

**Scienze Chimiche, Geologiche e Ambientali,  
curriculum Scienze Geologiche  
Chemical, Geological and Environmental Sciences,  
curriculum Terrestrial and Marine Environmental Sciences**

<p><b>Progetto di ricerca</b> <b>Research project</b></p>	<p><i>“Definizione, misurazione e quantificazione dei servizi ecosistemici negli interventi di rigenerazione urbana” – SCGA. 1</i></p> <p><i>“Definition, measurement, and quantification of ecosystem services in urban regeneration interventions” - SCGA. 1</i></p>
<p><b>Tipo</b> <b>Type</b></p>	<p>Borsa PNRR cofinanziata ex D.M. 118/2023 Scholarship PNRR co-funded ex D.M. 118/2023</p>
<p><b>Borse</b> <b>Scholarships</b></p>	<p>1</p>
<p><b>Abstract</b></p>	<p><b>ITA</b></p> <p>Gli interventi di rigenerazione urbana si basano spesso sui concetti di infrastrutture verdi e Nature Based Solutions (NBS), ed hanno come scopo la riduzione di una serie di effetti negativi propri dell’ambito urbano e il simultaneo miglioramento dello stato ecologico dell’area.</p> <p>Obiettivo del progetto è valutare e quantificare i servizi ecosistemici (SE) offerti dagli interventi di rigenerazione urbana. La valutazione dovrà avvenire considerando tutti gli aspetti compresi nei servizi ecosistemici: ecologici, sociali ed economici. Per raggiungere questo obiettivo si propone di definire una analisi quali-quantitativa multiscalarare e transdisciplinare, individuando diversi contesti in cui sono stati progettati interventi di rigenerazione urbana.</p> <p>Il candidato dovrà sviluppare un progetto utilizzando diverse metodologie, finalizzate a definire i diversi SE (C-stock, rimozione degli inquinanti, incremento della biodiversità, impollinazione, culturali) e a definirne anche l’impatto sociale ed economico. Per questo motivo lavorerà con tecniche differenti, quali e-DNA, droni, LAI, monitoraggio termico, misure di raccolta ed analisi dei dati quantitativi sociali ed economici, integrando i dati raccolti nei diversi casi studio.</p> <p>Le priorità della transizione digitale e della biodiversità verranno garantite da un’azione di monitoraggio dello stato di conservazione della biodiversità nelle aree di intervento utilizzando mappe digitali ricavate anche dall’elaborazione dei dati raccolti.</p> <p><b>ENG</b></p> <p>Urban regeneration interventions are often based on the concepts of green infrastructure and Nature Based Solutions (NBS) and aim at reducing negative effects typical of the urban environment and at the same time improving the ecological status of the area.</p> <p>The aim of the project is to evaluate and quantify the ecosystem services (SE) offered by urban regeneration interventions. The evaluation will have to take place considering all aspects included in ecosystem services: ecological, social, and economic. To achieve this goal, it is proposed to define a multiscalar and</p>

	<p>transdisciplinary qualitative-quantitative analysis, identifying different contexts in which urban regeneration interventions have been designed.</p> <p>The candidate will have to develop a project using different methodologies, aimed at defining the different SEs (C-stock, removal of pollutants, increase in biodiversity, pollination, cultural) and also at defining their social and economic impact. For this reason, the candidate will work with different techniques, such as e-DNA, drones, LAI, thermal monitoring, measures for the collection and analysis of quantitative social and economic data, integrating the data collected in the various case studies. The priorities of digital transition and biodiversity will be guaranteed by monitoring the state of conservation of biodiversity in the areas of intervention using digital maps also obtained from the processing of the data collected.</p>
<b>Tutor</b>	Prof. Emilio Padoa Schioppa, Antonio Finizio, Riccardo Castellanza
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	<b>Nhood</b> ( <a href="https://nhood.it/">https://nhood.it/</a> ) 6
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	12
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
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<p><b>Progetto di ricerca Research project</b></p>	<p><i>“Monitoraggio dello stato di salute degli ecosistemi urbani con tecniche innovative di telerilevamento” – SCGA. 2</i></p> <p><i>“Monitoring the health of urban ecosystems with innovative remote sensing techniques” - SCGA. 2</i></p>
<p><b>Tipo Type</b></p>	<p>Borsa PNRR cofinanziata ex D.M. 118/2023 Scholarship PNRR co-funded ex D.M. 118/2023</p>
<p><b>Borse Scholarships</b></p>	<p>1</p>
<p><b>Abstract</b></p>	<p><b>ITA</b></p> <p>Gli ecosistemi terrestri con la loro biodiversità vegetale e animale svolgono molteplici funzioni utili per garantire il benessere e lo sviluppo economico e sociale. La caratterizzazione dell'evoluzione delle dinamiche funzionali degli ecosistemi urbani è fondamentale al fine di conservare la biodiversità e promuovere la realizzazione di Nature Based Solutions (NBS) efficaci e resilienti nel tempo che consentano di ripristinare o migliorare i servizi ecosistemici correlati.</p> <p>Il progetto di dottorato prevede lo sviluppo di prodotti innovativi finalizzati al monitoraggio dello stato di salute del verde urbano utilizzando tecniche di telerilevamento con un approccio multi-scala. Le proprietà ottiche della vegetazione variano infatti in funzione delle sue caratteristiche biochimiche, strutturali e dello stato fisiologico. Integrando tecniche di telerilevamento, misure di campo e modellistica ecologica, il dottorando avrà come obiettivo la realizzazione di mappe di parametri della vegetazione (es. contenuto di clorofilla, fluorescenza indotta dal sole) e mappe di indicatori dello stato di salute utilizzando nuovi sensori trasportati da drone e l'analisi delle loro variazioni in risposta a fattori antropici e naturali (es. siccità). I risultati della ricerca forniranno indicatori operativi che permetteranno di monitorare nel tempo gli impatti di inquinamento e estremi climatici sulla vegetazione urbana e permetteranno di realizzare NBS per il ripristino di ambienti urbani.</p> <p><b>ENG</b></p> <p>Terrestrial ecosystems with their animal and vegetation biodiversity provide multiple functions for human well-being, economic and social development. In particular, the characterisation of the evolution of the functional dynamics of urban ecosystems is fundamental in order to preserve biodiversity and promote the implementation of effective and resilient Nature Based Solutions (NBS) over time, restoring or enhancing related ecosystem services.</p> <p>The PhD project is envisaged to develop innovative products aimed at monitoring the health of urban green areas using remote sensing techniques with a multi-scale approach. The optical properties of vegetation vary depending on its biochemical, structural, and physiological state. Integrating remote sensing techniques, field measurements and ecological modelling, the PhD student will aim to produce maps</p>

	of vegetation parameters (e.g., chlorophyll content, sun-induced fluorescence) and maps of health status indicators using new drone-borne sensors and the analysis of their variations in response to anthropogenic and natural factors (e.g., drought). The results of the research will provide operational indicators to monitor the impacts of pollution and climatic extremes on urban vegetation over time and will allow NBSs for the restoration of urban environments.
<b>Tutor</b>	Prof. Sandra Citterio
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	<b>AprFlyTech Srls</b> 6
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	6
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
curriculum Scienze Chimiche  
Chemical, Geological and Environmental Sciences,  
curriculum Chemical Sciences**

<b>Progetto di ricerca Research project</b>	<i>"Sintesi di nuovi modulatori del recettore del TLR4 umano"</i> – SCGA. 3 <i>"Synthesis of novel human TLR4 receptor modulators"</i> – SCGA. 3
<b>Tipo Type</b>	Borsa finanziata da ente esterno D.M. 117/2023 Scholarship funded by external body D.M. 117/2023  <b>CP2 Biotech</b>
<b>Borse Scholarships</b>	1
<b>Abstract</b>	<p><b>ITA</b></p> <p>Il progetto di ricerca è basato sullo sviluppo di nuove molecole di sintesi capaci di attivare il recettore TLR4 dell'immunità innata. Il progetto di ricerca è finalizzato alla possibile individuazione di nuove IP che possano avere un ruolo nella gestione di patologie rare e patologie infiammatorie autoimmuni. Le nuove molecole sintetizzate saranno oggetto di brevettazione e successiva pubblicazione. Il/la dottoranda avrà la possibilità di partecipare a congressi internazionali e di trascorrere il periodo previsto in un gruppo di ricerca estero.</p> <p><b>ENG</b></p> <p>The research project is based on the development of new synthetic molecules capable of activating the TLR4 receptor of innate immunity. The research project is aimed at the identification of new IPs that may have a role in the treatment of rare diseases and autoimmune inflammatory diseases. The new molecules synthesized will be subject to patenting and subsequent publication. The Ph.D. student will have the opportunity to participate in international conferences and spend the planned period in a foreign research group.</p>
<b>Tutor</b>	Prof. Luca Zoia
<b>Mesi previsti in azienda Expected months at the company</b>	18
<b>Mesi previsti all'estero Expected months abroad</b>	6-12
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
curriculum Scienze dell'Ambiente Terrestre e Marino  
Chemical, Geological and Environmental Sciences,  
curriculum Terrestrial and Marine Environmental Sciences**

<b>Progetto di ricerca Research project</b>	<i>"Reuse of Bioremediated Hydrocarbon-Contaminated Sediments as Soil for Non-Food Crops: Evaluating Properties, Ecotoxicity, Biological Safety, and Circular Economy Aspects" – SCGA. 4</i>
<b>Tipo Type</b>	Borsa finanziata da ente esterno D.M. 117/2023 Scholarship funded by external body D.M. 117/2023  <b>SISTEMI AMBIENTALI SRL</b>
<b>Borse Scholarships</b>	1
<b>Abstract</b>	<p><b>ENG</b></p> <p><u>Introduction:</u> This PhD project focuses on assessing the feasibility and sustainability of reusing hydrocarbon-contaminated sediments, treated using biological technologies, as a technosoil for cultivating non-food crops. It aims to explore various aspects, including the fertility of bioremediated sediments, their ecotoxicity, biological safety, and the implications for the circular economy.</p> <p><u>Evaluation of Fertility of Bioremediated Sediments for Non-Food Crop Cultivation:</u> The project's primary objective is to analyze the physical, chemical and biological fertility of bioremediated sediments for the growth of non-food crops. To this end, total content and availability of primary and secondary nutrients content, physical structure, water retention capacity, and permeability will be evaluated. Laboratory analyses will also measure residual hydrocarbon levels and bioavailability of potentially toxic elements to ensure they fall within safe legislation thresholds.</p> <p><u>Ecotoxicity and Biological Safety:</u> A critical aspect of the project involves assessing the ecotoxicity and biological safety of using bioremediated sediments as soil for non-food crops. Toxicity essays will be conducted to determine any potential adverse effects on plants growth, microorganisms, and other relevant organisms. This analysis will guarantee that the sediments pose no significant risks to the environment, or human safety.</p> <p><u>Circular Economy Considerations:</u> The project will also investigate the circular economy implications of the use of bioremediated sediments for non-food crop cultivation. It will evaluate the economic sustainability, resource efficiency, and environmental benefits associated with this practice. By reusing the sediments, the project aims to minimize waste generation, reduce the use primary raw materials, and promote a sustainable and circular approach to soil management.</p> <p><u>Conclusion:</u> This PhD project aims to provide a comprehensive evaluation of reusing bioremediated hydrocarbon-contaminated sediments as soil for non-food crops. By analyzing their properties, ecotoxicity, biological safety, and circular economy aspects, the study seeks to support the development of sustainable strategies for the sustainable recycle of contaminated sediments.</p>

	The findings will contribute to efficient resource utilization, reduced environmental impacts, and the promotion of circular economy principles in the field of sediment management.
<b>Tutor</b>	Prof. Andrea Franzetti
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	12
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	6-12
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
curriculum Scienze Geologiche  
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curriculum Geological Sciences**

<b>Progetto di ricerca Research project</b>	<i>"Advanced analysis of multi-satellite data using AI tools" - SCGA. 5</i>
<b>Tipo Type</b>	Borsa PNRR/Scholarship PNRR - Centro Nazionale HPC di Ateneo CUP: H43C22000520001
<b>Borse Scholarships</b>	1
<b>Abstract</b>	<p><b>ENG</b></p> <p>While the performance of the measurements of atmospheric parameters has reached very high accuracy, the analysis of the satellite and ground-based data deserves a more in-depth analysis. This would allow significant progress in the input of numerical atmospheric modelling, the control of climate dynamics, air pollution, transport of pollutants, agriculture, etc.. In particular, more detailed information extracted from space measurements could have a relevant impacts on the large-scale atmospheric monitoring and is one of the basic pillar of the space economy. Several international data banks are available for the analysis of atmospheric data. Those precious instruments, often automatically integrated by numerical models, show limitations for an advanced and high accuracy analysis of the large and very rich information of their content.</p> <p>Significant limitations, dictated by the quality control on the use of data, are related to:</p> <ol style="list-style-type: none"> <li>1.- Impossibility to compare results from different sources on the same ground area and/or time Period</li> <li>2.- Difficulties to compare results with different calibrations, spatio-temporal resolutions and instrumental characteristics and to evaluate the weights of those parameters of the results.</li> </ol> <p>Thales Alenia Space has developed a platform (The Satellite Highly Interactive Visualizations and Analytics (SHIVA)) devoted to satellite telemetry analysis that originated from the needs to analyse the telemetry history of spacecrafts for the purpose of verifying their integrity and well-behaviour.</p> <p>To achieve these goals, the platform is designed with a microservices architecture based on an archive comprising InfluxDB for efficient storage and retrieval of TM parameters and MongoDB for raw TM packets, frames and ancillary information. A Data Access Layer abstracts the underlying structure and streamlines query operations. The user interaction is provided by an immediate and responsive web UI, while the interactive plotting service has been developed using Bokeh. A matplotlib-based service allows offline batch generation of charts to be included in reports and an environment for data-scientists is offered as an integrated</p>



	JupyterHub server. Here we propose to test the possibilities to use an informatic instrument such SHIVA to develop a joint and advanced analysis platform of different kinds of measurements of atmosphere. Results will allow preliminary information on the gap between the present analysis of single data and a joint comparative and iterative analysis of different parameters and /or the same parameters measured by different sources with different accuracies. Testing will be concentrated over Milano and the Lombardia Region, to better answer to the objectives of MUSA.
<b>Tutor</b>	Prof. Cristina Flesia
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	/
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	Da definire To be defined
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
curriculum Scienze Geologiche  
Chemical, Geological and Environmental Sciences,  
curriculum Geological Sciences**

<b>Progetto di ricerca Research project</b>	<i>"The topography of the Moho discontinuity under the Alps-Apennines mountain chain, from the analysis of a state-of-the-art, multi-level Receiver Function database" – SCGA. 6</i>
<b>Tipo Type</b>	Borsa finanziata da ente esterno Scholarship funded by external body  <b>ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA INGV</b>
<b>Borse Scholarships</b>	1
<b>Abstract</b>	<p><b>ENG</b></p> <p>The knowledge of the deep crust structure under the mountain chains is a key-elements to develop geodynamic models that help in understanding how such mountain chains have been developed and their present-day morphology. In general, such knowledge is based on passive seismic data (i.e. where the source of elastic wave is natural) acquired during temporary seismic experiment or by permanent seismic networks. Our knowledge of the deep crust in the Centro-Mediterranean area has increased in the last decade, however a comprehensive and updated model of the crust-mantle boundary (so called "Moho) is still lacking. Most of the recent studies about the geodinamic of the area are still based on ten-years old papers (Piana Agostinetti and Amato, 2009; Spada et al. 2013) with a strong potential for mis-interpretation based on the limited number of observations available in the past, especially for the Southern Apennines.</p> <p>The present-day availability of a large number of new observations and the possibility of large-scale data analysis (both in terms of number of seismic stations and amount of passive seismic data) pose new challenges and can fulfil the need of a overall revision of the previous studies. Passive seismic data recorded in the Central-Mediterranean area represent an archive of information not organised in a compelling way and, thus, of difficult use for production of models of the crust useful for geodynamic modelling, both at local and regional scale. Moreover, part of this information have been collected during the last years following seismic sequences of national interest, without integrating the data-sets into permanent archives.</p> <p>During this study, we: (1) constitute an archive of passive seismic data for the Central-Mediterranean area, shareable as open-access, containing both raw and processed data; (2) employ such archive to compute a new Moho topography map for the region, using both "legacy" algorithms and more innovative approaches developed on purpose.</p>

<b>Tutor</b>	Prof. Marco Malusà
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	Da definire To be defined
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	Max 12
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
 curriculum Scienze dell'Ambiente Terrestre e Marino  
 Chemical, Geological and Environmental Sciences,  
 curriculum Terrestrial and Marine Environmental Science**

<b>Progetto di ricerca Research project</b>	<i>"Intensification of tropical cyclones: impact of fine scale processes"</i> – <b>SCGA. 7</b>
<b>Tipo Type</b>	Borsa cofinanziata da ente esterno Scholarship co-funded by external body  <b>Istituto Italiano di Oceanografia</b>
<b>Borse Scholarships</b>	1
<b>Abstract</b>	<p><b>ENG</b></p> <p>The intensification of tropical cyclones has long been described as the evolution towards a maximum intensity that depends on the environmental conditions. Under this paradigm, in a homogeneous and stationary environment the intensity of the cyclone should monotonically increase. Recent high resolution numerical simulations question this view, as oscillating intensities have been obtained in modeling experiments. Although such idealized setting is not realistic, as tropical cyclones evolve along a trajectory that brings them in regions characterized by different sea surface temperatures, different tropospheric moisture content, and different upper level winds, the physical processes at the base of the obtained results need to be understood in order to improve the forecast of tropical cyclone intensity. This is of paramount importance considering that, despite the recent efforts, the community skill to predict the strength of a tropical cyclone is still quite low. Recent research also indicates that the intensification rate of hurricanes has been increasing over the last decades, with a positive contribution from anthropogenic forcing.</p> <p>In this project idealized numerical simulations will be run using an atmospheric non hydrostatic fine resolution model, in which convective updrafts and downdrafts will be resolved. Their characteristics will be linked to larger scale conditions as well as to feedbacks within the low pressure perturbation, including interactions with clouds and radiative effects. The role of the air-sea fluxes and of the characteristics of the marine atmospheric boundary layer will be assessed. The project, building upon High Performance Computing capabilities, is carried in the framework of the science studies in support of the ESA Earth Explorer X Mission Harmony, whose aim is the study of the fine scale characteristics at the air-sea interface with a focus on extreme weather events and will be carried with the collaboration of Prof. Caroline Muller from IST, Austria, and with OGS, Trieste.</p>

<b>Tutor</b>	Prof.ssa Claudia Pasquero
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	Da definire To be defined
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	12
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
curriculum Scienze Geologiche  
Chemical, Geological and Environmental Sciences,  
curriculum Chemical Sciences**

<b>Progetto di ricerca Research project</b>	<p><i>“Attività sperimentale e di studio dei processi di conversione di materiali di scarto in catalizzatori per la produzione di idrogeno” – SCGA. 8</i></p> <p><i>“Experimental activities and study of the conversion processes of waste materials into catalysts for hydrogen production” - SCGA. 8</i></p>
<b>Tipo Type</b>	<p>Borsa finanziata da ente esterno Scholarship funded by external body</p> <p><b>Agenzia nazionale per le nuove tecnologie, l’energia e lo sviluppo economico sostenibile, ENEA</b></p>
<b>Borse Scholarships</b>	<p>1</p>
<b>Abstract</b>	<p><b>ITA</b></p> <p>Sulla base dei risultati preliminari ENEA, sembra possibile regolare le condizioni di formazione di biochar da processi termochimici di lignina e da miscele di lignina e plastici non (più) riciclabili in modo tale da produrre materiali che non siano completamente impoveriti dei gruppi funzionali tipici della lignina, in particolare nelle funzionalità contenenti ossigeno, e che, quindi, possano essere opportunamente rimodulate per la produzione di prodotti a maggior valore aggiunto.</p> <p>Il presente progetto di dottorato si propone di ottimizzare la formazione di un biochar 'reattivo', che servirà come materiale di partenza per la sintesi di materiali avanzati da utilizzare nei campi catalitico ed elettrochimico. In ambito catalitico, si mira a sviluppare, mediante processi di pirolisi di lignina e plastiche di scarto a temperature non superiori ai 600 °C con riscaldamento veloce, un supporto solido per legare catalizzatori metallici e/o loro precursori, al fine di ottenere una matrice termostabile redox opportunamente drogata. I catalizzatori così prodotti avranno applicazioni significative nei processi di gassificazione della biomassa per la produzione di idrogeno. Analogamente, attraverso processi termochimici a più alte temperature, si cercherà di funzionalizzare il biochar ottenuto per il suo utilizzo come materiale per elettrodi in celle elettrolitiche per la produzione di idrogeno.</p> <p>Durante il corso del dottorato, saranno utilizzate diverse tecniche analitiche avanzate per caratterizzare il biochar funzionalizzato ottenuto. Saranno inoltre condotte analisi qualitative e quantitative per determinare gli analiti formati durante i processi termochimici studiati. Questo contribuirà a comprendere in modo approfondito le proprietà chimiche e strutturali del materiale e a ottimizzare le condizioni di sintesi.</p> <p><b>ENG</b></p> <p>Based on preliminary results, it seems possible to adjust the formation conditions of biochar from thermochemical processes of lignin and mixtures of lignin and non-recyclable plastics in such a way as to produce materials that are not completely</p>

	<p>depleted of the typical functional groups of lignin, particularly in terms of oxygen-containing functionalities, and that can therefore be appropriately modified for the production of higher value-added products.</p> <p>The aim of this doctoral project is to optimize the formation of a 'reactive' biochar, which will serve as a starting material for the synthesis of advanced materials to be used in catalytic and electrochemical fields.</p> <p>With respect to the development of catalysts, the goal is to develop a solid support through pyrolysis processes of lignin and waste plastics at temperatures not exceeding 600 °C with rapid heating, in order to bind metallic catalysts and/or their precursors and obtain a thermally stable and appropriately doped redox matrix. The catalysts produced via this strategy are expected to have significant applications in biomass gasification processes for hydrogen production.</p> <p>Similarly, through thermochemical processes at higher temperatures, efforts will be made to functionalize the obtained biochar for its use as electrode material in electrolytic cells for hydrogen production.</p> <p>During the course of the doctoral program, various advanced analytical techniques will be used to characterize the functionalized biochar obtained. Qualitative and quantitative analyses will also be conducted to determine the analytes formed during the studied thermochemical processes. This will contribute to a thorough understanding of the chemical and structural properties of the material and to the optimization of synthesis conditions.</p>
<b>Tutor</b>	Prof. Heiko Lange
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	Da definire To be defined
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	Max 6
<b>Specific IPR rules:</b> standard	

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 curriculum Scienze dell'Ambiente Terrestre e Marino  
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<b>Progetto di ricerca Research project</b>	<i>"Production and chemical functionalization of biochar for environmental applications" – SCGA. 9</i>
<b>Tipo/Type</b>	Borsa Dipartimentale Scholarship Department
<b>Borse/Scholarships</b>	1
<b>Abstract</b>	<p><b>ENG</b></p> <p>The proposed project is in the frame of the Join Research Agreement between ENI and University of Milano Bicocca and aims at developing new products to be applied in bioremediation of soil contaminated by hydrocarbons. Bioremediation technologies exploit the ability of natural microorganisms to efficiently remove organic pollutants. Biochar is a co-product of biomass pyrolysis. It is in fact a biological material produced in the absence of oxygen, at temperatures below 700 ° C, to generate more permeable, less dense and carbon-rich products. The presence of pores, the high surface area, the ability to bind and retain nutrients (N and P) as well as organic pollutants, make biochar a good support for persistence and microbial growth (bacteria and fungi), to be applied as a soil improver to maintain and increase the physical, chemical and biological properties/ activities of the soil. Recently, it has been suggested that applying biochar to contaminated soil helps plant-microorganism systems reduce hydrocarbon concentrations. Indeed, plant-microorganism interaction can support the enzymatic ability of bacteria and fungi to degrade hydrocarbons. The aim of the project is to develop and validate a microbiologically activated biochar (Microbe-activated-Biochar (MaB), to be applied to the biological treatment of soils contaminated by hydrocarbons. The planned activity for this project are: A) production of biochar from biomass through pyrolysis, followed by physical and chemical characterization of the biochar (proportion between the pyrolysis product and the original biomass, absorption capacity, specific surface, porosity, composition, etc.); B) functional activation of biochar in order to increase its chemical and biochemical compatibility with the strains of selected microorganisms. Functional modification of the biochar can be performed through physical or chemical activation; C) the effectiveness of the MaB obtained in WP3 will be evaluated in the bioremediation of soils contaminated by hydrocarbons by laboratory tests and pilot experiments in the field.</p>
<b>Tutor</b>	Da definire/ To be defined
<b>Mesi previsti in azienda Expected months at the company</b>	/
<b>Mesi previsti all'estero Expected months abroad</b>	Da definire/To be defined
<b>Specific IPR rules:</b> standard	



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 curriculum Geological Science**

<b>Progetto di ricerca Research project</b>	<i>"Permeation grouting: an experimental and numerical study to improve its efficiency"</i> – <b>SCGA. 10</b>
<b>Tipo Type</b>	Dottorato in Alto Apprendistato High level training apprenticeship contract  <b>Groutfreezlab s.r.l.</b>
<b>Posizione Position</b>	1
<b>Abstract</b>	<p><b>ENG</b></p> <p>This research deals with the study of the permeation grouting technique and the effect of injections on the mechanical and permeability characteristics of the treated soil.</p> <p>This is a consolidation technique in which soil is injected with consolidating mixtures that permeate the voids between soil particles. The mixtures used can be of various types depending on particle size, porosity and permeability of the soil, but also on the environmental impact related to their use. In any case, injection is always carried out by means of a valved tube (or TAM: Tube with manchéttes), isolating each valve and injecting it through a double packer.</p> <p>Objective:</p> <ul style="list-style-type: none"> <li>- The goal of this research is to improve efficiency by studying the permeation of different consolidating mixtures, type of soil and boundary conditions. The post-treatment characteristics will be evaluated by the use of X-ray microtomographic analysis to study the relationships between mixture and grains and thus define how the mixture permeates the voids, modifying porosity and permeability of the sample. In addition standard geomechanical tests will be performed.</li> </ul> <p>Method:</p> <ol style="list-style-type: none"> <li>1. Realization of a machine that allows 3D laboratory injection with soil confinement to reproduce in situ soil conditions at a small scale.</li> <li>2. Extensive experimental campaign to evaluate key variable of permeation grouting. Two different types of tests are then carried out: 1D injections and 3D injections. The former are useful for studying the injection process and evaluating the injectability of a soil, including the type of mixture. The latter extend the concept of one-dimensional injection and allow observation of the progress of the mixture in the soil in all directions. From both tests, once the curing time has elapsed, specimens can be obtained for mechanical testing.</li> <li>3. Extensive image analyses by microCT to deeply understand injection process.</li> <li>4. Theoretical and numerical analyses to improve the efficiency of the process.</li> </ol> <p><b>inquadramento professionale</b> di partenza: livello 5°  inquadramento professionale d'arrivo: livello 3°  numero ore settimanali: 40 ore  retribuzione lorda annuale livello 5°: 21.663,74 € diviso 14 mensilità</p>

	<p>retribuzione netta mensile: 1.300,00 per 14 mensilità</p> <p>starting <b>professional classification</b>: level 5th  target occupational classification: level 3  number of hours per week: 40 hours  gross annual salary level 5th: €21,663.74 divided by 14 monthly salaries  net monthly salary: 1,300.00 for 14 monthly payments</p>
<b>Tutor</b>	Prof. Giovanni Crosta
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	36
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	Da definire To be defined
<b>Specific IPR rules:</b> standard	

**Scienze Chimiche, Geologiche e Ambientali,  
 curriculum Scienze dell'Ambiente Terrestre e Marino  
 Chemical, Geological and Environmental Sciences,  
 curriculum Terrestrial and Marine Environmental Science**

<b>Progetto di ricerca Research project</b>	<i>"Groundwater remediation: new biological and molecular strategies"</i> – <b>SCGA. 11</b>
<b>Tipo Type</b>	Dottorato in Alto Apprendistato High level training apprenticeship contract  <b>M3R-Monitoring and Management of Microbial Resources s.r.l.</b>
<b>Posizione Position</b>	1
<b>Abstract</b>	<p><b>ENG</b></p> <p>Groundwater contamination is a worldwide problem that has a significant impact on human health and socioeconomic development, and it can also endanger environment and its ecological services. Groundwater is the major source of freshwater and represents a crucial and essential resource for the planet since it is used for domestic, agricultural, and industrial purposes (Li, 2021). Due to the wide use of petroleum hydrocarbons for industrial development during the last century, these contaminants have significantly contributed to the pollution of aquatic environments with numerous and disastrous consequences on the ecosystems of this environmental matrix.</p> <p>Among treatment methods for groundwater remediation, one of the most commonly used technology is to pump out contaminated water and to treat "on site" (Pump&amp;Treat) or "off-site" (Pump&amp;Stock). However, these methods are cost-expensive and energy-demanding; instead, the application of phytotechnologies, which are based on the use of plants and microorganisms, could be a promising alternative to remediate petroleum hydrocarbons- contaminated groundwater, because they are environmentally-friendly and potentially more cost effective than the traditional ones (Abdullah, 2020).</p> <p>Therefore, the first objective of the project is to investigate the possibility to treat the pumped contaminated groundwater by means of these biological technologies instead of using physico- chemical methods.</p> <p>Moreover, for a thorough understanding of subsurface flowpaths and fluid migration in contaminated aquifers, DNA (deoxyribonucleic acid)-Based Tracers can be developed and used, in addition to traditional tracer method, to gain insight into the autochthonous microbial community (Zhang, 2022). Thus, the second objective of the project is to develop and test synthetic DNA tracer methods in contaminated aquifers to characterize and study the dynamics and metabolic activity of microorganisms in groundwater.</p> <p><b>inquadramento professionale</b> di partenza: settore terziario livello 4      inquadramento professionale d'arrivo: settore terziario livello 3      numero ore settimanali: 40      Retribuzione apprendista settore terziario livello 4 e 3</p>

	<p>Livello 4: retribuzione diretta mensile € 1.618,75; retribuzione completa mensile: € 1.903,94</p> <p>Livello 3: retribuzione diretta mensile € 1.793,11; retribuzione completa mensile: € 2.109,03</p> <p>starting <b>occupational classification</b>: tertiary sector level 4          target occupational classification: tertiary sector level 3          number of hours per week: 40          Tertiary sector level 4 and 3 apprentice salary          Level 4: direct monthly salary € 1.618.75; full monthly salary: € 1,903.94          Level 3: direct monthly wage € 1.793.11; full monthly wage: € 2,109.03</p>
<b>Tutor</b>	Prof. Andrea Franzetti
<b>Mesi previsti in azienda</b> <b>Expected months at the company</b>	36
<b>Mesi previsti all'estero</b> <b>Expected months abroad</b>	Da definire To be defined
<b>Specific IPR rules:</b> standard	