n. 1	Supervisor	Valeria Mezzanotte

Title BIOLOGICAL TREATMENT OF PFAS CONTAMINATED EFFLUENTS

The research is part of the project LIFE CAPTURE focused on the remediation of PFAS contaminated soils and groundwaters. For soils, the first step is the foam fractionation to extract PFAS, followed by a treatment train including biological treatment, photochemical oxidation and adsorption on activated carbon to remove them from the resulting foam. Biological treatment is expected to remove all the oxidizable compounds that could decrease the performance of the following photochemical oxidation and the final adsorption step should remove the remaining contaminants or the produced by-products.

The proposed research project will deal with the optimization of the biological treatment of foams, based on two lab-scale plants: one based on conventional activated sludge and the other one based on a MBR process. The research will be carried out at DISAT, where the two lab-scale plants are already available. COD and NH₄-N removal rate and efficiency for different operation parameters as well as for the composition of the microbial population within the reactors will be evaluated. Ecotoxicity tests will also be performed before and after treatment. The results will provide the basis for the last steps of the project consisting of the design, construction and operation of a large pilot plant.

The PhD candidate will spend about 6 months abroad, working, in Genk (Belgium), at Green Soil Group a partner of CAPTURE project.

Funding from LIFE CAPTURE project will be available

Supervisor webpage: https://www.unimib.it/valeria-federica-maria-mezzanotte

n. 2		Supervisor	Sara Villa	
Title	DETECTION AND MONITORING THE PRESENCE OF NANOPLASTICS			
	IN FRESHWATER ALPINE ENV	IRONMENTS		
The project will focus on plastic pollution, a pressing global environmental issue that still lacks sufficient research, particularly on nanoplastics.				
The aim is to gather data on the extent of nanoplastic pollution in Alpine aquatic ecosystems.				
Biological and environmental samples collected in high altitude areas in the Alps will be				
prepared for final identification and semi-quantification based on the nature of the biotic or				
abiotic matrices (e.g. Broton-transfer-reaction mass spectrometry). To determine the surrent				

abiotic matrices (e.g. Proton-transfer-reaction mass spectrometry). To determine the current level and effects of nanoplastic contamination in the organisms, the existing protocols has to been adapted considering that these species are under extinction due to climate and environmental changes.

This project proposal will be developed as part of an Italian network with MUSE-Museo delle Scienze of Trento (Climate and Ecology Unit) and Eurac Research (Institute for Alpine Environment). A period of 6 months is foreseen at the beginning of the second year of the PhD period.

The following additional fund is available for the sustainability of the project (2023-UNIMA2A-0367490).

Supervisor webpage: https://www.unimib.it/sara-villa

Notes: Scholarship funded by Eurac Research and MUSE-Museo delle Scienze of Trento

TitleSTRATIGRAPHIC SERIES FROM HIGH-ALTITUDE AREAS: ARCHIVES OF THE ENVIRONMENTAL, LAND USE AND CLIMATIC HISTORY OF THE ALPS DURING THE LAST MILLENNIAResearch description. Sedimentary records from lakes and mires are valuable archives of the past thanks to biotic and abiotic proxies therein preserved, shedding light on the history of plant ecosystems, climate variability and the interplay between environment-climate-humans. This project will focus on high altitude areas in the Alps where the information on past ecosystems and biodiversity changes, human interference from prehistoric to modern times (agropastor and biodiversity changes, etc.) and climate history are still poor. Stratigraphic of subsister economy, land use changes, etc.) and climate history are still poor. Stratigraphic content (fossil pollen/spores/algae, charcoal, coprophilous fungi as proxies of past herbivores occurrence and density), sedimentary properties (composition, grain size, organic C and total N, iron and phosphorus compounds, etc.), and ¹⁴ C dated to set in a robust chronological frame all the charges that will be reconstructed from the proxies series. The project will run within the ongoing "Convenzione Quadro" between CNR - UNIMIB and on "Convenzione Operativa" between CNR IGAG - UNIMIB DISAT. Duration of the period to be spent abroad: 6 months. Additional fundings to support the research: Project Pascoli-Amo - PSR Lombardy Region (Prof. Roberto Comolli) Projects REIST and ALPS (CNR-IGAG, titolare dei fondi Dr.ssa Roberta Pini)	n. 3		Supervisor	Roberto Comolli	
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Supervisor webpage: https://www.unimib.it/roberto-comolli	HISTORY OF THE ALPS DURING THE LAST MILLENNIA Research description. Sedimentary records from lakes and mires are valuable archives of the past thanks to biotic and abiotic proxies therein preserved, shedding light on the history of plant ecosystems, climate variability and the interplay between environment-climate-humans. This project will focus on high altitude areas in the Alps where the information on past ecosystems and biodiversity changes, human interference from prehistoric to modern times (agropastoral practices and the establishment of permanent alpine pastures, regional models of subsistence economy, land use changes, etc.) and climate history are still poor. Stratigraphic records from sensitive areas will be selected and analyzed for their micro- and macrobotanical content (fossil pollen/spores/algae, charcoal, coprophilous fungi as proxies of past herbivores occurrence and density), sedimentary properties (composition, grain size, organic C and total N, iron and phosphorus compounds, etc.), and ¹⁴ C dated to set in a robust chronological frame all the changes that will be reconstructed from the proxies series. The project will run within the ongoing "Convenzione Quadro" between CNR - UNIMIB and on "Convenzione Operativa" between CNR IGAG - UNIMIB DISAT. Duration of the period to be spent abroad: 6 months. Additional fundings to support the research: Project Pascoli-Amo – PSR Lombardy Region (Prof. Roberto Comolli) Projects PREIST and ALPS (CNR-IGAG, titolare dei fondi Dr.ssa Roberta Pini)				

n. 4		Supervisor	Chiara Urani
Title	INTERPLAY BETWEEN ENVIRON AND NEURODEGENERATIVE APPROACH	MENTAL META PROCESSES:	L CONTAMINATION AN INTEGRATED

Background Epidemiological and environmental data suggest a role played by metal exposure through inhalation and ingestion to an increased risk of developing neurological disorders, such as the amyotrophic lateral sclerosis (ALS). Only around 10% of ALS cases are related to genetic mutations. The remaining 90% are related to environmental factors, or to an interplay between the environment and genetic causes.

Project aims *i*) identification and characterization of metal contamination in areas with high anthropic impact and incidence of ALS; *ii*) study of metals' role and mechanisms in processes of neurotoxicity and neurodegeneration, with particular attention to ALS; *iii*) identification of possible correlation between sources of exposure and neurotoxicity.

Project activities 1) Collection from databases (e.g., from the Regional Agencies for Environmental Protection), elaboration, and analyses of metal concentrations in different environmental matrices; 2) Biological investigations using advanced cell models of target tissues (e.g., co-cultures and 3D models) for mechanistic studies of neurotoxic metals' effects; 3) Analytical analyses (e.g., ICP-MS) for metal accumulation and kinetics in biological systems.

This project will be developed within the existing interdisciplinary collaboration with the Interuniversity Research Centre MISTRAL, and other Universities (UniMI). In addition, the ETT company will provide knowledge and technical skills in the field of *in vitro* neurotoxicology.

The candidate is expected to spend the period abroad at research laboratories within the network of collaborations (e.g., Laboratory of Molecular Pathology, Institute of Pathology (EOC), Locarno, Switzerland, for single gene methylation or methylome studies, see https://doi.org/10.1038/s41467-023-40873-y).

Supervisor webpage: https://www.unimib.it/chiara-urani

University of Milano-Bicocca

PhD Course in Chemical, Geological and Environmental Sciences

Call for Interest 40th cycle – session I - Curriculum "Terrestrial and Marine Environmental Sciences"

n. 5		Supervisor	Giovanni Zambon
Title	EXPLORING THE IMPACTS OF CHANGES ON MOUNTAIN SOUNDSCAPE APPROACHES	ANTHROPIZAT ECOSYSTEM:	ION AND CLIMATE LANDSCAPE AND

Accelerating high-altitude climate warming and anthropogenic disturbances drastically alter the mountain ecosystem, including the soundscape, species distributions, and compositions of plant communities. Furthermore, these changes directly affect human perception and quality of life.

This study aims to evaluate the effect of anthropogenic noise and climate changes on protected mountain environments using landscape and soundscape approaches, including people's experience in natural spaces.

Vegetational data and biodiversity indicators will be assessed by in-field surveys and remote sensing techniques. Meanwhile, passive acoustic monitoring will be used to monitor noise and the presence of faunistic species. Using eco-acoustic indices and its spatial and temporal distribution, it will be possible to correlate the soundscape complexity and temporal dynamicity with the area biodiversity and the environmental quality. Lastly, human perception of the acoustic climate will be assessed using psychoacoustics indexes. These data would be integrated with landscape parameters to perform an in-depth analysis of anthropogenic disturbances and climate changes.

These multidisciplinary approaches can provide valuable insights into mountain territorial planning by identifying priority areas for sustainable management of natural resources and biodiversity conservation.

Supervisor webpage: https://www.unimib.it/giovanni-zambon

University of Milano-Bicocca

PhD Course in Chemical, Geological and Environmental Sciences

Call for Interest 40th cycle – session I - Curriculum "Terrestrial and Marine Environmental Sciences"

n. 6		Supervisor	Sandra Citterio
Title	EXPLORING THE POTENTIAL OF	PLANT-MICRO	DBE INTERACTIONS
	AND BIOCHAR FOR THE REST	ORATION AND	REMEDIATION OF
	DEGRADED SOILS		

Nowadays, one of the most concerning issues that the world is facing is land degradation. It is defined as a set of human-induced processes leading to reduction or loss of biological or economic productivity, that result in decreased yields, incomes, food security, and in the loss of vital ecosystem services. Among the factors causing land degradation in farming areas there are soil pollution and overgrazing. The identification and proper implementation of suitable technologies for the restoration or remediation of these soils is, thus, a prerequisite for sustainable development.

Among nature-based solutions, many technologies exploit the characteristics and interactions of plants and microorganisms to improve soil quality in terms of reducing erosion and compaction of surface horizons and removing/degrading contaminants.

A strategy to improve the efficiency of these technologies, such as phytoremediation, is to explore the plant-microbe interactions along with the use of soil amendments including biochar. The plant symbiotic relationships with bacteria and fungi, indeed, lead to a number of benefits such as the promotion of plant growth and the mobilization of nutrients that are not readily available to plants, especially in degraded soils.

This project aims at exploring and exploiting the potential of plant-microbe interactions for the restoration of overgrazed lands and/or the remediation of soils polluted by metals and hydrocarbons. Biomolecular techniques, including microscopy and flow cytometry, along with chemical methodologies, will be applied to study the molecular interplay between plants and microbial communities. Root endophytic and rhizosphere microorganisms, resistant to contaminants and with plant growth promoting (PGP) traits, will also be identified and isolated. The selected microbe consortia will be used to inoculate suitable plants species and to produce a microbe-colonized-biochar to improve the persistence of these microorganisms in degraded soils. In a perspective of circular economy, waste plant biomass will be considered among biochar feedstocks. Experiments will be undertaken under laboratory and field conditions. The project will involve foreign institutions active in the study of plant symbiosis and the University of Azuay (Ecuador). The period to be spent abroad will be at least 6 months.

Supervisor webpage: https://www.unimib.it/sandra-citterio

University of Milano-Bicocca

PhD Course in Chemical, Geological and Environmental Sciences

Call for Interest 40th cycle – session I - Curriculum "Terrestrial and Marine Environmental Sciences"

n. 7		Supervisor	Barbara Leoni	
Title	INTERPLAY OF INLAND WATER E	COSYSTEMS AN	D CLIMATE CHANGE	
	DYNAMICS ACROSS DIVERSE BIOMES			
Freshwater systems provide pivotal ecosystem services, and their role is even more important in the context of climate change, which threatens the quality and availability of these fundamental resources. Additionally, their contribution in providing positive feedback to the global climate is increasingly acknowledged, supported by evidence indicating that global warming has heightened greenhouse gas emissions (e.g. methane) from freshwater ecosystems. Long-standing environmental issues affecting lakes and rivers continue to persist without effective resolution. Inland waters are currently facing increased stress due to the cumulative and, at times, mutually reinforcing effects of climate change and pre-existing challenges, such as eutrophication. These challenges affect ecosystems across various biomes, ranging from extreme environments like glacial habitats to temperate and tropical systems. However, there remains a gap in our comprehensive understanding of how global processes intersect with specific stressors and local conditions				
This project aims to integrate long-term data from freshwater ecosystems with field-collected data and real-time, spatially explicit observations of water quality. By doing so, we seek to comprehend the functioning of these ecosystems and their responses to various anthropogenic stressors. The analyses will encompass a range of ecosystems, allowing us to grasp the scale of processes and assess whether the pace of change varies based on individual characteristics or prevailing mechanisms influencing their variability. This will broaden our understanding beyond temperate latitudes.				
We envision international collaborations with scientific networks such as GLEON (Global Lake Ecological Observatory Network) and with foreign universities like the University of Nevada, Reno (USA) and the Royal University of Phnom Penh (Cambodia). These collaborations would provide Ph.D. students with opportunities to spend time abroad.				

Supervisor webpage: https://www.unimib.it/barbara-leoni