prevention plans.
- Tsunami Simulation due to Climate Change: Model tsunamis from sea earthquakes in 3D and create preparedness plans for coastal cities.

Course - Introduction to Geographic Information System:

Earthquake Simulation and Preparedness: Simulate earthquake impacts in Lebanon in 3D and develop evacuation plans.

- Mapping Cultural Heritage Sites: Map UNESCO cultural heritage sites in the Arab region for preservation.
- Earthquake Hazard Atlas (1960-2024): Create an atlas to predict earthquake-prone areas and develop mitigation policies.
- Flood Hazard Atlas (1960-2024): Generate an atlas to predict flood-prone areas and develop mitigation policies.
- Public Transportation Management: Design a public transportation network for urban areas in Lebanon to ensure accessibility and connectivity.

ADDRESSING EARTHQUAKE ENGINEERING CHALLENGES

The Issam Fares Faculty of Technology at the University of Balamand (UOB) hosted a lecture on February 13th at the UOB Souk el Ghareb campus, titled "Tackling Engineering Construction Challenges Arising from the Devastating Earthquake in Turkey and Strategies for Risk Mitigation." Presented by Dr. Milad al Khatib, the lecture covered key topics such as structural and nonstructural factors affecting building stability during earthquakes, the damage caused by the recent earthquake in Turkey, and preventive measures for earthquake resilience. The event, initiated by Dr. Wahib Arairo, provided valuable insights into mitigating construction engineering risks post-earthquake, underscoring the university's dedication to advancing knowledge and resilience against natural disasters.

CAMPUS CLEANING INITIATIVE

At the end of the summer semester 2023-2024, the GoGreen Club spearheaded a comprehensive campus cleaning initiative, rallying the support of numerous university students. This collaborative effort aimed to enhance the campus environment by removing litter, sorting recyclables, and promoting sustainable practices.

COLLABORATIVE JOURNEY TOWARDS SUSTAINABILITY

On February 2nd, 2024, the Eco Club and the Institute of the Environment at the University of Balamand, in collaboration with Lycée Franco-Libanais Alphonse de Lamartine, launched a three-year project called the 'Atlas de la Biodiversité du Lycée Alphonse de Lamartine'. This initiative aims to create a biodiversity atlas and establish a museum to showcase the campus's flora and fauna. The project focuses on student education and environmental responsibility through workshops and conservation efforts. Dr. Manal Nader highlighted the importance of collaboration and education for a sustainable future.

RECONSTRUCTING THE IMPACT OF HEAVY INDUSTRIES ON AIR AND SOIL QUALITY USING A DENDROCHRONOLOGICAL APPROACH.

On February 2nd, 2024, the Eco Club and the Institute of the Environment (IOE) at the University of Balamand, in partnership with Lycée Franco-Libanais Alphonse de Lamartine, launched the 'Atlas de la Biodiversité du Lycée Alphonse de Lamartine' project. This three-year initiative aims to create an atlas of biodiversity and establish a museum showcasing the campus's flora and fauna. The project focuses on educating students and fostering environmental responsibility through workshops and conservation efforts. Dr. Manal Nader emphasized the importance of collaboration and education in achieving a sustainable future, aligning with the United Nations' Sustainable Development Goals (SDG 15).