PhD IN SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE

Research Programme

37th Cycle

Academic Years 2021/2022 – 2023/2024

Table of content

Introduction

Addressing climate change and finding just and effective ways to redesign all human activities in a sustainable way is complex, and requires approaches that take account of many different aspects. Single disciplinary methods are sub-optimal, and although they might identify solutions to very specific problems, they might ultimately have negative impacts on some other important areas.

The PhD-SDC aims to promote inter-disciplinary discussion among the PhD candidates following the different curricula, so that the potential impact of individual research programmes on different fields can be identified and addressed. The aim is to replicate the reality of experts asked to study, understand and solve complex problems, not in isolation in a 'single discipline bubble', but in collaboration with colleagues with different backgrounds and expertise.

Intra- and extra-curricula events will be organized, and interdisciplinary discussions will be promoted, to give all the PhD candidates opportunities to compare their ideas with those of their peers working in different areas who might see some potential implications of proposed solutions not previously considered. These events will provide opportunities for all the students to gain experience in presenting and reporting to different types of audiences and ensuring that the information is understandable to audiences with different backgrounds. Discussion, critique and feedback from colleagues on the effects of different proposed actions in different areas, will help the PhD candidates to develop and practice multi-level, multi-disciplinary approaches required to build a juster, more sustainable, healthier and decarbonized society.

Figure 1 – The 6 curricula offered by the PhD course in Sustainable Development and Climate Change

Aim of the document

This document describes the Research Programme for the Doctoral Course in Sustainable Development and Climate Change (PhD-SDC).

The PhD is organized in six curricula:

1. **Earth System and Environment**
2. **Socio-economic Risk and Impacts**
3. **Technology and Territory**
4. **Theories, Institutions and Cultures**
5. **Agriculture and Forestry**
6. **Health and Ecosystems**

The PhD is characterized by a strong interdisciplinary approach; an overview of the main research themes and scope of the curricula is provided below. Each curriculum offers several scholarships linked to research topics which are described in detail. In order to facilitate their reading by candidates, the information relevant to each scholarship is organized in a data sheet reporting:

- the **title** of the research topic;
- the **research keywords**;
- the **reference European Research Council** sectors which provide information on the research areas, and the list of ERC sectors (for a complete list of the ERC sectors visit the https://erc.europa.eu/sites/default/files/document/file/ERC_Panel_structure_2021_2022.pdf);
- the **reference Sustainable Development Goals** which represent the ultimate research aims; (for a more in depth description of the SDGs visit the https://sdgs.un.org/goals);
- the **reference person** – i.e. the individual, researcher or professor, offering the research topic and available to provide more information via email;
- the **host university** which is the location of the main research activity; in the case of the scholarships, University IUSS of Pavia will be where most of the common activities will be organized;
- the **research topic** describing the scope and objectives of the research in more detail;
- the **research team and environment** indicating where the research activities will be carried out and where most of the collaboration with other researchers and research institutes will be based;
- the **suggested skills** – i.e. the skills that, ideally, the candidate should possess in order to succeed in their doctoral research;

Curriculum 1: Earth System and Environment

Scholarships of Curriculum 1 are coded ***A##***

Earth system processes and new perspectives in environmental development

The PhD candidates will study different biological, chemical, geological, physical, mathematical and environmental aspects of climate change and sustainability. The impacts and risks of climate change, including extreme events, will be investigated.

The candidates will study key processes and scale interactions related to the atmosphere, oceans, the land surface and the sub-surface, and the cryosphere which determine the Earth's climate.

Multi-disciplinary approaches will be applied to understand the interplay between natural and human processes, and between greenhouse gases and ecosystems. Hierarchies of coupled models will be developed and used to understand the role of different processes in determining the Earth's climate and its evolution. Observations from conventional and satellite platforms will be leveraged to understand phenomena, and design and diagnose model performance. Observations and model simulations will be applied to disentangle the relative role of natural variability and human activities on the Earth's climate.

Modelling will be used to explore the interaction between global, large-scale, low-frequency phenomena and local, small-scale and high-frequency events (including extremes), and to assess the potential impacts of different adaptation and mitigation strategies. In particular, the socio-economic impacts of climate change will be investigated and quantified.

Changes detected over the last decades will be compared with changes that have occurred in the most recent and very distant past, including the paleo climate, to identify possible similarities and differences and to help to predict how the climate will evolve in the future. Changes in surface variables, such as temperature, wind and precipitation, in terms of both their average and their differences, will be studied. Particular emphasis will be placed on understanding past and future changes in the frequency and intensity of extreme events that populate the tails of the probability distribution functions. Sophisticated statistical techniques will be used to analyse available data and extract signals. Probability theory and stochastic calculus will be applied to improve the simulation and propagation of initial (e.g., linked to observations) and model uncertainties.

The impact of climate change on land surfaces and the sub-surface, on ecosystems and the energy, water and chemical (carbon, methane) cycles will be investigated. The impact of changes in the concentration of chemical species, in particular, of carbon and nitrogen compounds, on the ecosystems will be analysed. Greenhouse gas emissions will be monitored and quantified using observation and data assimilation systems, and numerical experiments will be designed and performed to investigate their propagation, from the local source area to the global region.

Combined analysis of past and present climates and application of multi-disciplinary approaches will allow estimation of future risks and identify the most effective adaptation and mitigation strategies.

Keywords:

- Climate and paleo-climate
- Environmental risks and impacts
- Physical and chemical processes

- Numerical modelling
- Greenhouse gas emissions
- Probability approaches and extremes

Curriculum 2: Socio-economic risk and impacts

Scholarships of Curriculum 2 are coded **B##**

Measuring the transition towards a decarbonised and sustainable economy

This curriculum focuses on analysis of the complex relationships between the phenomenon of climate change and the socio-economic system, defined based on market relationships and/or other types of interactions among economic actors (public and/or private companies, financial markets, international markets) and other stakeholders (institutions, civil society, workers, communities, consumers, etc.) included in these systems. The curriculum is oriented to:

(i) predicting future scenarios regarding the relationship between climate change and socio-economic systems, with reference, also, to the development of environmental, quantitative (e.g., greenhouse gas emissions, flood scenarios) and qualitative (e.g., ESG rating) impact models;

(ii) analysing and assessing the risks of climate change and energy transition on socio-economic systems and their actors, with reference also to distributional and social equity issues;

(iii) investigating the socio-economic causes of the current climate crisis.

Through this research agenda, the curriculum aims to provide economic policy and managerial practice recommendations to prevent and enable mitigation of environmental and climate risks on territories and an orderly transition towards a fair, circular and low-carbon economy, in line with the UN 2030 Sustainable Development Goals agenda.

The curriculum aims, also, to promote more responsible and sustainable production and consumption models in terms of: resources use (e.g., through the promotion of advanced circular economy models and green innovation); business strategy (e.g., through the adoption of corporate social responsibility principles in production processes, operations and stakeholder management); organization of the financial system (e.g., green fintech, investor activism in the ESG field); technological advances (e.g., favouring the development of sustainable artificial intelligence applications) and in terms of consumption patterns (e.g., energy communities, purchasing groups, cooperatives, collaborative consumption).

Methodologically, the curriculum will employ mainly quantitative measurement and evaluation methods, although not to the exclusion of qualitative approaches. Finally, the research will be conducted at different levels of analysis - micro and/or macro - to be defined depending on the research project objective(s).

Keywords:

- Energy transition
- Physical and transition risks
- Circular economy and eco-innovations
- Responsible business, finance and consumption
- Sustainable mobility
- Predictive models and evaluation models
- Scenario analysis and policies for sustainability

Curriculum 3: Technology and Territory

Scholarships of Curriculum 3 are coded **C##**

Technologies, systems and approaches for the sustainable transition of communities, territories and production processes

The doctoral research related to this curriculum will be focused on resilience, sustainable development paradigms, circularity and actions against climate change to be implemented in territories, communities and production processes and in the consumption of resources and energy. The goals will be ambitious and involve a range of technological and sectoral challenges, such as:

- development and sustainability of the built environment in relation to structures and infrastructures and their impact on territory, survey and monitoring of the territory, and the natural and built environment;
- systemic design and innovation in transport systems and sustainable mobility solutions, with particular reference to the development of pedestrian, bicycle and electric transport;
- enhancement of cultural heritage and the landscape, and urban and territorial regeneration;
- study of traditional and advanced smart technologies for sustainable production system conversion to ensure resilience of production and territorial systems;
- management of the entire raw materials life cycle with particular attention to domestic resources and reduction and management of waste;
- new technologies for the production, transport, storage and use of energy, with particular reference to the development of renewable sources, efficient and resilient energy systems, methodologies for their management and establishment of energy communities;
- chemical technologies and methodologies to enable development of new industrial processes, understanding of chemical synthesis, mechanisms and reactivity, study of materials and their properties, and sustainable catalytic processes;
- development of new materials, conversion systems and technologies necessary for progressive electrification of transport and production systems.

This urgent and complex transition will require the development of new multi-transdisciplinary approaches and integrated objectives, including:

- reducing climate-altering emissions, transition to renewable energy sources, closure of the carbon cycle;
- design of the built environment, plants and infrastructures based on the concepts of resilience and integration with the natural environment;
- new models of territorial organization and use of city spaces;
- extended application of the concepts of systemic design, circular economy, reduced use of natural resources, environmental impact, ‘smart cities’ and the Industry 4.0 paradigm and the notion of sustainability to economic and production systems, and management of public services, energy networks and transport;
- assessment of the social and economic impacts of new technologies.

The PhD candidates will be encouraged to interact in their training activities in relation to different components and transversal dimensions of the research, such as:

- synergies between basic and applied science and the other curricula;
- the technical knowledge framework used to measure, evaluate and monitor territorial vulnerabilities and exploit in experiments related to innovative methods and actions and projects oriented to resilience;
- metrics to assess the sustainability and resilience of territories, local communities, manufacturing organizations and production and consumption processes;
- territorial governance models to support the transition of institutions and communities, integrating mitigation, adaptation and transition objectives into plans, projects and strategies, in order to implement the multi-scale and inter-sectoral perspectives of resilience, sustainability and circularity.

Keywords:

- Sustainable mobility
- Energy transition
- Innovative materials and advanced technological processes
- Regeneration of cities, communities and infrastructures
- Governance of the territory and networks
- System and process monitoring
- Sustainable catalytic processes

Curriculum 4: Theories, Institutions and Cultures

Scholarships of Curriculum 4 are coded **D##**

Theories, institutions and cultures of the ecological transition

This curriculum promotes education and research activities related to the theories, institutions and cultures of sustainability and climate change, and favours a transdisciplinary methodological perspective based on different humanities and social science approaches, in particular from philosophy, literary studies, law and sociology. Particular attention will be devoted to issues related to ontology and ethics; national, European and international juridical regulations; climate, environmental and intergenerational justice; global politics; asymmetries and inequalities in distribution criteria; the ecological humanities and ecocriticism; environmental semiotics and aesthetics; and the interactions between the environment and living beings, including non-human beings. The overall education and research objective is to develop theoretical and practical tools to enable future researchers to manage the cognitive and practical challenges posed by sustainability and climate change, with specific reference to the intergenerational solidarity pact and the ecological transition, whose importance can no longer be neglected.

The research activities involved in the curriculum are detailed in the descriptions of the scholarships. They involve very different but, at the same time, strictly related topics, perspectives and issues. They include the critical analysis of representations of (un)sustainable societies in narrative, poetry, theatre and media, and in social and collective dynamics and practices capable of generating ecological thinking and promoting empowerment and agency in both individuals and communities. They also entail a reflection on the ethical, theoretical-political and social implications of the promotion of innovative models of social and economic development as well as the perspective of environmental and post-subjectivist aesthetics related to the Anthropocene era. Finally, the research activities will address the legal issues and the regulatory policies linked to the transition to new forms of sustainability also as regards business activities, management of climate change and sustainable finance, through different methodologies and legal perspectives, including comparative law and economic analysis of law.

Keywords:

- Theories of justice
- Ecological transition
- Regulatory policies
- Ecological humanities
- Health and climate
- Transgenerationality
- Governance and sustainable finance

Curriculum 5: Agriculture and Forestry

Scholarships of Curriculum 5 are coded **E##**

Innovative models for resilient and sustainable agri-food and forestry systems

The agriculture and forestry curriculum focuses on environmental, economic and social sustainability and climate change in key areas (agriculture, livestock and forestry), from both a life cycle and supply chain perspective with a particular focus on Mediterranean agricultural and forestry systems. The Mediterranean region is a mosaic of agricultural and forestry system hotspots that are threatened by the impact of climate change. The course aims to provide a solid, up-to-date and interdisciplinary cultural and scientific base and a deep understanding of the systemic implications of human activities and awareness of the importance of relationships with business, administrations and civil society in an international contest. The ultimate objective is to implement a transformative process of sustainable agriculture and forestry, within a climate change context, rooted in analysis and evaluation of new sustainable development models with a sound scientific, technical and technological base. The curriculum themes are consistent with the 2030 sustainable development goals related to food security, ending of extreme poverty, sustainable management of water resources, good quality education, combating drought, land degradation, desertification, hydro-geomorphic hazards, and enabling mitigation of and adaptation to climate change.

The PhD students will develop new tools and explore new options to tackle agriculture and forestry challenges posed by climate change. They will include: more efficient use of natural resources in agro-ecosystems; sustainable production of food and biomass; reduced dependence on non-renewable resources; conservation of biodiversity; more resilient agro-forestry systems; better animal welfare; reduced use of antibiotics and agrochemicals in food production; improved food quality, security and safety; investment in adaptation to and mitigation of climate change; reduced waste and increased recycling within a circular bio-economy; enhancing and promoting ecosystem services related to agriculture, livestock and urban greenery and forestry; preventing soil degradation and desertification; and safeguarding water resources.

Linked to the other interdisciplinary curricula and use and integration of a wide range of emerging technologies, this will contribute to the achievement of sustainable and profitable agri-food and forestry production that complies with conservation of environmental resources and landscapes and the values of equity and social solidarity. Life sciences, information technologies, crop modelling, robotics, digital agriculture technologies, renewable energies will all be exploited. An analytical perspective on agricultural and forestry socio-ecosystems is important and includes integration of research on the quantitative assessment of the impacts of climate change with semi-quantitative and participatory research on strengthening the adaptive capacity of rural communities. Climate change will require major transformative adaptations to ensure sustainable management of natural resources and support economic and cultural development of rural areas.

Keywords:

- Resource use efficiency
- Transformative adaptation
- Rural development

- Precision farming, biotechnologies and eco innovation
- Food security/safety and farm productivity
- Ecosystem services
- Smart and digital agriculture

Curriculum 6: Health and Ecosystems

Scholarships of Curriculum 6 are coded **F##**

Climate, global changes and health – from ecosystems to humans

This curriculum tackles research questions regarding the impacts of climate and global change on ecosystems and humans, and adaptation to and mitigation of climate change, to identify novel sustainable development models and understand the interactions between the environment and health.

The curriculum has two objectives:

- to study the impacts of climate change on the structure, function and health of the biotic and abiotic components of ecosystems at different spatio-temporal scales, in various environmental contexts;
- to study the human health risks associated with the synergies between environmental change (including various types and sources of pollution) and/or climate and global change, and a focus on current and future social and economic dynamics in the context of sustainable development.

Research activities include:

- implementation of protocols for measuring and monitoring climate change and its impacts on ecosystems, including use of modelling approaches;
- identification and evaluation of possible climate change adaptation and mitigation strategies, including ecological restoration and biotechnological means of curbing of greenhouse gas levels;
- analysis of vulnerability and adaptation to climate change of structural, functional and compositional traits characterizing biota and ecosystem processes (including biogeochemical cycles);
- study of the impacts of climate and global change on the ecosystems of extreme environments;
- analysis of the determinants of environmental pressures that produce real or potential impacts on biodiversity and ecosystem functions that are vulnerable to climate change;
- identification of ATC (Anthropogenic Threat Complexes) and their real or potential impact on ecosystem alterations induced by climate change in different environmental contexts;
- analysis of the impact of climate change and related adaptation and/or mitigation policies on human health via its associated ecosystem effects, based on modelling diffusion of viral, bacterial and parasitic infections, including zoonoses, and their influence on related control and prevention policies;
- study of the risks to animal and human health (related to the pathology predispositions of individuals), associated with chemical and environmental pollution in the context of climate and global change, with particular attention to current and future social and economic dynamics in the context of sustainable development;
- development of safe and sustainable solutions using non-toxic materials and products.

Keywords:

- Ecosystem health
- Human health
- Chemical and biological risks
- Biodiversity and biotechnology
- Anthropogenic threats
- Safe and sustainable by design products
- Advanced modelling

List of the Research Topics

Code	Research Topic	Host University
Curriculum 1 – Earth System and Environment		
A01	GHG emissions in the Po valley by inverse modelling	University of Modena and Reggio Emilia
A02	Arctic amplification and extreme events in the Mediterranean region	University of Trento
A03	Climate change impact on the Euro-Mediterranean region	Sant'Anna School of Advanced Studies Pisa
A04	Advancing multi-risk assessment for sustainable climate change adaptation	University Ca' Foscari of Venice
A05	Stochastic modeling with application to tipping points and extreme events	Scuola Normale Superiore
A06	Climate modelling for impact studies and risk management	IUSS Pavia
A07	Mitigation and adaptation to climate change in urban and coastal areas	University of Genoa
A08	Ozone risk assessment for forest species in different climate change scenarios at regional level	Catholic University of the S.H., Brescia (Italy)
A09	Monitoring of climate forcing and polluting compounds in urban atmosphere	University of Modena and Reggio Emilia
A10	Characterization and monitoring glacial and periglacial environments in Alpine regions	Politecnico di Torino
A11	Ocean acidification: insights from fossils and living species of Coccolithophores	University of Pavia
A12	Emission estimates of Radiatively Active Species at the regional scale	University of Urbino 'Carlo Bo'
A13	Storms, extremes, and impacts on coastal areas under climate change	University of Padova
A14	Mathematical modelling of volcanic phenomena and hazards	Scuola Normale Superiore
A15	Past climate changes to understand recent ones: geological-ecological approach	University of Sassari
A16	Methodologies for accounting and assigning GHG emission responsibility	University of Siena
A17	Disaster Risk Reduction in coastal areas affected by climate change	University of Modena and Reggio Emilia
A18	Computational Quantum Chemistry for Atmospheric Monitoring and Environmental Sustainability	Scuola Normale Superiore
A19	Thermodynamic behavior of fluid mixtures containing H2 and CO2	Politecnico di Torino
A20	Assessment of past and future climate changes in the extended Alpine area	University of Trento
Curriculum 2 – Socio-economic Risk and Impacts		
B01	Development of innovative strategies for the management of pluvial flooding risk in contexts characterized by climate change and non sustainable developments	University of Messina
B02	Flood risk assessment for a sustainable design of the environment	Politecnico di Milano

B03	Climate Change Impact on Economic Systems and Policies for an Orderly Transition.	IUSS Pavia
B04	Sustainability models for the post Covid-19 pandemic	University of Pavia
B05	The role of innovative start-ups in the transition towards a more innovative and sustainable economy	Politecnico di Torino
B06	Business strategies for decarbonization and circular economy.	Sant'Anna School of Advanced Studies Pisa
B07	Sustainable Artificial Intelligence models	University of Pavia
B08	Responsible capitalism and climate change	University of Pisa
B09	Sustainable mobility and eco-innovation in transportation economics	University of Insubria
B10	Insurance and financial solutions for climate risk management	IUSS Pavia
B11	Circular economy, decarbonisation and just transition: complementarity between eco innovations and the creation of human and social capital in companies	University of Ferrara
B12	Adapting to Climate Change: The role of international trade and labor market adjustments	University of Milan
B13	Socio-economic analysis of mitigation and adaptation policies in the Mediterranean area	University of Urbino 'Carlo Bo'
B14	Sustainability and Non-Financial Information	University of Trieste
B15	Sustainable mobility: models, methods and case studies.	University of Trieste
B16	Circular bioeconomy: assessing the sustainability of bio-based processes and products	University of Messina
B17	Sustainable finance: financial instruments and policies	Politecnico di Torino

Curriculum 3 – Technology and Territory

C01	Resilient microgrids	University of Pavia
C02	Wave energy exploitation with OWC devices embodied in fixed/floating structures	University Mediterranea of Reggio Calabria
C03	Functional Sustainable Materials for Emerging Photovoltaics	University of Torino
C04	Innovative solutions for energy harvesting and energy recycling	Politecnico di Torino
C05	Copper based catalysts for C-H activation for partial oxidation reactions	University of Torino
C06	Knowledge approaches for transformative resilience. Adaptation strategies and projects for urban regeneration	Politecnico di Torino
C07	Integrated techniques and instruments for deformation monitoring of natural and built environment	University of Modena and Reggio Emilia
C08	Innovative methodologies in sustainable catalysis towards applied chemistry	University of L'Aquila
C09	Analytical methodologies for sustainable, innovative, and greener industrial processes	University of Ferrara
C10	Sustainable production of solar fuels from CO2 using artificial leaves	University of Messina
C11	Safety oriented design for bicycling and pedestrian mobility	University of Cassino
C12	Integrated approaches for the seismic and energetic retrofit of existing buildings	University of Padova

C13	Sustainability of Cyber Physical Social Systems for the resilience of territories	Politecnico di Bari
C14	Hierarchical architected materials for energy and environmental applications	University of Trieste
C15	Sustainable management of water resources in a changing climate	University of Brescia
C16	Resilience of production systems: Additive Manufacturing at the service of manufacturing sustainability	Politecnico di Bari
C17	Health and energy implications of climate change in buildings design and refurbishment	University of Trieste
C18	Urban Sustainability in practice. An integrated approach to the regeneration of contemporary cities	University of Cagliari
C19	The role of spatial dimension in modelling decarbonised energy systems	Politecnico di Milano
C20	Integrated Sustainable Energy and Climate Action Plans (SECAP)	University of Brescia
C21	AI techniques for assessing the sustainability of Public Administration processes	University of Bari
C22	Strategies for the circular city and implementation of sustainable models	University of Genoa
C23	Decarbonisation of local energy systems	Politecnico di Torino
C24	Desing and advanced characterization of innovative materials for the next generation batteries	University of Pavia
C25	Sustainable Energy Communities	University of Pisa
C26	Eco-design of materials and technologies for sustainable energy production and storage	University of Siena
C27	Supermachines: superconductivity in the electromechanical conversion.	Politecnico di Torino
C28	E-mobility and smart grids	University of Messina
C29	Multidisciplinary approaches to define the sustainability of territorial transformations	University of Brescia

Curriculum 4 – Theories, Institutions and Cultures

D01	The challenges of sustainability: transgenerationality, technology, environment	University of Torino
D02	Institutions and governance of climate change	Università Cattolica del Sacro Cuore
D03	Governing Sustainable Development and Climate Change: Theories and Regulation	Sant'Anna School of Advanced Studies Pisa
D04	Epistemology, science and rationality: towards a philosophy of sustainable choice.	IUSS Pavia
D05	Sustainable finance and green-washing: from transparency to financial education, financial intermediaries conduct duties and organizational measures	University of Genoa
D06	Market regulation and sustainable investment policies: a comparative law perspective	IUSS Pavia
D07	The role of energy communities in the transition towards zero-carbon society	University of Torino
D08	The environment between philosophical conceptualisation and environmental aesthetics	University Ca' Foscari of Venice
D09	Ethical-political profiles of sustainable development and climate change	Sant'Anna School of Advanced Studies Pisa
D10	Climate change litigation in a comparative law perspective	University of insubria

D11	Social theory and research for sustainable development and global health	University of Cassino
D12	The role of corporate governance in transitioning towards a sustainable economy and finance	University of Genoa
D13	Changing the (Cultural) Climate. The Ecological Humanities, Ecocriticism and Cultures of Sustainability	University of Ferrara

Curriculum 5 – Agriculture and Forestry

E01	Dairy cattle adaptation to heath stress: modeling and management	University of Sassari
E02	Using stable isotopes to analyse soil-vegetation-atmosphere water transport in the Critical Zone	University of Padova
E03	Ecosystem services of urban agriculture and climate change	University of Firenze
E04	Sustainability assessment of agri-food processes with the Water-Energy-Food Nexus approach	University of Genoa
E05	Climate change and water resources for crops: impact and adaptation strategies	University of Firenze
E06	How to preserve the planet: technologies for sustainability	Politecnico di Torino
E07	Forest ecosystem services under climate change	University of Torino
E08	Improving fruit crop resilience to climate change through precision farming and breeding	University of Torino
E09	Climate change, food production and nutritional quality	Università Cattolica del Sacro Cuore
E10	Early diagnosis and biostrategies against mycotoxigenic fungi in Mediterranean crops	University of Pisa
E11	Climate change and governance of water resources in coastal agricultural districts	University of Sassari
E12	Innovative and integrated processes for sustainable management of water resources	University of Sassari
E13	The Open Green Grow	IUSS Pavia

Curriculum 6 - Health and Ecosystems

F01	Effects of global climate changes on water biota	University of Insubria
F02	Holistic analysis of nervous system stressors: from adaptation to pathology	University of Torino
F03	Climate change mitigation through shrub removal in alpine environments	University of Insubria
F04	Dynamics of transmission and control of Epidemics: mathematical modeling and simulations	University Mediterranea of Reggio Calabria
F05	Biodiversity of communities emerging after the retreat of glaciers analysed through environmental DNA	University of Milan
F06	Extinction risk of the groundwater fauna in the Anthropocene	University of L'Aquila
F07	Relationships between Climate Change, permafrost and ecosystems in alpine periglacial, proglacial and glacial environments	University of Insubria
F08	Evaluation of the effects of global warming on Nodavirosis	University of Messina
F09	Marine ecosystems vulnerability to climate change in an altered Mediterranean Sea	University of Cagliari
F10	The relationship between the exposome, the socioeconomical context and health	University of Torino

F11	Exploring the climate exposome to assess the health effects of climate change	IUSS Pavia
F12	Microplastics and climate change: potential threat to human health.	University of Messina
F13	Enzyme-based bio-devices for CO2 conversion to chemicals and biofuels	University of Torino

Curriculum: 1. Earth System and Environment scholarship code **A01**

GHG emissions in the Po valley by inverse modelling

Research keywords:	GHG emissions Lagrangian/inverse modelling Remote sensing
Reference ERCs:	PE10_3 Climatology and climate change PE10_2 Meteorology, atmospheric physics and dynamics PE10_14 Earth observations from space/remote sensing
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Bigi Alessandro (alessandro.bigi@unimore.it)
Host university:	University of Modena and Reggio Emilia *Department of Engineering Enzo Ferrari*

Research topic

Urban areas are considered responsible of the largest share of CO2 emissions worldwide, however their emission estimate is affected by large uncertainty, due to the lack of local measurements and specific investigation.
The project aims to fill this gap and estimate CO2 and CH4 emissions in the Po basin, an hotspot region for atmospheric pollution in Europe and hosting almost one third of Italian population.
The activity will mainly rely on the particle lagrangian dispersion model FLEXPART-WRF (FLEXible PARTicle Weather Research and Forecasting). Modelling results will be constrained on publicly available measurements collected in situ within the ICOS and GAW research infrastructures and remotely by satellite (e.g. TROPOMI on board Sentinel 5) and eventually on ad hoc experimental measurements collect in Modena. First goal of the project is the validation of local bottom-up inventory emissions of GHG in the Po valley by inverse modelling, as indications by the IPCC. Further goal is the set up of a modelling tool to monitor the trend in GHG emissions of the Po valley and its roadmap to the respect of the Paris Agreement.

Research team and environment

The main hub of the research activities will be the LARMA Lab of the Dept. Of Engineering Enzo Ferrari (www.Larma.Unimore.It). The group includes scientists with skills on remote sensing, atmospheric dispersion modelling and atmospheric monitoring of gas and aerosols by regulatory and non-regulatory instruments. Currently the team is composed by three professors, three research technicians and three postdocs. The lab has international collaborations in Europe with several partners of the ACTRIS and ICOS Research Infrastructures and strictly collaborates with the local Regional Environmental Agency and the municipality of Modena. Lab facilities include dedicated HPC resources, equipment for atmospheric sample preparation and extraction, licensed software for environmental modelling (i.E. PMSS, eCognition, ENVI), priority access to the instrumental resources of the Main University Shared Lab for physical and chemical analysis (www.Cigs.Unimore.It) and equipment for the set up/calibration/maintenance of atmospheric monitoring instruments. The team is also in charge of the Meteorological Observatory of Modena (www.Ossgeo.Unimore.It a WMO Centennial Observatory) and of the local AERONET sun photometer. Department facilities include also a mechanical shop to produce prototypical metal parts and a lab for electronics and optics instrument calibration.

Suggested skills

Ideally the successful candidate should have good background in atmospheric chemistry and/or physics and climate change. Experience in data analysis (preferably R, bash, unix environment) and atmospheric modelling (either weather, dispersion or receptor models) are considered an asset.

Curriculum: 1. Earth System and Environment scholarship code **A02**

Arctic amplification and extreme events in the Mediterranean region

Research keywords:	Climate change Extremes Polar amplification
Reference ERCs:	PE10_3 Climatology and climate change PE10_2 Meteorology, atmospheric physics and dynamics PE6_12 Scientific computing, simulation and modelling tools
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Bordoni Simona (simona.bordoni@unitn.it)
Host university:	University of Trento *Department of Civil, Environmental and Mechanical Engineering*

Research topic

Over the past few decades, Arctic surface temperatures have increased at roughly twice the rate as the global mean surface temperature, through a phenomenon referred to as Arctic amplification. One of the most evident and dramatic manifestations of this accelerated warming in the Arctic is the loss of sea ice, which is causing a decrease in the planetary albedo with significant impacts on the Earths climate both at the local and global scales.

This research project will investigate mechanisms of both Arctic amplification and of its remote influences. More specifically, it will explore the possible impacts of high-latitude warming on the position, strength and waviness of the jet stream. It has in fact been hypothesized that a less intense jet stream, as a result of the weakened meridional pole-to-equator temperature gradient, might be more wavy, with potential significant impacts on the frequency and duration of extreme events, such as blocking, over Europe and the Mediterranean region.

This is at however at odds with the future decline of blocking projected by climate models, and exact mechanisms remain debated.

The project will begin with a careful and systematic evaluation of blocking events in the ERA5 reanalysis and other observed data and their possible relation to Arctic temperatures and circulation patterns. Hypotheses emerging from this observational analysis will then be tested with numerical simulations in the model hierarchy. These will include simulations with idealized and realistic atmospheric general circulation models, in which ice albedo effects will be parameterized in simple ways and in which sea surface temperature anomalies will be imposed in the Arctic region and/or elsewhere, as well as analysis of Earth System Model outputs in the CMIP6 archive and Large Ensemble simulations. This hierarchical approach will help shed light on the underlying processes behind future changes in blocking and reduce the associated uncertainty. It will also better quantify projected changes in the impacts of blocking, such as those related to temperature extremes, that have enormous societal relevance.

Research team and environment

The PhD candidate will work in the vibrant and diverse environment provided by the atmospheric physics group at the University of Trento, with skills and interests ranging from mountain meteorology to climate and large-scale atmospheric dynamics. Unitn is the home of the recently established Masters of Science program in Environmental Meteorology joint with the University of Innsbruck, Austria, and offers a wide range of training and seminar activities. The projects supervisor has just returned to Italy after twenty years in the United States, and is involved in several international collaborations and activities, including panels, workshops and summer schools. Worth of notice is her involvement in a European project aimed at developing and applying Storm-Resolving (that is, very high resolution) Earth System Models to the study of anthropogenic climate change. As they become available, these global simulations at unprecedented resolution will be leveraged as part of the research project. The PhD candidate will be fully immersed in and will greatly benefit from the very active, international and broad research program led by the supervisor.

Suggested skills

The PhD candidate is expected to have a background in physics, math, earth and environmental sciences or related disciplines, as well as experience in the analysis of observational data and/or numerical simulations. Previous training in meteorology, atmospheric physics, oceanography and/or climate dynamics will be considered a plus.GOAL 15

Climate change impact on the Euro-Mediterranean region

Research keywords:	Climate change impact Large-scale and local climate variations Noise and signals
Reference ERCs:	PE10_3 Climatology and climate change PE10_2 Meteorology, atmospheric physics and dynamics PE1_19 Scientific computing and data processing
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Buizza Roberto (roberto.buizza@santannapisa.it)
Host university:	Sant'Anna School of Advanced Studies Pisa *Life Science Institute*

Research topic

The main theme of this scholarship is the study of the impact of climate change on the Mediterranean region. The work will look both at induced large-scale changes, and their impact in specific regions, for example on water access and the agriculture and food sector. Climate change has already caused a substantial average warming of the Mediterranean region, and an increase in the frequency, intensity and length of extreme local events such as heat waves, dry spells and intense precipitation events. These changes, for example, have a particular impact on human activities that are affected by temperature and water access. They can also have a strong impact of health, migration and conflicts.

One of the key questions that remains to be addressed is whether and how local precipitation patterns will change in the future. Once way to answer this question is to investigate whether, over the past few decades, there has been a robust relationship between changes in the statistics of local, small-scale events, and changes in the statistics of large-scale patterns. If this is the case, one could then investigate whether large-scale patterns are expected to change substantially in the future, and from these expected changes deduce the probability of possible future changes in the local, small-scale events. This is an example on how knowledge of scales interactions can be exploited to understand the local impact of future climate changes.

The study will rely on climate data accessible from the European Union Copernicus project, in particular the most recent global ERA-5 reanalysis, which covers the period 1950-to-date, and ERA-CLIM2, which covers the whole XXth century.

One of the key objectives of this work will be to understand the relationship between climate-induced changes that affect the whole Mediterranean region, and more local, small-scales variations. The results of this investigation are expected to provide valuable insights on observed changes and on what to expect in the future climate. Insights that could help identifying the most effective mitigation and adaptation policies.

Research team and environment

Scuola Superiore SantAnna has been working on sustainable development and climate change for many years. On climate change, SantAnna was the promoter of an initiative that involves also the Scuola Superiore IUSS of Pavia and the Scuola Normale of Pisa, that led to the establishment of the Center for Climate Change Sustainable Actions (3CSA). 3CSA has been involved in multi-disciplinary research projects and in the design of the inter-university, multi-disciplinary doctoral program on climate change and sustainable development. 3CSA has been fostering the interaction between social scientists, economists, experts in genomic and agriculture, and physicists, to study climate change and its impact. In 2021, the coordinator of 3CSA has been co-organizer of the UK-Italian pre-COP26 Climate Exp0 virtual conference (17-21 May 2021), which has involved 800 speakers, and has been attended by 5,200 people from 150+ countries. 3CSA has been involved in the organization of 9

initiatives (seminars, workshops, panel discussions) selected by the Ministero dellAmbiente All4climateItaly 2021 initiative. The winning candidate will work within this group.

Suggested skills

Ideally, the successful candidate should have a good understanding of the Earth-system and of climate change, and have experience with data analysis.GOAL 15

Advancing multi-risk assessment for sustainable climate change adaptation

Research keywords:	Multi-risk approach for compound and interlinked climate, environmental and natural hazards on terrestrial, marine, and coastal environments Risk trade-offs and synergies between land and sea interactions Machine learning and data science for advanced risk assessment
Reference ERCs:	PE10_3 Climatology and climate change PE6_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video) PE4_18 Environment chemistry
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 14: Life Below Water
Reference person:	Critto Andrea (critto@unive.it)
Host university:	University Ca' Foscari of Venice *Department of Environmental Sciences Informatics and Statistics*

Research topic

Climate change is inextricably linked with natural disasters and other environmental and anthropogenic risks within a complex system featured by the interplay of micro- and macro-processes, a non-linear causal structure, and potential irreversible effects. However, the prevalent climate change risk governance paradigm still focuses on hazard-silos, thereby not accounting for interactions and feedbacks that can significantly alter our understanding of future disaster scenarios. The PhDs main objective is to explore new conceptual and analytical approaches for transdisciplinary, integrated, multi risk assessments, toward sustainable climate adaptation, in the context of the spatiotemporal dynamics of terrestrial, marine, and coastal environments in response to multiple natural and anthropogenic hazards. The research will seek to connect different aspects of multi-risks within real-world case studies, including the consideration of compound and consecutive events, cascading and transboundary effects, focusing on trade-offs and synergies between land and sea interactions. Emphasis will be given to the use of new technologies (machine learning, artificial intelligence, crowdsourcing and earth observation data) unlocking opportunities of addressing multi-risks and sustainable adaptation pathways in ways that have never been possible before.

Research team and environment

The PhD candidate will take advantages of the laboratories, tools and infrastructures at the CMCC@CaFoscari. CMCC@CaFoscari is the research centre on climate change of CaFoscari University of Venice, the result of a strategic partnership with the CMCC FoundationEuro-Mediterranean Center on Climate Change (CMCC). CMCC@CaFoscari is today the most important climate research centre developed by an Italian university. Its multidisciplinary task force includes climatologists, economists, chemists, and statisticians, conducting national and international research on the interaction between the climate, the environment, the economy, and society. The Fellow will benefit from CMCCs computational modelling infrastructure, including one of the most powerful supercomputers in Europe, dedicated to the climatic modelling and forecasting and to the assessment of the economic repercussions of climate change. The beneficiary will be offered with an international and multi-disciplinary environment that is non-discriminatory and transparent in its recruitment and professional advancement. Furthermore, professional supervision and career mentorship, a periodic research review and evaluation, and a stimulating research and training atmosphere are all guaranteed for the Fellows career advancement.

Suggested skills

A) Knowledge of the impacts of climate change and extreme events;
B) Knowledge of environmental risk assessment;

C) Experience in data compilation and handling;
D) Experience in the development and validation of Machine Learning models (e.g. Neural Networks) for the spatio-temporal analysis of environmental systems dynamics;
E) Programming skills in R and Phyton;
F) Excellent communication and writing skills in English;GOAL 14

Stochastic modeling with application to tipping points and extreme events

Research keywords:	Stochastic models Tipping points Extreme events
Reference ERCs:	PE1_13 Probability PE1_12 Mathematical physics PE10_3 Climatology and climate change
Reference SDGs:	GOAL 13: Climate Action

Reference person:	Flandoli Franco (franco.flandoli@sns.it)
Host university:	Scuola Normale Superiore *Faculty of Sciences*

Research topic

The aim of the project is to develop stochastic models, often of simplified or intermediate form with respect to General Circulation Models, for the investigation of climate phenomena, aiming to understand tipping points and examine methodologies for the computation of probability of extreme events. The PhD candidate will also employ techniques of stochastic model reduction, among the tools to construct stochastic models of reduced complexity. The models we have in mind may be based on ordinary or partial differential equations; but also empirical models based on statistical tools and machine learning algorithms may be investigated. The models will be used to investigate the existence of tipping points and of extreme events, for instance those related to ice reduction, volcanic events, ENSO cycle, heat waves and strong precipitations; interaction with other PhD candidates of the program and educational activities of the program may have a crucial role in detecting specific applications; in particular, the interaction with the research group at INGV related to the other PhD grant at Scuola Normale. Among the purposes of the models and the techniques developed during the PhD program there will be the computation of relevant probabilities and mean values, in particular the probability of tails and extreme events. The PhD candidate will learn techniques based on Kolmogorov and Girsanov approach, besides the classical Monte Carlo, for the purpose of these computations. Uncertainty quantification will also be a key question.

Research team and environment

The local team at Scuola Normale Superiore in Pisa is directed by Franco Flandoli and is composed of several PhD, post doc and young research people, working on stochastic models of different kinds, ranging from fluid dynamics to particle systems, with applications in climate and other fields. Scuola Normale Superiore runs PhD programs in theoretical and applied Mathematics, Physics, Chemistry and Biology, Computer Sciences, and Humanities; therefore the environment is very rich of interaction with other PhD candidates and with professors in several disciplines, with the opportunity to attend seminars and courses of great interest. The group has intense research contacts with other institutions in Italy and abroad. In addition, part of the activities will be done in collaboration with a team at INGV of Pisa, related to the other PhD grant, following a long standing collaboration between the two groups.

Suggested skills

The proposed research has many faces and may profit from very different skills. In general, a good background in mathematics or mathematical modelling is required, possibly including elements of probability and statistics, modeling by differential equations (ordinary or partial) and some attitude to numerical computation; however, not all is needed at the beginning and it may be developed during the PhD thanks to courses and other activities.

Climate modelling for impact studies and risk management

Research keywords:	Climate predictions Climate extremes Mitigation and Adaptation
Reference ERCs:	PE10_3 Climatology and climate change PE10_2 Meteorology, atmospheric physics and dynamics PE6_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Gaetani Marco (marco.gaetani@iusspavia.it)
Host university:	IUSS Pavia *Department of Science, Technology and Society*

Research topic

The training course will focus on understanding and modelling the climate system, its evolution in response to anthropic forcings and the consequent impact on the natural and anthropic environment, and will be oriented towards the reduction of climate risk and the identification of sustainable development strategies. Particular attention will be given to the study of extreme events, such as droughts, heat waves and intense rainfall.
The specific topics that may be addressed during the PhD include:
1) Comparative analysis of the ability of global and regional climate models (with particular attention to CMIP and CORDEX climate projections) to correctly reproduce the chemical-physical processes controlling the variability of the climate system and its stability with respect to natural and anthropogenic (concentration of greenhouse gases, land use) forcings, with the objective of reducing the uncertainties affecting climate predictions on seasonal, decadal and multi-decadal time scales.
2) The study of methods for the calibration and renormalization (bias correction) of the systematic errors present in the numerical models for climate predictions.
3) The study of new approaches for the detection of extreme events, and for the identification of trends in their frequency connected with climate change, also through the application of methodologies developed in the field of artificial intelligence.
4) The study of methodologies for the downscaling at regional and local scale of climate predictions produced with global and regional climate models.
5) The development of innovative multi-model methodologies and techniques aimed at improving climate services for the energy and agrifood sectors.

Research team and environment

IUSS mission is to provide advanced education to undergraduate and graduate students, as well as fundamental and applied research in the fields of Science, Technology, Engineering and Mathematics (STEM), and Human, Social and Life Sciences. At IUSS, PhD candidates will find an open multidisciplinary environment offering real opportunities for developing academic and professional tools for facing the challenges arising from increasing complexity and fast changes in the society and the environment. IUSS is always and actively committed towards internationalisation, inclusion and diversity. The selected candidate will join the research centre on Climate change impAct studies for RISk MAnagement (CARISMA). The CARISMA team is composed by STEM and Social scientists working in the prism of climate change on: data analysis and modelling of Earth system and economic system processes; impact assessment of extreme natural events and anthropogenic activities on human and natural environments; risk management of natural and anthropogenic hazards; formulation and proposal of new economic, political and legal models of sustainable development. The research activity will be carried out in collaboration with the Climate Modelling and Impact Laboratory of the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and may include stays at the Casaccia Research Centre (Rome).

Suggested skills

The ideal candidate should be skilled in the fields of Physical and Mathematical Sciences, Computer Sciences and Earth and Environmental Sciences. Specific skills in the field of climate science will be considered a plus. Moreover, the candidate should be strongly motivated to work in a pluralist and multi-disciplinary environment, collaborating with the STEM and social scientists of the CARISMA research centre.GOAL 15

Curriculum: 1. Earth System and Environment scholarship code **A07**

Mitigation and adaptation to climate change in urban and coastal areas

Research keywords:	Mitigation and Adaptation Urban and coastal area Environmental indicators
Reference ERCs:	SH7_5 Sustainability sciences, environment and resources SH7_6 Environmental and climate change, societal impact and policy PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Gallo Michela (michela.gallo@unige.it)
Host university:	University of Genoa *Department of Civil, Chemical and Environmental Enginnering - DICCA*

Research topic

The research area is focused on the evaluation of mitigation and adaptation strategies to climate change that can be adopted locally and specifically in urban and coastal areas. The analysis that will be conducted will provide for the quantification of the most significant expected environmental impacts and their possible reduction following the implementation of specific measures, including the implementation of a cost-benefit analysis of the various mitigation and adaptation strategies and the integration of solutions within local governance tools. The analysis will be structured through the construction of appropriate sets of indicators and the definition of criteria to identify the priorities for intervention and implementation of mitigation and adaptation actions in the context of urban and coastal areas, in accordance with the Strategy and the proposed National Plan for Adaptation to Climate Change (PNACC) and the most recent guidelines of the European Union on the subject of climate emergency.

Research team and environment

The PhD will take place at the Department of Civil, Chemical and Environmental Engineering (DICCA) of the University of Genoa. The PhD student will be integrated into the "sustainable development of processes" research group, a team that has been operating for almost 20 years within the CE.Si.S.P. (Interuniversity Center for the Development of Product Sustainability) The main research activities concern: GHG inventories and strategies, GHG calculation and monitoring, mitigation and adaptation stratetegies for industries and communities, Carbon Capture and Storage R&D, EU-ETS application, development, validation and verification of CDM projects, development of VER projects Carbon offsets, Carbon footprints, Life Cycle Assessment studies, Eco-Design and environmenatl labels, circular economy.

Suggested skills

In order to perform a successfully research in this topic, a master's degree in a technical-scientific area is required that guarantees adequate knowledge of the concepts related to the assessment of environmental impacts and the definition of environmental indicators. The candidate should be familiar with the definition of mitigation and adaptation to climate change, with particular reference to climatic changes expected in urban and coastal areas of the Mediterranean area.

The candidate must also demonstrate a knowledge of the main methodologies adopted at international level (i.E. UNFCCC, EU-ETS) for the definition and calculation of greenhouse gas inventories, relating to industrial sectors and territorial areas. A further skill is represented by the knowledge of the LCA methodology, its applications and use of the main calculation models used in the LCA analysis.

Curriculum: 1. Earth System and Environment scholarship code **A08**

Ozone risk assessment for forest species in different climate change scenarios at regional level

Research keywords:	Atmospheric and deposition models Stomatal conductance Ozone risk
Reference ERCs:	PE10_4 Terrestrial ecology, land cover change PE10_1 Atmospheric chemistry, atmospheric composition, air pollution LS8_14 Ecophysiology, from organisms to ecosystems
Reference SDGs:	GOAL 2: Zero Hunger GOAL 3: Good Health and Well-being GOAL 15: Life on Land
Reference person:	Gerosa Giacomo Alessandro (giacomo.gerosa@unicatt.it)
Host university:	Catholic University of the S.H., Brescia (Italy) *Department of Matemathics and Physics*

Research topic

Ozone is a secondary pollutant which causes visible damage to vegetation as well as growth reduction in forest plants. The phytotoxic ozone dose (known as PODy) seems to be the most suitable metrics for the estimation of the ozone impact under future scenarios of climate change. This metric assumes that ozone damage is related to the actual ozone amount uptaken by plants through leaf stomata, rather than the total ozone quantity deposited on the forest ecosystem. Therefore, all the factors affecting the stomatal dynamics are the primary drivers of ozone uptake, climatic factors above all. For this sake, it is expected that ozone threat on vegetation will strongly depends on foreseen climatic change of a certain studied area for the next century.

The project will focus on modeling activities aimed at defining an integrated calculation of phytotoxic ozone dose based on meteorological and chemical data, spatialization techniques, O3 deposition models and plant physiology models to produce regional-scale maps for the assessment of ozone risk for forest in northern Italy.

The main objectives of the project will be:

I) the development, calibration and validation of a modelistic chain for the estimation of the phytotoxic ozone dose absorbed by forest vegetation at 1km2 resolution in flat and complex terrain.

Ii) the production of large scale risk assessment maps for ozone based on future climate scenarios in order to outline possible strategies for mitigating the impacts of this pollutant.

Research team and environment

The candidate will join the interdisciplinary research group of Environmental physics and ecophysiology. The group has long experience in measuring ozone fluxes over forest and crop by means of micrometeorological techniques, in developing SVAT deposition models (Soil Vegetation Atmosphere Transfer models), as well as experience in modeling stomatal conductance by considering both the environmental factors and the plant physiology. The working environment is the Department of Mathematics and Physics of the Catholic University seat in Brescia. There, the candidate will find theoretical and practical support, as well as occasion of discussion. Specifical aspects related to the prevision of future ozone concentrations with atmospheric models (like WRF-chem) might be developed in collaboration with colleagues from Notre Dame University (USA) and some aspects of soil water content and plant physiology might be treated together with colleagues from the Catholic University of Leuven (Belgium).

Suggested skills

Masters degree or equivalent in Mathematics, Physics, Biology, Environmental sciences, Forest and crop science or adjacent fields.

Strong commitment, ability to work in a team, and eager for international mobility is required.

A strong interest for multidisciplinary research is required.

A solid background in computer science, micrometeorology, ecophysiology and ecology is required.

Good knowledge of English language, both spoken and written, is essential.

Documented experience and skills in data analysis, geostatistics and programming (i.E. MATLAB, Fortran, Visual Basic).GOAL 15

Monitoring of climate forcing and polluting compounds in urban atmosphere

Research keywords:	Low cost/compact atmospheric sensors Urban atmosphere Atmospheric pollution
Reference ERCs:	PE10_1 Atmospheric chemistry, atmospheric composition, air pollution PE10_2 Meteorology, atmospheric physics and dynamics PE10_3 Climatology and climate change
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Ghermandi Grazia (grazia.ghermandi@unimore.it)
Host university:	University of Modena and Reggio Emilia *Department of Engineering Enzo Ferrari*

Research topic

The project aims to assess the temporal and spatial variability of atmospheric levels of climate forcing and polluting compounds in the atmosphere of urban area(s) representative of the Po basin, i.E. One the European regions with the most critical air pollution levels.

The experimental monitoring will focus on atmospheric compounds with scientific or regulatory relevance, e.g. NOx, PM, Black and Brown Carbon aerosol. This activity will rely on compact sensors and, in case of sufficient TRL, low cost equipment.

The experimental activity might be coupled with a simulation activity focussing on the atmospheric dispersion modelling of selected compounds within the pilot urban area using state-of-the-art microscale lagrangian particle dispersion models, i.E. GRAMM-GRAL and/or PMSS, which are proven to be suitable for complex urban domains.

The project will aim also to evaluate the reliability and the uncertainty of compact/lower-cost measurement devices compared to regulatory/reference instruments and assess their suitability to increase the spatial and temporal density of atmospheric monitoring in urban areas.

Research team and environment

The main hub of the research activities will be the LARMA Lab of the Dept. Of Engineering Enzo Ferrari (www.Larma.Unimore.It). The group includes scientists with skills on remote sensing, atmospheric dispersion modelling and atmospheric monitoring of gas and aerosols by regulatory and non-regulatory instruments. Currently the team is composed by three professors, three research technicians and three postdocs. The lab has international collaborations in Europe with several partners of the ACTRIS and ICOS Research Infrastructures and strictly collaborates with the local Regional Environmental Agency and the municipality of Modena. Lab facilities include dedicated HPC resources, equipment for atmospheric sample preparation and extraction, licensed software for environmental modelling (i.E. PMSS, eCognition, ENVI), priority access to the instrumental resources of the Main University Shared Lab for physical and chemical analysis (www.Cigs.Unimore.It) and equipment for the set up/calibration/maintenance of atmospheric monitoring instruments. The team is also in charge of the Meteorological Observatory of Modena (www.Ossgeo.Unimore.It a WMO Centennial Observatory) and of the local AERONET sun photometer. Department facilities include also a mechanical shop to produce prototypical metal parts and a lab for electronics and optics instrument calibration.

Suggested skills

Ideally the successful candidate should have good background in experimental monitoring and atmospheric chemistry and/or physics. Experience in data analysis (preferably R, bash, unix environment) and/or atmospheric dispersion modelling (lagrangian or eulerian) are considered an asset.

Curriculum: 1. Earth System and Environment scholarship code **A10**

Characterization and monitoring glacial and periglacial environments in Alpine regions

Research keywords:	Climate Changes . Cryosphere Alpine regions
Reference ERCs:	PE10_3 Climatology and climate change
Reference SDGs:	GOAL 13: Climate Action
Reference person:	Godio Alberto (alberto.godio@polito.it)
Host university:	Politecnico di Torino *Department of Environment, Land and Infrastructure Engineering*

Research topic

The research project deals with the mountain environment and it is aimed at studying how the advance of climate change (involving the thermal regimes and in the atmospheric micro- and meso-circulation, etc.) alters the processes related to the action of frost in such environments. These processes play a fundamental role in modeling the hydrological, morphological, geophysical, chemical, and biological characteristics of Alpine territories. It worthy to mention that glacier dynamics, pedological and the geomorphological processes are affected by the action of ice. The research will tackle how the mountain environment changes is affected by climate changes, focusing on those processes linked to the action of frost, that are pervasive, peculiar, and fundamental in mountain environments.

These issues are scientifically relevant and fundamental in setting the man-mountain relationships, with a particular focus to some key issues, such as the territory protection (landslides, glacial collapses, ruptures of glacial banks, proglacial lake dam-breaks, etc.), the management of water resources, that are stored in the mountains in the form of ice and snow and recharge a large area of our country, the issue of sediment management, and the related erosion/deposition processes at the basin scale. The cooperation with local authorities and stakeholders in the alpine environment regarding the monitoring of permafrost, rock-glacier will provide an added value to the research.

The research involves complementary approaches in order to investigate how the aforementioned aspects are influenced by climate changes: (i) laboratory experiments, carried out in a climate chamber recently built at Politecnico di Torino, (ii) field monitoring, with geophysical measurements and detection from drones and remote sensing, and (iii) mathematical modeling of the investigated processes, addressing future scenarios of evolution dictated by the climate change.

Research team and environment

The multidisciplinary research team involves scientists of Politecnico di Torino (DIATI) with expertise in geophysics, fluid mechanics and geomorphology, including Carlo Camporeale, Chiara Colombero and Luca Ridolfi. The different experimental and modeling approaches will allow the PhD student to acquire a complete training, with skills in different fields. Furthermore, he/she will have the opportunity to carry out experiments and measurements in a cold room and on glaciers, using up-to date instruments and technologies. Part of the experimental field activities will be carried out in test sites of the North-Western Alps. The research will be developed in collaboration with local authorities/stakeholder, dealing with the characterization and monitoring of the Alpine environment (eg, Fondazione Montagna sicura, ARPA Piemonte and ARPA Valle d'Aosta).

Suggested skills

The basic knowledges of the physics of the Earth system must be supported by skills about basic data processing and development and application of interpretative models. Capability to carry on field and in laboratory experimental activities is also required. The candidate is expected to work in a dynamic multidisciplinary national and international research team.

Ocean acidification: insights from fossils and living species of Coccolithophores

Research keywords:	Coccolithophores Carbon Cycle Coccolith-derived proxy
Reference ERCs:	PE10_3 Climatology and climate change PE10_6 Palaeoclimatology, palaeoecology PE10_9 Biogeochemistry, biogeochemical cycles, environmental chemistry
Reference SDGs:	GOAL 13: Climate Action GOAL 14: Life Below Water
Reference person:	Lupi Claudia (claudia.lupi@unipv.it)
Host university:	University of Pavia *Earth and Environmental Sciences*

Research topic

As global surface temperatures and pCO2 have increased since late19th century, partly due to anthropogenic forcing, the need to predict the oceans response and the reaction of marine biota is becoming more pressing. With the intent of reading the past to inform the future, the project focuses on a calcareous phytoplanktonic group at the base of the food chain, the coccolithophores.

This project aims to deepen on past and future climate mechanisms and drivers by combining information extracted from cultured living marine microalgae and microfossils preserved in sediments. It focuses on the role of coccolithophores in the global carbon cycle and on the feedbacks, they may produce in association with climate change.

The elemental chemistry on coccolithophores is still in evolution if compared to foraminifera, but it is a powerful tool to collect data on present and past oceanic conditions. In fact, coccoliths are abundant in marine sediments, widely distributed and dissolution-resistant. The limited use of coccoliths in geochemistry is due to their small size (<20 m) and difficulty in isolating individual species.

In this project, we will compare the geochemical variations in both fossil and living species of coccolithophores. Specifically, Pleistocene coccolithophore associations from IODP Site U1501 of the Expedition 368 to the South China Sea will be studied. The selected time interval belongs to Marine Isotope Stage 5 (130-70 kyr), a geological interval considered as an analogue for modern warming. The findings from geological record will comprise analyses of both microfossil and clay minerals. We will able, through micropaleontological analysis to underline carbon and carbonate pump efficiency and resiliency of Coccolithopores, while, through clay mineral analysis, we will able to reconstruct intensity and direction of winds and surface currents. The results obtained from the fossil and sedimentary archives will be compared with experiments on the species Helicosphaera carteri cultivated in turbidostats under CO2-controlled conditions. Helicosphaera carteri cultures will be grown under levels consistent the worst and best scenarios predicted by the Intergovernmental Panel on Climate Change (IPCC).

Comparing information from monospecific cultures and fossil samples is a useful tool to calibrate element chemical data as environmental proxies, but it has to be taken into account the ecological tolerance of each species towards surrounding conditions together with possible species-specific cellular factors occurring during calcification. Therefore, the microalgae-derived geochemical proxies for paleoclimatology will be tested by applying innovative methodologies, such as the X-ray fluorescence at the synchrotron and Raman microspectroscopy, in combination with consolidated technique such as the inductively coupled plasma-mass spectrometry (ICP-MS).

Combined geochemical data from living and fossil microalgae will provide a valuable tool to clarify their response towards higher pCO2 and T. This project will contribute to the knowledge on:

- The linear or non-linear response of living species under stressful conditions, the vital effects, and the environmental factors influencing the calcification and growth of coccolithophores theca.

- The use of elemental chemistry on living microplankton to complement the species- specific geochemical analyses.
- The effects of anthropogenic climate change on oceanic primary producers.

Research team and environment
The selected candidate will be employed for three years at the University of Pavia (Italy) in a young and dynamic team. The PhD candidate will have access to facilities concerning the study of deep marine sediments in the coccolith content at both optical and electronic microscope. Moreover, he/she is expected to perform part of the research work in national and international outstanding institutions such as the Italian Institute of Oceanography and Applied Geophysics (OGS) in Trieste (Italy) for culture experiments and the Tongji University in Shanghai (China) for clay mineral study and paleoceanographic reconstructions.

Suggested skills
Successful candidates are expected to have a background in geology, marine biology or ocean chemistry with interest in biogeochemistry and climate changes. Previous research experience with coccolithophores will be a plus. We are looking for a candidate who knows how to work both in a team and independently, and he/she is willing to test him/herself with pioneering and transdisciplinary researches.

Curriculum: 1. Earth System and Environment scholarship code A12

Emission estimates of Radiatively Active Species at the regional scale

Research keywords:	Atmospheric Observations Atmospheric modelling Emission inventories
Reference ERCs:	PE4_18 Environment chemistry PE10_1 Atmospheric chemistry, atmospheric composition, air pollution PE10_2 Meteorology, atmospheric physics and dynamics
Reference SDGs:	GOAL 13: Climate Action GOAL 17: Partnerships to achieve the Goal
Reference person:	Maione Michela (michela.maione@uniurb.it)
Host university:	University of Urbino 'Carlo Bo' *Department of Pure and Applied Sciences (DiSPeA)*

Research topic

To tackle climate change and its negative impacts, the first legally binding global climate change agreement was adopted at the Paris climate conference (COP21) in December 2015. The Parties to the agreement are required to contain their emissions of radiatively active species in order to limit anthropogenic global warming well below 2C, possibly 1.5C, above pre-industrial level. In this frame, the European Union pledged to cut its emissions below 1990 levels by at least 40% before 2030 to get zero net emissions by 2050. A detailed quantification of emissions of radiatively active species by all Parties is needed in order to supervise if all countries attain their commitments to be achieved within the "transparency framework" established by the Paris Agreement. To this purpose, the UNFCCC (United Nations Framework Convention on Climate Change) requires each Party to provide its annual greenhouse gases inventories, ensuring accurate, transparent, consistent and complete reporting, following the guidelines developed by the IPCC (Intergovernmental Panel on Climate Change). The inventories are built using "bottom-up" methods, based on statistical activity data and emission factors that are affected, however, by great uncertainties. A complementary approach to the bottom-up emission inventories method is represented by top-down or inverse modelling techniques, which, using atmospheric transport models, link emissions to GHG concentrations measured in the atmosphere. The research project consists in developing advanced top-down methods for the estimation of GHG emissions at the European to the national scale, to support the monitoring of the EU objectives regarding the reduction of its emissions. In Europe there are the conditions for the application of top-down models thanks to the presence of international networks of inter-calibrated observatories that provide continuous high-precision and high-frequency measurements of a suite of radiatively active species. Nonetheless, the application of this approach on a regional and national scale is more complex than the global one requiring high resolution atmospheric transport models. The expected scientific results of the project concern the improvement of the modeling approach at the regional to national scale, but are also relevant for environmental policies, falling within the scope of the Global Information System on greenhouse gases (IG3IS) launched by the World Meteorological Organisation.

Research team and environment

The training will take place at the University of Urbino Carlo Bo under the supervision of Prof. Michela Maione and Prof. Umberto Giostra from the departments of Pure and Applied Sciences. Research activities carried out at UNIURB that are relevant for the proposal are: chemical and physical basis of climate change, analytical methods for measuring atmospheric composition changes and atmospheric modelling. Tutors: Michela Maione is professor of environmental chemistry. Her research is in the field of atmospheric composition change in relation to air quality and climate change. She is responsible for the long-term programme for observations of climate altering and ozone depleting substances and of volatile organic compounds at the GAW-WMO station of Monte Cimone. This activity is carried out within international networks, such as AGAGE and ACTRIS. She has authored more than 100 publications and is Lead Author in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Umberto Giostra is professor of climatology. His main activity concerns theoretical, numerical and experimental studies on atmospheric turbulence structure, on meso-scale motions

(meandering and gravity waves) and on dispersion modelling. He has authored more than 60 publications in peer-reviewed journals. Has been involved as PI or WP leader in more than 20 research projects. Has supervised more than 30 Master's Degree theses (Physics and Environmental Sciences), more than 20 PhD theses. He has tutored more than 20 post-doc and CNR (Italian Research Council) research fellows.

Suggested skills
Atmospheric physics. Atmospheric chemistry. Fortran programming on different benchmarks.
Matlab and R programming language.

Storms, extremes, and impacts on coastal areas under climate change

Research keywords:	Storms Extreme events Flooding, wind, surge impacts
Reference ERCs:	PE10_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics PE10_14 Earth observations from space/remote sensing
Reference SDGs:	GOAL 1: No Poverty GOAL 2: Zero Hunger GOAL 11: Sustainable Cities and Communities
Reference person:	Marani Marco (marco.marani@unipd.it)
Host university:	University of Padova *Department of Civil, Environmental, and Architectural Engineering*

Research topic

The research will focus on the quantitative description of the intensity and impacts of storm events in coastal areas in the Italian noth-east. The tools used will include deterministic and/or probabilistic modelling tools of ordinary and extreme events, remote sensing, and field observations. The processes studied, defined in a research plan developed with the advisor, may include rainfall and/or wind intensity within storm events (e.g. The Vaia storm of 2018) in areas located at increasing distance from the coast, storm surges due to wind and pressure gradients in the northern Adriatic sea, sediment transport in coastal zones and within lagoons in the same area. The impacts considered may include the implications of storms for the evolution of coastal environments, with specific reference to the destiny of the Venice lagoon and of lagoons located to the north of the Po River Delta, and/or their impacts on the environment, such as damages to forested areas, floodplain, urban, and coastal flooding. The improved understanding of storm events in the area of interest, as well as of the associated impacts, will be used to quantitatively evaluate how such phenomena and impacts may change due to climate change and anthropogenic interventions (e.g. The MoSE system protecting the city of Venice) according to different expected scenarios.

Research team and environment

The research activity will take place at the Department of Civil, Environmental, and Architectural Engineering at the University of Padova, within a research group of about 10 researchers (PhD students, Post-Docs, Research Scientists, and Faculty Members), under the coordination of Prof. Marco Marani (https://en.Didattica.Unipd.It/off/docente/283FDE1B3E817B636223A32C32B8786F). The group work covers hydrologic modelling, statistical hydrology, coastal morphodynamics, coastal hydrodynamic circulation, sediment transport. Methods include field work (in the Venice lagoon and elsewhere), environmental remote sensing, numerical modelling. The group collaborates with several other research groups within the University of Padova (Department of Geosciences, Department of Agro-Forestry), in Italy (e.g. University of Bologna, IUSS, Pavia, Polytechnic Turin, CNR Bologna, University of Palermo, and others) and abroad (e.g. Duke University, The University of Iowa, University of Connecticut, and others).

Suggested skills

Basic knowledge of:
Global and local water cycle and hydrological processes at Earth's surface
Statistics and probability
Coding, with no preference for a specific programming language (e.g. Matlab, Python, R, etc.)GOAL 11

Mathematical modelling of volcanic phenomena and hazards

Research keywords:	Mathematical modelling Volcanic processes Volcanic hazard and risk
Reference ERCs:	PE1_13 Probability PE10_5 Geology, tectonics, volcanology PE10_20 Geohazards
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Neri Augusto (augusto.neri@ingv.it)
Host university:	Scuola Normale Superiore *in collaboration with Istituto Nazionale di Geofisica e Vulcanologia (INGV)*

Research topic

Mathematical modeling of the dynamics of volcanic phenomena is a key tool to assess the temporal and spatial dimension of their hazards and risks, as well as to quantify the related uncertainties. Models can range from simple empirical descriptions of the processes up to multidimensional and multiphase flow models able to better reproduce the complexity of volcanic phenomena. Furthermore, inputs and boundary conditions are often difficult to constrain, and the output results can often be described only in terms of probability distributions obtained through uncertainty quantification, inverse modeling and stochastic techniques. In addition, the development of forecasting models is crucial for hazard and risk assessments, especially if enhanced by consideration of multiple plausible scenarios based on the knowledge of the volcanic system. The study of volcanological data and observations will be also essential to constrain, test, and statistically calibrate the models. The integration of mathematical models and multidisciplinary data is also of primary importance and will require the development and application of effective tools of data analysis capable of identifying significant relationships from heterogeneous, possibly sparse, and uncertain data sources. This research work aims at a better understanding of the volcanic phenomena and at improved hazard and risk assessments. Multi-hazard and multi-risk analyses and products will be also encouraged, as key tools to combine the volcanic hazards with those associated with other natural sources, including those related to climate change.

Research team and environment

INGV is the Italian institutional body for understanding Solid Earth processes and estimating the associated hazards. Concerning volcanic phenomena, the Institute's research focuses on: collection and analysis of the various multi-parameter signals acquired by the monitoring networks of Italian volcanoes; field studies aimed at geologically reconstructing the eruptive history; experimental and observational investigations able to characterize magmatic systems and mixtures; mathematical models based on the resolution of multiphase transport equations able to describe the dynamics of volcanic processes. INGV-Sezione di Pisa is particularly focused on the mathematical modelling of pre-eruptive and eruptive processes as well as on the statistical and probability analyses of volcanological data and simulations. A long-lasting collaboration exists between INGV-Sezione di Pisa and SNS, carried out through national and international research projects, joint publications, as well as formal agreements supporting PhD fellowships dedicated to the above subjects.

Suggested skills

The candidate should have a good mathematical, physical or engineering background in order to contribute to the development of quantitative models of the volcanic processes and hazards investigated. Mathematical skills should be related to numerical modelling of fluid-dynamic processes and/or statistical and probabilistic analyses (including machine learning and similar techniques) of volcanological data and simulations. However, some of the above expertise can be developed during the PhD thanks to courses and other research activities.GOAL 13

Past climate changes to understand recent ones: geological-ecological approach

Research keywords:	Sea level change Quaternary Anthropocene
Reference ERCs:	PE10_12 Sedimentology, soil science, palaeontology, earth evolution PE10_11 Geochemistry, cosmochemistry, crystal chemistry, isotope geochemistry, thermodynamics PE10_8 Oceanography (physical, chemical, biological, geological)
Reference SDGs:	GOAL 5: Gender Equality GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Pascucci Vincenzo (pascucci@uniss.it)
Host university:	University of Sassari *Architecture, Design and Planning*

Research topic

Climate change is one of the most important topics of discussion today. Numerous scientific studies model that, if the current rate of warming remains unchanged (about 1C every 50 years), by 2100 the global temperature will be about 2C higher than it is today, resulting in a rise in sea level of 40 (or 120) cm compared to today (depending on the models used). The combined effect of these two rapid changes will result in a radical change in the coastal geography of the entire planet. However, most models do not take into account either the adaptability of natural systems to new geographical conditions or the differences between these and more urbanized coastline. Moreover, these catastrophic projections should be corrected with more information on the local responses of closed basins, such as the Mediterranean Sea, to warming. These have repeatedly shown that in times of warming crises, rather than increasing in volume, due to low turnover and high evaporation, they drop, at least in the early stages, relative to the oceans.

A fundamental strategy to improve the accuracy of medium- and long-term climate projections is to study the evolution of the past climate, both remote relative to the last interglacial, and recent, warm-cold Holocene oscillations. It is also essential to define how much humans have influenced natural climate change in the latter. Therefore, it is essential to precisely define the high and very high frequency glacio-eustatic fluctuations of the late Quaternary (last 150,000 years), the time interval closest to the present and immediately preceding the beginning of the fossil fuel era. Indeed, glacial-eustatic fluctuations closely relate to global mean temperature, the volume of the polar ice caps and sea level height. It is possible from paleoclimatic reconstructions (proxies), such as the $\delta^{18}O$ made on ice cores and/or foraminiferal shells, to estimate the relative altitude of the paleo-sea level in a given geological time interval. Based on the sea level altitude, it is possible to estimate the global mean temperature in a given time interval: a decrease in temperature corresponds to an expansion of the ice caps and, therefore, a decrease in the mean sea level.

The data produced could be compared with those derived from the study of Mediterranean coral deposits. In fact, their slow development encompasses long periods of time that can be compared with the recent geological periods of the Holocene and, of course, the Anthropocene, and could make it possible to define and distinguish, at least in part, how much impact humans have on climate change and to assess its effects on extremely sensitive organisms.

Research team and environment

Research team is composed by researchers based in the University of Sassari. Their background spans from sedimentology to marine geology passing from ecology. Main research topic of the last 10 years have been the late Quaternary climate changes as recorded by sediments. Nevertheless, much attention has been given to the modern/present environment (mostly marine) to understand how much the human is contributing to the on-going climate changes. The team has modern lab of sedimentology, marine geology and geochronology. This

latter is based on luminescence. In Sassari is active a full-equipped lab for luminescence dating. Main on-going projects are addressed to the better understanding of the evolution of the last interglacial (the last warm time without humans), to the study of Martian analogues where apply the luminescence dating technique and to coastal conservation.

Suggested skills

Successful candidates should be strongly motivated in working in a consolidated team where there is the need of new skills and ideas. They should have a basic background in Earth Sciences with special skill in Sedimentology and Marine Geology and/or Oceanography. They should be motivated to perform field campaigns, also in extreme environment (i.E. Greenland). They should be available to travel and study abroad, at least for a full semester.GOAL 13

Methodologies for accounting and assigning GHG emission responsibility

Research keywords:	Anthropogenic GHG emissions Producer vs. Consumer responsibility GHG accounting framework
Reference ERCs:	SH7_6 Environmental and climate change, societal impact and policy SH7_5 Sustainability sciences, environment and resources PE10_3 Climatology and climate change
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Pulselli Federico Maria (federico.pulselli@unisi.it)
Host university:	University of Siena *Department of Physical Sciences, Earth and Environment*

Research topic

A pivotal prerequisite for the control and the mitigation of the greenhouse gas (GHG) emission in atmosphere is the existence of a systematic monitoring and accounting process, such as the IPCC Guidelines for National GHG Inventories. The research project will be based on the study, refinement and application of GHG accounting methods at both national and subnational level. It will also focus on the topic of GHG emission responsibility, enriching the environmental accounting system with implications on emission localization, reasons, drivers, and the economic/production sectors involved. Starting from the main criteria for emission responsibility assignment, i.e. the producer-based or geographical criterion and the consumer-based criterion, the research is aimed to: 1) investigate the best ways to apply the IPCC guidelines for GHG inventories at the sub-national level with a bottom-up approach, with the aim of refining procedures and facilitate their progressive diffusion and adoption; 2) analyze the quality and availability of data required to calculate consumer responsibility and related methods (e.g, the EEIO - Environmentally Extended Input Output dataset and the simplified NCI - National Carbon Intensity method) with the aim of computing the geography of emissions, which, in turn, may have consequences in terms of policy; 3) design an accounting system able to assign emission responsibility in an intermediate and fair way compared to the two extremes described above (i.e. producer and consumer responsibility). The research will investigate the possibility to integrate the standardized accounting system proposed by IPCC, including the allocation of responsibility (and related implications) to the countries that create the demand for the large flows of goods involved in international trade.

Research team and environment

The University of Siena considers sustainability as a strategic task and hosts the UN-SDSN hub for the Mediterranean Area. The PhD candidate will work in the Department of Physical Sciences, Earth and Environment in which many research groups operate in the Environmental and Earth System Science fields. The PhD candidate will work within the Ecodynamics Group, a multidisciplinary research team that has been dealing with sustainability and climate change for three decades. One of the main research projects of the group is the multi-year GHG accounting framework for the Province of Siena. This project has contributed to lead this area to the status of carbon neutrality (since 2011). Other projects of the group are based on sustainability assessment of systems and processes, dissemination and education.

Suggested skills

The PhD candidate is expected to have a background in environmental science, sustainability foundations, assessment and indicators.
Knowledge of GHG accounting methods, Life Cycle Assessment and other environmental accounting methods is seen as a merit.

The candidate should be motivated and open-minded, available to develop and share his/her experience in a multidisciplinary environment.

He/she must be available to stay in Siena and also travel for both education and research purposes.GOAL 13

Curriculum: 1. Earth System and Environment scholarship code A17

Disaster Risk Reduction in coastal areas affected by climate change

Research keywords:	Disaster risk reduction in coastal and nearshore areas Coastal management and conservation Climate change
Reference ERCs:	PE10_13 Physical geography, geomorphology PE10_14 Earth observations from space/remote sensing PE10_20 Geohazards
Reference SDGs:	GOAL 13: Climate Action
Reference person:	Soldati Mauro (soldati@unimore.it)
Host university:	University of Modena and Reggio Emilia *Dipartimento di Scienze Chimiche e Geologiche*

Research topic

Climate change is heavily impacting coastal areas resulting in both short-term (storm surges etc.) or long-term processes (sea level rise) that determine disaster risk situations and remarkable socio-economic implications. The land-and-sea interface (the so-called `white ribbon' area) is extremely sensitive to climate change effects and remarkably important for coastal scientists and managers dealing with coastal dynamics. Under the current effects of climate change, it is necessary to draw special attention to this environment, which is often unexplored or not adequately investigated. A sustainable management of coastal shores would be possible through a holistic approach to risk assessment taking into consideration the interaction between subaerial and submarine processes. In this context, this PhD project will foresee integrated geomorphological mapping, monitoring and modeling of selected sites of the Mediterranean, merging ground-based, satellite, aerial remote sensing, as well as marine surveys. The thesis will focus on the instability of coastal areas enhanced by climate change effects by investigating the whole coastal system, from the cliff edges to the seafloor. The research project will include direct measurements to be carried out in the short- and medium-term, using cutting-edge technology such as X-band radar, multibeam surveys (including back-scatter analysis), ROV and USV mapping, video-monitoring, UAV and TLS surveying, Optical RS and SAR interpretation.

The outputs of the thesis - including an original methodological approach and newly acquired datasets - can be of interest to managers and end-users, as a tool for a more sustainable and cost-effective management of coastal assets under threat. In this respect, the thesis is expected to provide data acquisition and interpretation tools that can serve as a reliable ground for understanding the causes and effects of coastal risks, so as to sensitize relevant authorities to build a collective understanding of how adaptation and mitigation measures can be planned and performed toward an improved governance of coastal risk.

Research team and environment

The PhD student will be part of the Geomorphology Team of the Department of Chemical and Geological Sciences. The Team comprises 4 permanent staff members (1 Emeritus Professor, 1 Full professor, 1 Associate Professor, 1 Senior researcher) plus 2 contract lecturers, 2 contract researchers, 1 PhD student and a number of Master students. The research group has the capacity to provide appropriate training to PhD students and early career scientists thanks to the experience acquired in long-standing research and teaching activities. The Team has been involved in several research projects on coastal risk assessment funded by the Council of Europe in the frame of the EUR-OPA Major Hazards Agreement, and has a long-standing research experience in the field of environmental geomorphology applied to societal issues. The PhD student will have the chance to interact with the staff in an informal atmosphere, and have the chance to be part of international research network dealing with geohazards.

Suggested skills

The candidate should be able to:

- Recognize and understand geomorphological processes and landforms in coastal areas:
- Deal with geological and geomorphological datasets in a GIS environment;

- Detect hazard and risk situations;
- Work in a multidisciplinary team and in an international context;

Computational Quantum Chemistry for Atmospheric Monitoring and Environmental Sustainability

Research keywords:	Quantum chemical calculations Atmospheric spectroscopy and reactivity Photocatalytic removal of environmental pollutants
Reference ERCs:	PE4_13 Theoretical and computational chemistry PE4_2 Spectroscopic and spectrometric techniques PE4_12 Chemical reactions: mechanisms, dynamics, kinetics and catalytic reactions
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Tasinato Nicola (nicola.tasinato@sns.it)
Host university:	Scuola Normale Superiore *Faculty of Sciences*

Research topic

Two research lines are available.

1. Spectroscopy and atmospheric reactivity of environmental pollutants

Composition changes of the Earths atmosphere, mainly due to various anthropogenic factors, are considered responsible for several adverse climate and environmental impacts. Anthropogenic activities have exerted a profound impact on the atmospheric composition, both altering the mixing ratio of natural occurring gases and releasing synthetic hazardous chemicals. Climate change studies need the temporal trend of hazardous atmospheric pollutants of both greenhouse and ozone-depleting gases. For this purpose, remote sensing spectroscopic techniques are widely used to probe the atmosphere and retrieve the concentration profiles of a number of species. Besides environmental monitoring, the fate of the compounds released into the atmosphere needs to be precisely characterized in order to understand how rapidly these substances degrade, when and where they are destroyed, and whether the degradation products can lead to more climate forcing than the parent species.

The research focuses on the following two topics:

Determination of the structural, rotational and vibrational spectroscopic properties of atmospheric relevance by adopting an integrated experimental - theoretical approach. State-of-the-art quantum chemical calculations are performed to drive experiments and assist the analysis of the recorded spectra in order to determine the spectroscopic information required to exploit the observational data acquired by ground- or space-based observatories. Notably, detailed quantum chemical calculations are even more important for unstable species difficult to study experimentally.

Molecular modeling of the atmospheric degradation pathways of environmental pollutants by quantum chemical calculations. These are carried out in order to achieve a full characterization of the degradation pathway, thus allowing the identification of reaction products and intermediates, from which the corresponding thermochemistry and chemical kinetics, and hence atmospheric lifetimes and branching ratios, can be derived.

2. Degradation of environmental pollutants on semiconductor scavengers.

The growing concerns of scientific communities and international politicians about climate changes and environmental degradation related to the human activities have even more highlighted the needs for the development of eco-sustainable technologies to limit the human impact on the environment. The photo-catalytic decomposition of hazardous compounds promoted by semiconductors represents an eco-sustainable technological solution for their removal as well as for protecting cultural heritage. Quantum chemical modeling and laboratory experiments are performed to disclose the atomistic details of the adsorbatesubstrate interaction and hence providing the information required for the rational design of catalytic coatings with improved photo-degradation capacities.

Key questions we aim to answer are:

- Characterize the spectroscopic signature of atmospheric pollutants of anthropogenic origin (e.g. Halogenated organics) to provide the required knowledge for their atmospheric monitoring.
- Understand the degradation pathway of molecules emitted in the atmosphere, their atmospheric lifetimes, the main environmental sinks, and identify first-generation products.
- Assess the capacity of environmental pollutants in altering the Earth's radiative budget or in exerting a hazardous effect on atmospheric composition.
- Unveil the adsorption interaction and degradation of hazardous compounds on catalytic materials.
- Develop accurate and cost-effective computational protocols for modeling molecular systems in the gas- or condensed phase.

Research team and environment

The research activity is carried out within the SMART Laboratory (https://smart.Sns.It/) that is dedicated to the development of advanced theoretical models for computational chemistry, their implementation in a number crunching simulation software and application to several chemical issues, with particular emphasis on environmental sciences and astrochemistry/astrobiology. The Laboratory has extensive facilities for developing software and running large-scale atomistic simulations and it manages a server room hosting the Avogadro Computational Cluster. This is equipped with more than 100 servers and 3000 CPUs and with dedicated storage with up to 300 TB of raw space for long term conservation of data. The cluster also includes three fat nodes with a high number of dedicated cores (80, 160 and 240, respectively) and massive amounts of RAM (from 4 to 6 TB), ideal for running high demanding calculations completely in memory. Several compilers, scientific libraries and calculations suites are installed and maintained both open source or licensed. SMART also hosts the DreamsLab, an immersive virtual reality (IVR) laboratory equipped with powerful graphic workstations and last-generation IVR hardware such as Oculus Rift and HTC Vive and an immersive CAVE3D theater equipped with Optitrack IR sensors. While the SMART laboratory provides the required infrastructure for the theoretical and computational researches, laboratory experiments will be carried out thanks to ongoing collaborations.

Suggested skills

Basic knowledge in: thermochemistry, spectroscopy, chemical kinetics, electronic structure and quantum chemistry.GOAL 13

Thermodynamic behavior of fluid mixtures containing H2 and CO2

Research keywords:	Energy transition Underground storage Fluid physico-chemical behavior
Reference ERCs:	PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage PE8_6 Energy processes engineering PE5_5 Ionic liquids
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Verga Francesca (francesca.verga@polito.it)
Host university:	Politecnico di Torino *Department of Environment, Land and Infrastructure Engineering*

Research topic

Renewable sources are considered key to decarbonize energy systems and reduce dependency on fossil fuels. However, in the short-to-medium term, renewables will not be sufficient to replace fossil fuels. To compensate CO2 emissions from burning fossil fuels, strategies such as CO2 capture and permanent storage (CCS) have been developed and applied in this transition to a more environmentally-sustainable scenario, aiming at decelerating and even at discontinuing the accumulation of CO2. At present, there are still significant scientific and technological challenges for energy-efficient, economically and environmentally viable CO2 capture, conversion and storage processes.

Furthermore, technologies relying on solar energy and wind power are not fully viable yet due to their unstable and intermittent nature. In this view, large-scale electrical or chemical energy storage can provide means for balancing supply and demand, increasing energy security, promoting a better management of the grid and allowing convergence towards a low carbon economy. Chemical storage implies transforming electrical power into chemical energy in the form of H2, which can then be used as such or combined with captured CO2 to produce green CH4 (referred to as the gas-to-power technology), thus it is very versatile.

This is the perspective framing the research activity about experimental and numerical characterization of fluid mixtures containing H2 and CO2.

Three main complementary streams relevant to energy transition and decarbonization processes are envisioned: carbon capture, hydrogen utilization and underground storage of H2 and CO2. All of them require a thorough description of the thermodynamic as well as the volumetric and phase behavior of multicomponent fluid mixtures. The research will also investigate solubility phenomena of gases into liquids.

The characterizations will investigate the impact of the variation of the thermodynamic conditions for multicomponent mixtures for the broad sector of the geoscience, with a special focus on pressure and temperature conditions relevant to underground storage of H2 and CO2 in geological formations. The obtained experimental results will allow validation and calibration of different Equations of States and families of curves defined according to the parametrization needed for the final application.

The steps preceding the storage of either gas will also be investigated as they are directly linked to the same analyses of the multicomponent mixture phase behavior. Thus, carbon capture through separation by sequestrating solvents (e.g. Scrubbing of flue gases with ionic liquids; transport with liquid organic hydrogen methods) will be also be addressed.

Research team and environment

The candidate will work in a multidisciplinary environment that includes engineers, physics, chemists and geologists to tackle all the different aspects of the research. The activities will be developed at the SEASTAR Competence Center - Sustainable Energy Applied Sciences, Technology & Advanced Research in Torino, , which offers laboratory equipped for testing multicomponent fluid mixtures containing H2 and CO2 under extreme

conditions (specially manufactured PVT cell), within a collaboration between Politecnico di Torino and Istituto Italiano di Tecnologia.

Suggested skills

A strong background in chemistry and/or petroleum engineering would guarantee the technical competences necessary to carry out the research. Furthermore, the ideal candidate should have an interest in the topics related to energy transition and climate change mitigation solutions.GOAL 13

Assessment of past and future climate changes in the extended Alpine area

Research keywords:	Alps Climate change Mountain
Reference ERCs:	PE10_3 Climatology and climate change PE10_2 Meteorology, atmospheric physics and dynamics PE10_1 Atmospheric chemistry, atmospheric composition, air pollution
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 7: Affordable and Clean Energy GOAL 13: Climate Action
Reference person:	Zardi Dino (dino.zardi@unitn.it)
Host university:	University of Trento *Department of Civil, Environmental Mechanical Engineering (DICAM) and Centre Agriculture Food Environment (C3A)*

Research topic

Increasingly strong evidence, both from data analysis and from modelling projections, confirm that climate changes are affecting mountainous regions at a higher rate and with stronger intensity than other areas. This situation threatens a variety of environmental resources and fragile ecosystems, typically hosted in the mountains. Furthermore, mountain ranges have effects on neighbouring regions, as they affect atmospheric thermal structures, atmospheric circulations, and the water cycle well beyond their geographic position. Our understanding of the mechanisms implied by the above interactions is still quite limited, and this hinders our capability of predicting future evolutions, and hence adopting suitable long-term strategies.

The project will provide an integrated and up-to-date assessment of our present understanding of climate change impacts in the Alpine region, and in surrounding areas whose climate is closely affected by Alpine effects. The research will consider effects in various environmental aspects, such as the surface energy budgets, the water cycle components (precipitation, evaporation, runoff, glacier melting, etc.), the air quality, the interactions with the biosphere.

Effects from and on land use changes will be particularly investigated, in view of assessing effective impacts from adaptation and mitigation strategies.

A preliminary systematic literature review will allow a detailed and up-to-date overview of the present state of our knowledge on the subject. Also, it will allow focusing on the most challenging open questions, as well as on the available observational and modelling resources to face them. In particular datasets from both surface observation networks and remote sensing systems will be integrated, along with climate model output, downscaled to the appropriate resolution at regional scale, to assess past and expected changes in climatic regimes of the main environmental variables, and their possibly different magnitude in different subareas and/or seasonal situations.

The analysis will not be limited to mean values, but will also concentrate on extreme events and their statistical properties.

Connection with larger scale features (such as North Atlantic Oscillation, El Nino Southern Oscillation, Madden-Julian Oscillation, etc.) will also be investigated.

Research team and environment

The research team will involve researchers of the Atmospheric Atmospheric Physics Group and of other Groups at the Department of Civil Environmental Engineering (DICAM) and at the Centre Agriculture Food Environment (C3A) at the University of Trento. Further cooperation is foreseen with other research bodies and universities, in Italy and abroad, and in particular with the Institute of Atmospheric and Cryospheric Sciences (ACINN) of the University of Innsbruck (Austria), the Institute for Atmospheric and Climate Research of the National Research Council (CNR-ISAC), and the University of Torino.

Suggested skills

Sound background in atmospheric and climate sciences.

Experience in the treatment and analysis of meteo-climatic data.

Skills in numerical modelling, in particular with weather and climate prediction models.GOAL 13

Curriculum: 2. Socio-Economic Risk and Impacts scholarship code **B01**

Development of innovative strategies for the management of pluvial flooding risk in contexts characterized by climate change and non sustainable developments

Research keywords:	Pluvial flooding Resilience and risk impact Sustainable engineering
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics SH7_6 Environmental and climate change, societal impact and policy PE10_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action

Reference person:	Aronica Giuseppe Tito (giuseppetito.aronica@unime.it)
Host university:	University of Messina *Department of Engineering*

Research topic

Since the beginning of the century, floods in Europe have caused over 700 deaths, the evacuation of about half a million people and at least 25 billion euros in economic damage, to which must also be added considerable social and environmental damage.

It is estimated that by the middle of the century about 80% of the European population will live in urban areas. The growing complexity of urban systems and the uncertainty associated with flood risk, exacerbated by climate change, pose serious challenges to the sustainability of our communities.

Therefore, it appears more urgent than ever to develop innovative and sustainable strategies for the management of flood risk, in order to increase the socio-economic resilience of urban communities with regard to the disastrous effects resulting from extreme hydro-meteorological events.

For this purpose, the proposed research topic intends to focus on the development of a methodological framework for modeling the cascade effects of pluvial flooding events, through the simulation of risk scenarios for the urban population, infrastructures and ecosystem services, which take into account also of the uncertainty associated with forecasts on climatic variability and anthropogenic transformations. Subsequently, potential mitigation actions consisting in the implementation of sustainable rainwater control solutions will be considered as measures to increase the resilience of cities.

Since understanding the potential changes, both in the extent of extreme rainfall and in the characteristics of the urban areas, is fundamental for the design of sustainable urban drainage systems capable of mitigating the effects of pluvial flooding events, particular attention will be paid to the estimation of possible future changes in short-term rainfall, as well as the implementation of interventions aimed at minimizing soil imperviousness and sealing through the widespread use of materials that allow the infiltration, retention and temporary detention of water.

This will enable a step change in the management of pluvial flooding improving understanding of the potential impacts and quicker recovery of individuals, communities and buildings.

Research team and environment

The research activity will take place at the Department of Engineering, University of Messina, within the Research Group of Water Engineering and Hydrology coordinated by Prof. Giuseppe T. Aronica. The Group includes an Associate Professor and other members (PhD students, Post-Docs, Research Assistants) and cover research topics related to flood risk management and flood defense design, flood propagation modelling, hydrological and hydraulic modelling of flash floods and debris flows, flood vulnerability and damage evaluation, pluvial flooding, sustainable urban drainage systems, flood early warning, stochastic hydrology applied to the

analysis of extreme hydrometeorological events. The research activities are supported by several national and International grants in the field of flood risk assessment and mitigation, damage evaluation, development of disaster risk reduction strategies. The Research Group collaborates with several other research groups in Italy (University of Palermo, IUSS Pavia, University of Catania, Polytechnic Turin, University of Naples, and others) and abroad (University of Exeter, University of Thessaloniki, University of Bristol, Middlesex University, University of Sarajevo and others).

Suggested skills

The ideal candidate should have a background in civil and environmental engineering studies, in particular in the field of pluvial flooding, flood vulnerability and damage evaluation, sustainable urban drainage systems,

Familiarity with programming languages such as MATLAB, R, C++, Fortran will be positively considered, as experiences in statistics, data analysis and socio-economic modelling will be an added value. Fluency in English, both written and spoken, is recommended

Finally, the candidate should be strongly motivated to work in collaborative environment, with an inter-disciplinary approach, and a willingness for international mobility is required.

Flood risk assessment for a sustainable design of the environment

Research keywords:	Flood risk Sustainable design Flood damages
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics SH1_12 Environmental economics; resource and energy economics; agricultural economics PE10_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 13: Climate Action
Reference person:	Ballio Francesco (francesco.ballio@polimi.it)
Host university:	Politecnico di Milano *Civil and Environmental Engineering*

Research topic

The research line is focussed on the assessment of flood risk within a global change scenario, thus integrating trends and uncertainties linked not only to climate changes, but also to the demographic /social and economic dynamics. Such a global view should be taken as a baseline of any rational strategy for flood risk mitigation. Specific focus will be given to the development of damage models, and to the identification of risk indices capable of characterizing the dynamics of the global scenarios of the risk chain (hazard, exposure, vulnerability), with particular attention to the local spatial scale. Ultimate target of the research is the proposal of a solid and comprehensive methodology for the evaluation of land use planning and design with respect not only to flood risk mitigation but to a wider set of the sustainable development goals proposed by the UN, in particular to objectives 3 (good health and well-being) and 13 (climate actions).

Research team and environment

The researcgh team at Politecnico di Milano has a solid experience in all components of flood risk assesment and management, both with respect to prevention (land use planning and mitigation measures) and emergency management (civil protection). The group has strong scientific relations with the major international group on flood damages, as well as continuous collaboration with national stakeholders responsible for flood management (river authorities, regional authorities, civil protection). Weakest point in the research group are possibly the economic competences, which can be easily complemented within the network of the national doctorate.

Suggested skills

As the research is strongly inter-disciplinary we cannot expect candidates to be already competent in most of the required knowledge field. We, therefore, look for persons willing to learn and synthetise knowledge along a wide spectrum of disciplines including water sciences, land use planning, economics and, more in general social sciences,

Climate Change Impact on Economic Systems and Policies for an Orderly Transition.

Research keywords:	Climate Change Orderly Transition Economic Impacts
Reference ERCs:	SH1_1 Macroeconomics; monetary economics; economic growth SH1_12 Environmental economics; resource and energy economics; agricultural economics SH1_7 Behavioural economics; experimental economics; neuro-economics
Reference SDGs:	GOAL 8: Decent Work and Economic Growth GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Caiani Alessandro (alessandro.caiani@iusspavia.it)
Host university:	IUSS Pavia *Department of Science, Technology and Society*

Research topic

The candidate should have a background in economic studies, in particular in the field of macroeconomic analysis. His training and research activity will center on the study and development of models aimed at achieving a better understanding of the interactions between climate, the environment, and the economy. The focus will be on the effects of climate change on the real and financial spheres of the economy, with the aim of identifying the most suitable economic policies and the regulation schemes to mitigate the economic risks connected both to global warming and to the transition from a carbon-intensive to a low-carbon economy. The candidate will be encouraged to adopt a multidisciplinary approach and to use a wide range of tools such as dynamic heterogeneous-agent models (.e.g. Agent-Based Models), Integrated Assessment Models, econometric models, network analysis and machine learning techniques, behavioral and experimental economics methods. The research activity will be carried out in the research centre on Climate change impAct studies for RISk MAnagement (CARISMA) of IUSS.

Research team and environment

IUSS mission is to provide advanced education to undergraduate and graduate students, as well as fundamental and applied research in the fields of Science, Technology, Engineering and Mathematics (STEM), and Human, Social, and Life Sciences. At IUSS, PhD candidates will find an open multidisciplinary environment offering real opportunities for developing academic and professional tools to face the challenges arising from increasing complexity and fast changes in the society and the environment. IUSS is always and actively committed towards internationalisation, inclusion and diversity. The selected candidate will join the research centre on Climate change impAct studies for RISk MAnagement (CARISMA). The CARISMA team is composed by STEM and Social scientists working in the prism of climate change on data analysis and modelling of Earth System and Economic System processes; impact assessment of extreme natural events and anthropogenic activities on human and natural environments; risk assessment and management of natural and anthropogenic hazards; and formulation/proposal of new economic, political and legal models of sustainable development.

Suggested skills

The ideal candidate should have a background in economic studies, in particular in the field of macroeconomic analysis. Good quantitative skills, e.g. In economic modeling and statistical/econometric analysis, are valuable assets. Familiarity with some statistical software and/or programming languages such as MATLAB, R, Python, Java, C++, Stata, Eviews are also appreciated, though not mandatory. Fluency in English, both written and spoken, is highly recommended. Finally, the candidate should be strongly motivated to work in a pluralist and multi-disciplinary environment, collaborating with the STEM and social scientists of the CARISMA Research Centre at IUSS.GOAL 13

Sustainability models for the post Covid-19 pandemic

Research keywords:	Sustainability Well-being Inequality measures
Reference ERCs:	SH1_6 Econometrics; operations research PE1_14 Mathematical statistics PE6_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 5: Gender Equality GOAL 8: Decent Work and Economic Growth
Reference person:	Cerchiello Paola (paola.cerchiello@unipv.it)
Host university:	University of Pavia *Dep Economics and Management*

Research topic

The research activity will focus on the methods of measuring the socio-economic effects of the pandemic, with the aim of suggesting sustainable European, national and regional policies, which identify the correct trade-off between economic and health effects. Such policies should also propose reliable technologies, distributed and inclusive, which allow the mitigation of adverse effects and reduce the main inequalities. In this context we will make use of the collaboration of the wide network of partners of the European project Periscope, recently funded, of which we are European coordinators.

Research team and environment

The candidate will be part of the statisticalab (https://statisticallabunip.Wixsite.Com/statisticallab), based in the dep of economics and management of the University of Pavia. The enviroment is stimulating and young,

Suggested skills

The candidate should have good basis of statistics and data analysis as well as knowledge of pyhton and r.GOAL 8

The role of innovative start-ups in the transition towards a more innovative and sustainable economy

Research keywords:	Innovative start-ups Eco-innovation Digital Technologies
Reference ERCs:	SH1_9 Industrial organisation; entrepreneurship; R&D and innovation SH1_10 Management; strategy; organisational behaviour
Reference SDGs:	GOAL 5: Gender Equality GOAL 9: Industry, Innovation and Infrastructure GOAL 12: Responsible Consumption and Production
Reference person:	Colombelli Alessandra (alessandra.colombelli@polito.it)
Host university:	Politecnico di Torino *Department of Management and Production Engineering*

Research topic

The project will contribute to the literature on entrepreneurship and sustainable development. The research will analyze the most innovative trends and business practices to respond to climate change challenges and support a transition towards a more innovative and sustainable economy. Moreover, the project will evaluate the long-term consequences of phenomena such as the COVID-19 pandemic for companies sustainability and the achievement of the objectives of the European Green Deal, focusing on green strategies among innovative start-ups. The project is built around four interconnected research pillars: 1) What is the role of start-ups in generating and spreading green technologies in support of a more innovative and sustainable economy? 2) How can start-ups jointly leverage digital and green technologies and what is the impact of such technologies on the transition towards a more innovative and sustainable economy? 3) What was the impact of coronavirus on the adoption and development of climate-smart technologies among start-ups? What characteristics and business strategies have contributed to enhanced resilience among start-ups during the economic crisis caused by the pandemic? 4) How relevant are regional, national, and EU policies and institutions in creating the right incentives to protect eco-innovation and entrepreneurial sustainability?

Research team and environment

The research project will involve the members of the Department of Management and Production Engineering and the Entrepreneurship and Innovation Centre (EIC) (http://eic.Polito.It/), which is hosted by the Technology Transfer Lab at the Politecnico di Torino. The Center brings together competencies and skills of scholars that are active in the study of innovation and entrepreneurship along several complementary dimensions, ranging from the strategic management of technology to entrepreneurial finance and the dynamics of local innovation systems. The activity of the research team focuses on the development of an integrated framework for understanding the dynamics of innovation and entrepreneurship, with a particular interest in how to apply best practices and new ideas to the local ecosystem. The innovation process is studied according to a systemic approach. In this perspective, the research activities are oriented at investigating not only the characteristics of innovative start-ups but also the role of different stakeholders that contribute to shaping the environmental conditions of local entrepreneurial ecosystems. Specifically, a research line of the research team is dedicated to the interplay between businesses and the environment. It analyses three macro-themes: (1) circular economy market strategies, new business models, and digitalization as an enabler of circular economy practices; (2) eco-innovation and patenting activities, green innovations, and (3) green start-ups and social entrepreneurship.

Suggested skills

Basic knowledge in the area of entrepreneurship, economics and management of innovation is required. Moreover, the candidate should demonstrate basic econometric and statistical skills and competencies in handling large databases. Further capabilities that are preferable in the candidate are the ability to carry out

analysis and synthesis on the state of the art of the literature, ability to present a scientific work both in oral and written form, proactivity, creativity, independent and critical thinking.GOAL 12

Business strategies for decarbonization and circular economy.

Research keywords:	Decarbonization Circular economy Sustainability Management
Reference ERCs:	SH7_6 Environmental and climate change, societal impact and policy SH7_5 Sustainability sciences, environment and resources SH1_10 Management; strategy; organisational behaviour
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Frey Marco (Marco.Frey@santannapisa.it)
Host university:	Sant'Anna School of Advanced Studies Pisa *Institute of Management*

Research topic

The central theme of the research will concern the development of management and technical solutions to combine a circular economy approach with decarbonization challenges. The research's topic will focus on the implementation and measurement of the impacts of companies' strategic decisions in a multistakeholder and shared value perspective. The institutional and territorial reference framework will therefore be considered to understand which partnerships can be developed by companies to improve their contribution to more sustainable development and decarbonization.

Research team and environment

The research will take place at the Sustainability Management Lab of the Institute of Management. The Institute of Management has been running for more than ten years a Ph.D. in Management Innovation, Sustainability and Healthcare. The Sustainability Management Lab, composed of more than 40 researchers, is active in research on sustainability for eighteen years. More than 30 projects funded by the European Commission and 150 national projects or projects commissioned by companies have been carried out. Topics include, among others, circular economy, sustainable production and consumption, efficient use of resources, energy transitions, valuation of natural capital, and ecosystem services. The Sustainability Management Lab activities also concern companies' mitigation and adaptation strategies for climate change. The most used tools are: - Statistical and econometric analysis. - Life Cycle Assessment. - Organizational Network Analysis. - Ad hoc assessment tools (for example, measuring the circular economy). There are observatories and laboratories such as those on safety management or management of packaging with consortia to link research and business strategies, or more than ten-year partnerships with institutions and companies. There are also opportunities related to training activities, particularly with the GECA post-graduate degree (Environmental Management and Control, active for 25 years) and with Schools on Circular economy.

Suggested skills

We are looking for candidates with economic and business management skills, with particular reference to sustainability management.GOAL 13

Sustainable Artificial Intelligence models

Research keywords:	Risk management models Machine learning Network models
Reference ERCs:	SH1_6 Econometrics; operations research PE1_14 Mathematical statistics PE6_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 8: Decent Work and Economic Growth GOAL 9: Industry, Innovation and Infrastructure
Reference person:	Giudici Paolo (giudici@unipv.it)
Host university:	University of Pavia *Economics and Management*

Research topic

This research project will develop predictive and explainable statistical models to measure the impacts and risks of artificial intelligence applications. In particular, the research will focus on network models to measure the interdependencesgenerated by peer-to-peer platforms, to promote an efficient and sustainable credit allocation, and on the measurement of the cyber risks that arise from the increasing use of cloud computing, blockchain and the internet of things. The preventive measure of risks will allow to develop economic innovations that are sustainable and trustworthy.

Research team and environment

The Phd candidate that will conduct the research will be able to leverage the resources of the statistical laboratory of the University of Pavia (6 professors, 6 post-doc researchers, 6 Phd students) that coordinates the European project "FIN-TECH", with 24 international partners.

Suggested skills

Multidisciplinary skills especially at the interface between sustainability, statistics and machine learningGOAL 9

Responsible capitalism and climate change

Research keywords:	Capitalism Climate change Strategy
Reference ERCs:	SH1_2 International trade; international management; international business; spatial economics SH1_5 Corporate finance; banking and financial intermediation; accounting; auditing; insurance SH1_10 Management; strategy; organisational behaviour
Reference SDGs:	GOAL 10: Reduced Inequality GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Giuliani Elisa (elisa.giuliani@unipi.it)
Host university:	University of Pisa *Responsible Management Research Center, Dept. Economia e Management*

Research topic

The research investigates the link between contemporary capitalism - understood as the socio-economic model in its various international varieties - and the phenomenon of climate change. The project has a microeconomic focus and, therefore, concentrates mainly on economic agents (industrial and/or financial) to study whether and how, through strategic choices and operational behaviour, they contribute to slowing or promoting deterioration of the environment and biodiversity, in the context of the ongoing climate change.

The following are the primary (but not exclusive) topics of this programme: (i) the relationship between tax avoidance and environmental policies/ performance (including those related to climate change mitigation) of economic agents; (ii) the role of finance (with particular reference to large institutional investors) to achieve climate targets; (iii) analysis of the changes introduced at the corporate governance level to meet demands to decarbonise economies. These topics may involve investigation of more than one sectors and wide-ranging international analysis which will include economic agents operating in both high- and lower-income countries.

This scholarship is aimed at generating solid scientific foundations for opportunities to rethink or reprogramme some of the basic rules governing the functioning of capitalism, in order to achieve a model whose intrinsic features include greater responsibility for society and the environment.

Research team and environment

The PhD candidate will have the opportunity to work in collaboration with scholars affiliated to the Responsible Management Research Center - REMARC of the University of Pisa. REMARC's goal is to conduct an inter-disciplinary research on companies' responsible management practices and on sustainable development policies. It seeks to have an impact on managers and on policy makers at local, national and international levels, and it counts on a network of top-notch external collaborators. It is part of the Network for Business Sustainability and of the Post-Growth Economics Network. REMARC regularly organizes seminars and dissemination events: the successful PhD candidate will be asked to participate in seminars and will be actively involved in center's dissemination and other research activities. Scholars affiliated to REMARC have published in top journals including the American Economic Review, Science, Nature Sustainability, Journal of Economic Geography, Journal of World Business, Journal of Business Ethics, Research Policy, World Development, among others. Website: https://remarc.Ec.Unipi.It/

Suggested skills

The ideal candidate has a degree in economics or managament studies, or related disciplines. It is highly recommended that applicant has a solid background in statistics and/or econometrics because the project's methodological focus will be quantitative - although qualitative methodological approaches are also possible in

combination with quantitative ones (as e.g. In the case of mixed methods approaches). Strong interest in the proposed research topics and willingness to learn advanced statistical and econometrics methodologies are key for this grant.GOAL 13

Sustainable mobility and eco-innovation in transportation economics

Research keywords:	Sustainable mobility Innovation diffusion Green transportation
Reference ERCs:	SH7_9 Energy, transportation and mobility SH7_6 Environmental and climate change, societal impact and policy SH1_9 Industrial organisation; entrepreneurship; R&D and innovation
Reference SDGs:	GOAL 9: Industry, Innovation and Infrastructure GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Maggi Elena (elena.maggi@uninsubria.it)
Host university:	University of Insubria *Department of Economics - Varese*

Research topic

Decarbonization processes and the development of eco-innovations are of utmost importance in modern industries. According to the Sustainable Development Goals of the UN 2030 Agenda, as passenger and freight transports are among the main sources of pollution and energy consumption, more research is required to understand different ways to reduce transport negative externalities, also by influencing the individuals behaviour in their own daily mobility choices and by introducing innovative services and processes. In the transition towards a sustainable and smart mobility, the market penetration of eco-innovations is a key factor to allow for networks externalities among users and to favour the innovation diffusion in the whole community. Within the cluster 5 action of Horizon Europe Programme, innovation efforts in transportation could contribute to achieving a climate-neutral, safe, seamless and smart mobility concept for people and goods. The aim of the research is twofold. First, by using both Revealed and Stated Preferences methods, the behaviour of passenger travellers and firms for freight transport and logistics will be analysed to identify the users drivers of innovation adoption, i.E., attributes influencing the consumers decision to use it (e.G., relative advantage, compatibility, complexity, trialability, and observability). Second, by using multicriteria methodologies (e.G., Agent-Based Models), the research will assess the effectiveness of business strategies and public policies (e.G., price-based or preference-based) that could be designed and implemented to influence the transport users innovation adoption, resulting in behavioural changes and a lower-impact carbon footprint.

Research team and environment

The selected candidate will join the research team on Empirical and Applied Economics Transport, regulation and sustainable development of the Economics Department of University of Insubria in Varese. The Department of Economics, which also offers a PhD program in Methods and Models for Economic Decisions, has several active collaborations with national and international universities, in particular on transport and innovation economics, with University of Hohenheim, University of Jena, University of Bordeaux, University of West England Bristol, Universit della Svizzera Italiana, Venice International University, Politecnico di Milano, Universit di Milano Bicocca, Universit di Padova, Universit di Torino, etc. At the University of Insubria, the PhD candidate will find an open multidisciplinary environment, offering the opportunity to collaborate with researchers of other Departments, such as the Climate Change Research Center, the team of Sustainable Development University Network and the Bio-economy research team. The PhD student will be able to use the library and all the laboratory and software facilities of the Department of Economics.

Suggested skills

The PhD student should have good skills in data analysis and modelling. A background in economic studies and a good knowledge of Stata software and/or other statistical/econometric software are particularly appreciated. Good quantitative skills and transport and innovation economics knowledge are valuable assets. Fluency in English, both written and spoken, is required. Ability and willingness to work in collaborative, multi-disciplinary

environment and experience of both quantitative and qualitative research works are also very appreciated skills.GOAL 13

Insurance and financial solutions for climate risk management

Research keywords:	Climate risk Risk transfer Risk financing
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics SH1_6 Econometrics; operations research SH1_5 Corporate finance; banking and financial intermediation; accounting; auditing; insurance
Reference SDGs:	GOAL 8: Decent Work and Economic Growth GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Martina Mario (mario.martina@iusspavia.it)
Host university:	IUSS Pavia *Department of Science, Technology and Society*

Research topic

The climatic conditions of a territory (temperature, precipitation, etc.) and, in particular, extreme natural events related to the climate (floods, storms, drought, etc.) have a substantial role in the socio-economic system and its development. Climate change and the consequent change in the frequency and intensity of extreme events amplify their impacts on the local territory and the global scale. This structural change affects not only economic activity but also the financial system. Climate-related risks are commonly understood to comprise two main risk drivers: (a) physical risk, which refers to the financial impact of a changing climate, including more frequent extreme weather events and gradual changes in climate, (b) transition risk, which refers to the loss that can result, directly or indirectly, from the ongoing change of climatic conditions and the process of adjustment towards a lower-carbon and more environmentally sustainable economy. Methodologies to estimate the magnitude of climate-related risks for the economic and financial system are being developed rapidly. Available estimates suggest that both physical and transition risks are likely to be significant.

The research will focus mainly on:

(1) how to estimate and, possibly, quantify the climatic risk due to the impacts of the climate and its change on the socio-economic-financial system referring to both the local and global scale;

(2) the existing and innovative financial and insurance mechanisms to manage the climate risk and reduce its impact by increasing the system's resilience as a whole.

Estimating climate risk will require addressing some issues:

- representing the physical climate variables and the impact of extreme events on the territory.
- describing the relationship between direct physical damages and indirect effects, such as business interruption, also considering the interdependency of the entities,
- understanding the link between the local scale of the impacts and the global scale of climatic phenomena,
- assessing the uncertainty associated with data and estimates.

As for risk management strategies, traditional damage compensation and risk prevention incentive mechanisms will be analysed and compared with innovative solutions such as parametric insurance programs or financial resilience support programs.

Research team and environment

The research activity will be at IUSS School within the CARISMA research group. IUSS mission is to provide advanced education to undergraduate and graduate students, as well as fundamental and applied research in the fields of Science, Technology, Engineering and Mathematics (STEM), and Human, Social and Life Sciences. At IUSS, PhD candidates will find an open multi-disciplinary environment offering real opportunities for developing academic and professional tools for facing the challenges arising from increasing complexity and fast changes in society and the environment. IUSS is always and actively committed to internationalisation, inclusion and

diversity. The selected candidate will join the research centre on Climate change impAct studies for RISk MAnagement (CARISMA). The CARISMA team is composed of STEM and Social scientists working in the prism of climate change on data analysis and modelling of Earth System and Economic System processes; impact assessment of extreme natural events and anthropogenic activities on human and natural environments; risk assessment and management of natural and anthropogenic hazards; formulation and proposal of new economic, political and legal models of sustainable development.

Suggested skills

Considering the multi-disciplinary character of the research, the candidate can have different backgrounds: engineering, mathematics, data science, economics, finance or actuarial sciences. Regardless of the background, the candidate should know statistics (e.g. Data analysis, statistical distribution, extreme value theory), risk concepts (e.g. Hazard, vulnerability, exposure), and data processing and modelling. The candidate should have an interest in conceptualising a framework to assess the risk related to climate, on programming/coding a model to simulate the climate impact and to compute various metrics and scores, on visualising and analysing results, and on proposing insurance and financial solutions to cope with the climate risk. The candidate should have an attitude at teamwork and critical thinking and be strongly motivated to work in a pluralist and multi-disciplinary environment, collaborating with both the STEM and social scientists.GOAL 13

Circular economy, decarbonisation and just transition: complementarity between eco innovations and the creation of human and social capital in companies

Research keywords:	Eco Innovation Just transition Circularity
Reference ERCs:	SH1_9 Industrial organisation; entrepreneurship; R&D and innovation SH1_12 Environmental economics; resource and energy economics; agricultural economics SH7_6 Environmental and climate change, societal impact and policy
Reference SDGs:	GOAL 9: Industry, Innovation and Infrastructure GOAL 10: Reduced Inequality GOAL 13: Climate Action
Reference person:	Mazzanti Massimiliano (mzzmsm@unife.it)
Host university:	University of Ferrara *Economics & Management*

Research topic

The transition to the Green economy is driven by the co-evolution of different environmental and social transitions occurring at different geographical dimensions. A key question is whether and how different socio-technical transitions are supporting the achievement of sustainability with respect to economic, environmental and social impacts and the convergence between states and regions to support a "just transition". Through the development of interlinked national and regional innovation systems and a well-conceived mix of regulations on the innovation, industrial and environmental dimensions, sustainable convergence between countries and regions could be achieved. The Green Deal strategy (circular economy and decarbonisation in primis) is a factor of structural change: it connects the transitions of the old sectors and those of the new techno-organizational systems. The total impact is composite and based on the evolution and diversity of technical-economic specializations. In addition, there are different models of capitalism also within Europe, which can generate different economic and environmental performances, including the crucial issue of inequality and access to knowledge. This potential diversity of performance largely depends on the different characteristics of the socio-economic model, namely the type of regulatory (environmental) frameworks, occupational systems, innovation systems, and their effects on the dissemination of knowledge. The quantity and quality of knowledge (human, social, R&D) produced by a defined economic system is the main pillar to explain its overall socio-economic and economic-environmental performance. The empirical research actions are based on questionnaires and interviews with companies, trade unions, workers, to evaluate the characteristics of innovative and territorial relationships, evaluating the relationship between the characteristics of the models and the overall sustainability performance.

Research team and environment

The environment is the SEEDS inter-university network (www.Sustainability-seeds.Org) UNIFE leads. SEEDS entities participate in the ETC/WMGE European Topic Centre on Waste and Materials in a Green Economy that supports the European Environment Agency (EEA) in designing green economy and circular economy strategies. SEEDS is a mamber of network on eco innovation global knowledge diffusion (www.Inno4sd.Net). UNIFE also created in 2018 a new research centre CERCIS on circular economy and innovations under the 2018-2022 Excellence Departments MUR funding.

Suggested skills

Knowledge of quantitative and qualitative methods for empirical research in applied economics, including survey analysis for firms and consumers and econometrics for cross section and panel data; interdisciplinary skills and motivations to create bridges between fieldsGOAL 13

Adapting to Climate Change: The role of international trade and labor market adjustments

Research keywords:	Climate change Adaptation Trade and labor market
Reference ERCs:	SH1_12 Environmental economics; resource and energy economics; agricultural economics SH1_2 International trade; international management; international business; spatial economics SH1_13 Labour and demographic economics
Reference SDGs:	GOAL 8: Decent Work and Economic Growth GOAL 10: Reduced Inequality GOAL 13: Climate Action
Reference person:	Olper Alessandro (alessandro.olper@unimi.it)
Host university:	University of Milan *Department of Environmental Science and Policy*

Research topic

A growing body of econometric evidence correlating random weather variation to economic outcomes has systematically started to accumulate at national and global levels. This literature primarily focuses on the potential economic impacts of climate change based on out-of-sample predictions and strong assumptions about the ability of individuals and economies to adapt to future climate change. However, these predictions tell us little about the process and mechanisms through which individuals and sectors ultimately adapt to climate change. The project contributes to the current state of the art by providing insights into the potential to adapt to climate change in both agricultural and non-agricultural sectors. Specifically, it will address two important margins of adjustment to climate change: the role of international trade and of inter-sectoral labor reallocation. The two mechanisms are potentially linked with the pathways involved in the economic impacts of climate change. Particularly, they show differentiated effects both across sectors (agriculture vs non-agricultural sectors), and across poor vs rich countries and regions. The project will use modern dynamic panel data tools and new quantitative trade models.

Research team and environment

The research team consists of senior and junior members of the Department of Environmental Science and Policy (ESP), University of Milano, namely a professor in agricultural economics (the supervisor), an associated professor and a researcher in the same area, plus two post-doc researchers with a background in environmental economics and international trade, respectively. ESP is a highly multidisciplinary department, involved in sustainability and climate change research activities, counting more than 50 Ph.D. Students and post-doc researchers. Researchers (55) cover several different backgrounds, with environmental and agricultural economists, ecologists, biologists, agronomists, climatologists, geologists, and food scientists. Collaboration between disciplines is greatly encouraged. More senior members are involved in the following three different Ph.D. Schools: Economics, Environmental Science, and Agricultural and Food Science.

Suggested skills

A master level background in Environmental and/or applied economics, with skeel in quantitative methods and econometrics.GOAL 13

Socio-economic analysis of mitigation and adaptation policies in the Mediterranean area

Research keywords:	Resilience Adaptation Mitigation
Reference ERCs:	SH7_6 Environmental and climate change, societal impact and policy SH1_3 Development economics; structural change; political economy of development SH7_5 Sustainability sciences, environment and resources
Reference SDGs:	GOAL 9: Industry, Innovation and Infrastructure GOAL 13: Climate Action GOAL 17: Partnerships to achieve the Goal
Reference person:	Paglialunga Elena (elena.paglialunga@uniurb.it)
Host university:	University of Urbino 'Carlo Bo' *Department of Economics, Society, Politics*

Research topic

The Mediterranean area is highly susceptible and vulnerable to climate change. Observed temperature increase tends to be higher in this area than the global average, and this tendency will persist in the future according to numerical simulation models. The aim of this research project is to investigate the socio-economic vulnerability and the level of socio-economic exposure to the damage caused by climate change of the Mediterranean countries in this area, while accounting for their different socio-economic conditions. Research topic will also focus on an assessment of resilience as a crucial component of effective mitigation and adaptation policies and strategies. Particular attention will be devoted to the theoretical and empirical study of how countries cooperate with each other, taking into account strategic interactions between them.

The aim of the PhD project is to develop theoretical and empirical analyses of the socio-economic impacts of climate change, mitigation and adaptation policies and strategies. In this context, activities will also consider the role of socio-economic resilience of different countries/regions in fostering the effectiveness of mitigation and adaptation policies. Finally, in the assessment of adaptation strategies, the consequences and optimal responses to extreme events caused by climate change (e.G., floods, landslides, heat waves, droughts) will be explored. In addition to aggregated analyses at a geographical level (country/region), the project aims to focus on particularly vulnerable sectors such as agriculture and manufacturing. With regard to the agricultural sector, the project will: i) map the hazard of different territories with respect to extreme events linked to climate change; ii) evaluate innovative responses to change, in terms of innovative agricultural practices and economic-financial instruments for income protection (e.g. Insurance); iii) evaluate the contribution of the agricultural sector in terms of emission mitigation, with a view to carbon capture and fixation and to the reduction of directly and indirectly generated emissions. As for the manufacturing sector, particular attention will be paid to the economic dynamics related to the increasing stringency of emission containment policies, such as the European Emission Trading Scheme. More specifically, the consequences of emission mitigation policies on the environmental and socio-economic performance of manufacturing companies will be assessed.

Research team and environment

Research will be carried out within the Department of Economics, Society, Politics (DESP) of the University of Urbino Carlo Bo. The DESP is a multidisciplinary department featuring 49 professors and researchers in the fields of economics, management, mathematics, statistics, political science and sociology. The department activated an international PhD programme in Global Studies in 2017 with two thematic areas: i. International economic policy, business and governance (with a focus on economic and political relations across national borders); ii. Global society, cross-border mobility and law (with a focus on cross-border movements of capital, knowledge, labour and people, mainly from institutional, legal and social perspectives). Professors and researchers at DESP were involved in several research projects that are relevant to the proposed scholarship, including: - quantitative

economic analysis of environmental policies and adaptation and mitigation climate policies about their socio-economic consequences at various levels; - theoretical modelling of dynamic patterns of investments to deal with environmental issues - economic analysis of agricultural practices aimed at reducing the environmental burden of food production and at adapting to a changing climate (both in Europe and in MENA countries); - analysis of sustainable management practices, including certifications and CSR; - sociological and geopolitical analysis of environmental problems.

Suggested skills

The program is designed for highly qualified and motivated students who wish to acquire knowledge to understand the dynamics of climate change, socio-economic vulnerability, mitigation, and adaptation policies and strategies, cutting edge research skills used to evaluate public policies and the economic and social dynamics related to climate change. A key feature of the program is the combination of multi-disciplinary training in both theory and applied quantitative methods.GOAL 17

Sustainability and Non-Financial Information

Research keywords:	Non-Financial Reporting ESG Value Relevance
Reference ERCs:	SH1_4 Finance; asset pricing; international finance; market microstructure SH1_5 Corporate finance; banking and financial intermediation; accounting; auditing; insurance SH1_10 Management; strategy; organisational behaviour
Reference SDGs:	GOAL 5: Gender Equality GOAL 5: Gender Equality GOAL 10: Reduced Inequality
Reference person:	Rossi Paola (prossi@units.it)
Host university:	University of Trieste *Dipartimento di Scienze Economiche, Aziendali, Matematiche e Statistiche*

Research topic

The research project, starting from the study of the regulation on non-financial information introduced in Europe by Directive 2014/95 / EU, aims to: 1) analyse the content and quality of the information; 2) examine the impacts of the new communication on the economic, financial and social performance of companies 3) examine the interaction of the regulation with the circular economy and the green economy. The research lines are described below:

1. Analysis of the quantity and quality of non-financial information through the study of the reporting of a sample of European companies and the use of methodologies such as content analysis or discourse analysis. Examination of the GRI and IIRC framework applied to the implementation of Directive 2014/95 /EU.
2. Analysis of the effects of the new non-financial disclosure on corporate performance, ESG performance, market value and information asymmetry. Application of value relevance models.
3. Analysis of the key performance indicators used by companies with particular reference to the circular economy and the green economy and distinguishing between different circular business models.

Research team and environment

The research team is drawing from the fields of financial accounting, management accounting, accounting history and finance. Our team is focused on high-quality research with frequent exchange between team members, the members of the department, and external academics and professionals. The unique academic environment in which our team works includes doctoral fellows, research fellows and professors in a broad variety of research fields such as micro-macroeconomics, financial economics, econometrics, business management and organization, statistics and mathematics. Our activities include participation to national and international research projects, seminars with doctoral fellows and visiting professors, PhD workshops, and conferences. The recently renewed building hosting the Department and located within the main campus of the University of Trieste includes computer labs, three thematic labs in Innovation and Technology Transfer, Merceology and Economic and Political Geography, and rooms for doctoral fellows. Database access and a large variety of electronic journals in the fields of economics, finance, business, and statistics are also available.

Suggested skills

Candidates should preferably have an academic background in accounting and finance, analytical capabilities, ability to handle and analyze datasets and to perform quantitative research in econometrics and social sciences. Fluency in English is recommended.GOAL 10

Curriculum: 2. Socio-Economic Risk and Impacts scholarship code **B15**

Sustainable mobility: models, methods and case studies.

Research keywords:	Sustainable logistics Corporate Social Responsibility Carbon pricing
Reference ERCs:	SH7_9 Energy, transportation and mobility SH7_6 Environmental and climate change, societal impact and policy SH1_12 Environmental economics; resource and energy economics; agricultural economics
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Rotaris Lucia (lucia.rotaris@deams.units.it)
Host university:	University of Trieste *Department of Economics, Business, Mathematics and Statistics (DEAMS)*

Research topic

Adopting a more sustainable transport system is a major challenge for the EU since a quarter of EU's greenhouse gas emissions are due to transport activities whose environmental footprint continues to rise as transport demand grows. The EU goal is to reduce by 90% the greenhouse gas emissions produced by transport by 2050. The research project aims at studying how business models should change to reach this ambitious goal and what policies could be used to support them. It focuses also on how production and consumption of transport services affect the environmental sustainability. It also studies how circular and green economy principles applied at the firm level can influence the socio-economic and environmental system as a whole and how public policies can reduce the environmental impact of both production and consumption driving the transition toward a more environmentally sustainable transport sector. Several research lines can be developed within this broad framework.

A special focus could be devoted to logistics and, more specifically, to reverse logistics. These are crucial activities of any supply chain aiming at increasing material productivity while reducing the environmental impact by ensuring that end of life products and materials used to transport inputs, components and final products are reintroduced into the business system. Indeed, logistics service providers are increasingly looking at reverse logistics as an additional business opportunity. However, cost-benefit analysis and life cycle assessment of the environmental impacts produced by reverse logistics of critical supply chains (mechanics, agri-food, furniture, clothing, textiles) is seldom performed and should be further studied.

An interesting research line could deal with the role that corporate social responsibility adopted by firms providing transport services could play in reducing the environmental footprint of transport. Corporate social responsibility is a business practice rapidly expanding in many sectors and refers to the strategies used by for-profit companies in order to create social benefits while pursuing institutional goals such as growth and maximizing shareholder value. However, very little is known on the socially responsible strategies adopted within the transport sector, both with reference to passengers and freight transport providers, on the effectiveness of the initiatives adopted to increase social welfare and customer satisfaction, and on the policies that could foster these socially responsible business models. The analysis of this topic could be focused both on the supply side of the market, investigating the strategies adopted and the relative costs and the expected benefits, and on the demand side, analyzing the preferences of transport users with respect to the initiatives implemented. Several analytical approaches could be used including qualitative description of illustrative case studies, multi-criteria analysis and discrete choice models.

An additional research line could focus on the impacts that phasing out the existing environmentally harmful subsidies on fossil fuels and applying the polluter-pays' principle would produce on fleet renewal, traffic pollution, and cost of providing transport services. Multi-criteria analysis, preferences analysis via discrete choice models and agent-based models could be used to study this topic.

Research team and environment

The research team is interdisciplinary drawing from the fields of transport economics, political economics, regional economics and agricultural economics. Our team is focused on high-quality research with frequent exchange between team members, the members of the department, and external academics and professionals. The unique academic environment in which our team works includes doctoral fellows, research fellows and professors in a broad variety of research fields such as economic geography, labour economics, behavioral economics, international macroeconomics, financial economics, econometrics, business management and organization, statistics and mathematics. Our activities include participation to national and international research projects, seminars with doctoral fellows and visiting professors, PhD workshops, and conferences. The recently renewed building hosting the Department and located within the main campus of the University of Trieste includes computer labs, three thematic labs in Innovation and Technology Transfer, Merceology and Economic and Political Geography, and rooms for doctoral fellows. Database access and a large variety of electronic journals in the fields of economics, finance, business, and statistics are also available.

Suggested skills

Candidates should preferably have an academic background in applied economics, analytical capabilities, ability to handle and analyze datasets and to perform quantitative research in econometrics and social sciences. Fluency in English is recommended.GOAL 13

Circular bioeconomy: assessing the sustainability of bio-based processes and products

Research keywords:	Circular economy Bioeconomy Sustainability assessment
Reference ERCs:	SH7_5 Sustainability sciences, environment and resources SH7_6 Environmental and climate change, societal impact and policy SH1_10 Management; strategy; organisational behaviour
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Salomone Roberta (roberta.salomone@unime.it)
Host university:	University of Messina *Department of Economics*

Research topic

To achieve a sustainable and circular bioeconomy (BE) is one of the EU priorities. Among the objectives, the development of integrated circular supply chains, from farmers to industry, which transform organic waste into valuable resources. The link between BE and the circular economy is highly emphasized and often associated with the creation of a sustainable production model, but the effects that new processes and new cascade recycling applications could have in terms of GHG and other emissions/impacts are not yet fully known. Indeed, it is not taken for granted that circular BE strategies always and in any case involve an improvement in sustainability; a complete life cycle assessment is essential, using Life Cycle Thinking approaches and tools. The proposed research aims to measure circularity and sustainability through the combined use of LCA, LCC and Social LCA methods. The results will allow identifying improvement actions using measurable results, and shedding light on concerns about the possible negative side effects of BE.

Research team and environment

The research will take place at the Sustainability Lab, of the Department of Economics of the University of Messina. The Sustainability Lab is a study and research laboratory for corporate sustainability and Life Cycle Management, equipped with 5 computers, 4 printers, 1 server. Software: SimaPro Analyst, GaBi Professional, Adobe Acrobato 20 Pro, DeltaGraph, Nvivo, Vensim Pro, VOSviewer. Database: Ecoinvent 3 for SimaPro, Social Hotspot Database (SHDB) for SimaPro, Product Social Impact Life Cycle Assessment (PSILCA) for SimaPro, Ecoinvent 3 for GaBi. At the moment the researchers working at the Sustainability Lab are involved in the following projects: CRESTING CiRcular Economy: SusTainability ImplicatioNs and Guiding progress - Marie Skodowska Curie (MSCA) Innovative Training Network - European Commission (2018-2021) G.A. No 765198 - UNIME partner - http://cresting.Hull.Ac.Uk ELETTRORIGENERA Regenerative electrolysers for the conversion and accumulation of surplus electricity from renewable sources in hydrogen and efficient reuse of energy in residential applications - P.O. FESR SICILY 2014/2020, Action 1.1.5 - UNIME partner - PRIN 2017 "Promoting Agri-Food Sustainability: Development of an Italian Life Cycle Inventory Database of Agri-Food Products" (ILCIDAF) - PRIN 2017EC9WF2_002 - UNIME partner THALASSA - TecHnology And materials for safe Low consumption And low life cycle cost veSSels And crafts - PON "Research and Innovation 2014 and 2020" and FSC - Progetto ARS01_00293 - CUP B46C18000720005

Suggested skills

We are looking for candidates with a background or experience within at least one of the following areas: Sustainability Management, Industrial Ecology, Industrial Management, Environmental Sciences, Sustainability Assessment.

The person we look for is expected to have:

Good command of written and verbal English;

Proficiency in advanced computer skills including Microsoft Word, Excel, PowerPoint and Outlook, as well as other products included in Microsoft Office 365 Business;
Ability and willingness to work in collaborative, multi-disciplinary environment, with an inter-disciplinary approach and interest, and preferably with experience of both quantitative and qualitative research work;
availability to stably work in Messina but also to travel and move whenever required;
knowledge and understanding in environmental systems analysis, like life cycle assessment, is seen as a merit;
proven record of designing and writing scientific publications is desirable but not required.GOAL 13

Sustainable finance: financial instruments and policies

Research keywords:	Sustainable finance Impact finance Climate finance
Reference ERCs:	SH1_5 Corporate finance; banking and financial intermediation; accounting; auditing; insurance SH1_12 Environmental economics; resource and energy economics; agricultural economics SH7_3 Population dynamics: households, family and fertility
Reference SDGs:	GOAL 8: Decent Work and Economic Growth GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities
Reference person:	Ughetto Elisa (elisa.ughetto@polito.it)
Host university:	Politecnico di Torino *Department of Production and Management Engineering*

Research topic

The research project relates to the area of sustainable finance. The project is aimed at studying how the financial system intervenes to mobilize resources to mitigate the effects of climate change on the economic, innovative and financial performance of firms and to create social and environmental impact. A mapping of the financial instruments and policies will be combined with a quantitative analysis based on the construction of a unique database of policies, extreme climate events, institutional investors and firms financial accounting and innovative performance data. The aim of the analysis will be to explore the effect that specific financial instruments and policies have on firms innovative dynamics and economic and financial performances. The data will be analyzed through the use of econometric techniques. One of the main catalysts to develop sustainable businesses are for example venture capital funds that operate in the sustainable field. The project will gain insight on the role of venture capitalists as supporters and promoters of sustainable businesses and the potential barriers and opportunities associated with this. Among these players, it is observable that impact investors are increasingly moving into the sustainability space with the intention to generate measurable social and environmental impact alongside a financial return. A detailed analysis of the funds characteristics, investment strategies and target ventures and an analysis of the results that these funds obtain in terms of investments, committed capital and economic and financial performance of invested firms will be an expected outcome of the project.

Research team and environment

The research activity will take place at Politecnico di Torino but the research project will be conducted in collaboration with the Observatory on Climate Finance from Politecnico di Milano and the Bureau of Entrepreneurial Finance, a research center that involves teams of academics from both Politecnico di Milano and Politecnico di Torino. The Ph.D student will have access to data gathered by the Observatory on Climate Finance and other relevant proprietary databases.

Suggested skills

The PhD student should have good skills in data mining and data analysis. Knowledge of Stata software is particularly appreciated.GOAL 11

Curriculum: 3. Technology and Territory scholarship code **C01**

Resilient microgrids

Research keywords:	Microgrids resilience Artificial intelligence for optimization Supporting renewable energies further penetration in isolated and grid-connected grids
Reference ERCs:	PE7_2 Electrical engineering: power components and/or systems PE7_3 Simulation engineering and modelling PE7_12 Electrical energy production, distribution, applications
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities
Reference person:	Anglani Norma (nanglani@unipv.it)
Host university:	University of Pavia *Electrical Computer and Biomedical Engineering (ECBE)*

Research topic

The objective of the project is to investigate, through the testing of suitable artificial intelligence (AI) techniques, how to better design, control and manage hybrid microgrids (whose sources are both fossil fuel based and renewable), according to the characteristics of their devices and loads (for example looking at commercial, residential or industrial buildings).
In general, the resilience of an electrical system deals with the robustness towards power outages and, when an outage occurred, the subsequent quick repowering, while mitigating the consequences of the disruption.

Resilience is a high priority both for isolated and grid-connected networks.
During interruptions, there are "critical" loads that can suffer huge economic losses.
Traditionally, diesel generators are used to provide backup energy during interruptions, but renewable energies, especially in scenarios with higher levels of penetration, are getting more and more attention from a resilience standpoint, for two main reasons.
Firstly, in the management of natural disasters, which have had an impact on the electricity grid, manifold aspects have shown their weakness, for instance: unreliable operations of backup generators including lack of supply options, interruptions in fuel supplies, and, last but not least, the role played by the ageing infrastructure.
Secondly, the market is experiencing a significant drop in the cost of renewable energy sources (RES), as well as in photovoltaic and battery energy storage systems (BESS), leading to a significant increase in the number of distributed RES and BESS.

In the past how to bind the control parameters of the converters of an isolated microgrid to economic parameters has been formulated, and tested in one of the partner labs, .
The aim was to understand how different energy/power management strategies could affect (i) the lifetime of devices such as electrochemical storage, of fundamental importance for an increase in the use of renewables and (ii) the consumption of fossil fuel-fed power-generating modules, aiming at its minimization.
Since some fields had been neglected at that time, now they are recalled and become the current focus of the research, which aims at the general optimization of a microgrid management by looking at 2 of the 3 levels. At the higher level, which is the system-level, consisting of various devices, and also at a medium level, when the single device is considered. The lower -components level- is not our focus.
The optimization will take place (i) at the level of system analysis, with a study on the different EMS (energy management systems) proposed in the literature that set rules on the power flow within the microgrid, (ii) at the integrated design level of components, such as storage management and converters for renewable sources, which may include DC/DC converters, or AC/DC inverters (for DC networks), with also diagnostic functions for network components.

Research team and environment

The candidate will be part of a wide-interest small research group, mainly made up of electrical and electronic engineers, all devoted to research dealing with energy management and power electronics, nonetheless the candidate will be able to benefit by the wide international contacts the group has been building over the years. The group is made up of one full, one associate professor, one postDoc and several PhD candidates. Exchanges and stages abroad are encouraged to foster an open minded and fruitful personal growth. The candidate will have to be keen to group work.

Suggested skills

Desirable knowledge of tools such as matlab/simulink/plecs/python. Basic knowledge of AI techniques is a plusGOAL 11

Curriculum: 3. Technology and Territory scholarship code **C02**

Wave energy exploitation with OWC devices embodied in fixed/floating structures

Research keywords:	Wave energy Ocean engineering OWC in marine structures
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics PE8_5 Fluid mechanics PE8_6 Energy processes engineering
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities
Reference person:	Arena Felice (arena@unirc.it)
Host university:	University Mediterranea of Reggio Calabria *Natural Ocean Engineering Laboratory - DICEAM*

Research topic

The research program deals with the development of Oscillating Water Column (OWC) devices, integrated on either fixed or floating marine structures, for the wave energy exploitation.
The research activities will be developed by considering:

- analysis and development of innovative models, analytical and/or numerical, of marine structures (i.E. Fixed breakwater, offshore floating structures), with OWC devices;
- study of the hydrodynamics problems for the modelling of large floating structures in which OWC devices are embodied;
- risk analysis of marine structures in severe meteocean conditions, by taking into account extreme waves during sea storms; this analysis will include the study of the action of extreme waves (freak waves) on the OWC wave energy converters;
- data processing from experimental activities with physical modeling of Oscillating Water Column systems, on fixed and floating structures. These data are available at NOEL laboratory.

Both Monte Carlo approaches and experimental data will be used for the analysis of the dynamic response.
The hydrodynamic analysis will be conducted in the context of the potential theory for an irrotational flow with a free surface (to determine excitation forces, added mass and radiated damping).

Research team and environment

The research team operates in the NOEL (Natural Ocean Engineering Laboratory) established within UNIRC. It is composed by a highly specialized team working in the field of marine engineering. Actually, the team involves 1 Full Professor, 1 Associated Professor, 4 Researchers, 2 Post-docs and PhD Students. The team has a 30-year experience in conducting field experiments on small-scale models on marine structures and wave energy harvesters at the NOEL natural basin. This laboratory is a unique environment were experimentalists can pursue tests with the support of sensors, acquisition data center and specialized personnel established permanently in the laboratory infrastructure facing the basin (for details see www.Noel.Unirc.It). The mission of this group is to utilize the knowledge acquired in the field of marine and civil engineering to develop novel methodologies in the analysis of the wave phenomena and of the wave climate, for wave structure interaction (floating of fixed structures). The group is also involved in the analysis of coastal structures for protection purposes (for instance caisson breakwaters), in the development of novel coastal structures hosting devices for wave energy harvesting, in the developing of experimental activities for the testing of a floating offshore wind turbine model in a field site, in the testing of the prototype of an offshore multipurpose platform for fish farming and exploitation of wind and wave energy (Horizon 2020 project The Blue Growth Farm 774426).

Suggested skills

The background of the candidate should be in engineering. In detail, a basic knowledge is required in: wave energy converters, ocean energy, wave energy, freak waves, stochastic mechanics, MonteCarlo simulation. A good knowledge is also appreciated in: fluid mechanics, ocean engineering.

Finally, the candidate should have a strong motivation to work in a multi-disciplinary team, with the NOEL research group.GOAL 11

Functional Sustainable Materials for Emerging Photovoltaics

Research keywords:	Functional organic materials Emerging photovoltaics Green chemistry
Reference ERCs:	PE5_15 Polymer chemistry PE5_17 Organic chemistry PE4_15 Photochemistry
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Barolo Claudia (claudia.barolo@unito.it)
Host university:	University of Torino *Department of Chemistry*

Research topic

The use of renewable forms of energy (production and storage) and lighting systems that allow substantial savings passes through the use of innovative devices that often require unsustainable materials and / or processes. The objective of this project is to develop efficient functional materials, which, starting from a design that also follows the principles of the circular economy, do not foresee (or minimize) the use of Critical Raw Material and are synthesized with specific attention to the principles of green chemistry.
The PhD student will be responsible for designing, synthesizing and characterizing functional organic and hybrid materials for application in innovative photovoltaic devices. He/She will have also the opportunity to test the best materials directly in both small-scale and large-scale devices thanks to the collaboration with the CHOSE (Center for Hybrid and Organic Solar Energy).

Research team and environment

The PhD student will work at the Department of Chemistry of the University of Torino within the NIS Interdipartmental Centre and INSTM reference Centre. The team is composed by several senior reaserchers and a number of PhD/Post Docs working on different European and National projects. For the activities will be available an advanced synthesis laboratory (including microwave systems for organic synthesis and a plasma at atmospheric pressure) equipped with various analytical chromatographic techniques (HPLC LC-MS, ICP-MS, GC-MS), automatic systems for preparative chromatography, classical spectroscopic techniques (NMR 600 MHz, FT-IR, UV-Vis and steady-state and time-resolved fluorometer, Raman), sun simulator, electrochemical equipment for device testing, TGA and DSC, powder XRD systems for polymer 3D printing . Moreover part of the PhD will be also hold within the laboratories of CHOSE (Center for Hybrid and Organic Solar Energy) at the Universit of Tor Vergata in Rome, under the supervision of Prof. Francesca Brunetti.

Suggested skills

Scientific/technical knowledge on: material science, chemistry, industrial chemistry, organic and physical chemistry plus engineering of devices, characterization of organic and hybrid materials, electrochemistry, testing of photo/electro materials. Devices assembly and testing.GOAL 13

Innovative solutions for energy harvesting and energy recycling

Research keywords:	Energy Harvesting Energy Recycling Circuits and Systems
Reference ERCs:	PE7_3 Simulation engineering and modelling PE7_2 Electrical engineering: power components and/or systems PE7_8 Networks, e.g. communication networks and nodes, Internet of Things, sensor networks, networks of robots
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure
Reference person:	Bonnin Michele (michele.bonnin@polito.it)
Host university:	Politecnico di Torino *Electronics and Telecommunications*

Research topic

The fast grow of new technologies, e.g. Internet of Things, demands to interconnect network of devices with embedded electronics, sensors, actuators and software are connected and interact via the Internet.
Among the challenges posed by these technologies, there is the problem of how supply power to a network of wireless systems. Batteries are not always the best solution because of dimension constrains, remote and difficult to access position, limited lifespan, and the related environmental hazards.
Energy harvesting and energy recycling refer to a set of technical solutions to realize devices capable of self-powering, collecting power from the surrounding environment or recovering energy that would normally be wasted. The main limitations of these solutions are the limited power density, and that the power of environmental dispersed energy is distributed over a wide frequency band.
The research aims to study the basic physics and at the design of energy harvesting and energy recycling systems. State of the art models for energy harvesting (piezoelectric materials, magnetic induction, electrostatic,) will be analyzed. Innovative solutions to improve efficiency of these devices, will be developed applying an highly multidisciplinary approach.
The research will be conducted in collaboration with MemComputing Inc., a Californian spin-off with great experience in the application of artificial intelligence solutions to engineering problems and industrial applications."

Research team and environment

The research activity will be carried out within the LiNCS (Linear and Nonlinear Circuits & Systems) group at Politecnico di Torino. The group is composed by three permanent staff members (two full professors and one associate professor), and several PHD students-postdoc fellows. The group has recognized expertise in nonlinear dynamics, nonlinear circuits systems analysis, noise modelling, stochastic processes and theoretical foundation of artificial intelligence. The research activity will be conducted in collaboration with the Department of Applied Mathematics of Le Havre University (France) and MemComputing Inc., a start-up company specialized in application of artificial intelligence solutions to engineering problems, based in San Diego, CA, USA.

Suggested skills

Good background in electronics, circuit theory and programming skills (MATLAB) are required.
Candidates with good knowledges in physics and mathematics, in particular nonlinear dynamics and stochastic processes are encouraged. Working enthusiasm, creativity and attitude to problem solving are welcome.

Copper based catalysts for C-H activation for partial oxidation reactions

Research keywords:	Synthesis and characterization of heterogeneous catalysts Copper based catalysts Partial oxidation reactions
Reference ERCs:	PE4_10 Heterogeneous catalysis PE5_6 New materials: oxides, alloys, composite, organic-inorganic hybrid, nanoparticles PE4_1 Physical chemistry
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Bordiga Silvia (silvia.bordiga@unito.it)
Host university:	University of Torino *Department of Chemistry*

Research topic

The research activities of the present PhD project are part of the ERC-Synergy project Unraveling the secrets of Cu-based catalysts for C-H activations. Started in May 2020. The PhD student will join the effort of two other PhDs that started in the previous cycle, contributing to the development of new catalysts based on copper ions, for the selective activation of the C-H bond to give partial oxidation reactions.

More specifically, the activities will focus on the development of hybrid inorganic-organic materials such as MOFs, containing structural units able of stabilizing the presence of copper ions to be involved in the reactions of interest (hopefully carried out in green conditions). In this first year of the project, a lot of pre-selection work has been done on molecular complexes showing that some of them are able to undergo a reversible redox cycle upon contact with an oxidant or a reductive agent, opening good perspective towards the development of heterogeneous counterpart. The most promising molecular catalysts will be developed in order to become suited to be inserted into MOFs and therefore, with the launch of a new position, it will be possible to intensify the efforts for the preparation of new materials that will be extensively characterized to explore their potential as catalysts for the reactions of interest. The PhD applicant will exploit a wide spectrum of synthesis methodologies (Synthesis laboratory equipped with ovens, muffles, autoclaves, microwaves) working in close collaboration with the projects team working in Oslo (experts in Zeolites and MOFs) and in NMBU (experts on Cu-based enzymes) to make CUBEs heterogeneous catalysts. The materials will be then deeply characterized in respect of their structural, morphological and functional properties in collaboration with the team working in MPI-CEC (experts in advanced characterization and modelling). More in detail, the research will consider the quantification and speciation of Cu species dispersed in the catalysts aiming to maximize the amount of active and selective species towards the selective partial oxidation of simple organic substrate using simple oxidants, such as molecular oxygen.

The PhD candidate will use most commune approaches to characterize porous crystalline materials, ranging from P-XRD, volumetric and microcalorimetric measurements to in situ and operando spectroscopic approaches (IR; RAMAN; UV-Vis; photoluminescence; XAS) in various modalities and using measurement cells that allow studies resolved in time and temperature, even in the presence of probe molecules or reagents.

Research team and environment

The PhD activities will take place mostly in Turin at the Innovation Centre building, part of the Chemistry department at Turin University (https://www.Chimica.Unito.It/do/home.Pl). Being part of an ERC-Synergy project, the PhD candidate will spend some time also in the other labs involved in the project and will be part of all the activities of the CUBEs consortium (https://www.Cube-synergy.Eu). The PhDs daily activities will be supervised by the main tutor (prof. Silvia Bordiga) with the contribution of the full environment of the laboratory

ad in particular of Prof. Francesca Bonino and Dr. Matteo Bonomo (MOFs synthesis) and Dr. Matteo Signorile and Prof. Elisa Borfecchia (MOFs characterization and testing).

Suggested skills

All the applicants with a Master Degree in Chemistry and related disciplines are suitable to take the challenge of this project, Among them, due to the multidisciplinary approaches at the border between the synthesis of nanostructured materials and their physical chemical characterizations, a Master Degree in Materials Science is the curriculum of excellence. More in details, previous experiences in hydrothermal synthesis of porous materials, their characterization with the basic chemical physical approaches and the spectroscopic study of their reactivity under controlled chemical condition are advisable.GOAL 13

Knowledge approaches for transformative resilience. Adaptation strategies and projects for urban regeneration

Research keywords:	Transformative resilience Adaptation strategies and projects Urban regeneration
Reference ERCs:	SH7_8 Land use and planning SH7_7 Cities; urban, regional and rural studies SH7_6 Environmental and climate change, societal impact and policy
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Brunetta Grazia (grazia.brunetta@polito.it)
Host university:	Politecnico di Torino *Interuniversity Department of Regional and Urban Studies and Planning (DIST) - Interdepartmental Centre Responsible Risk Resilience (R3C)*

Research topic

Applying resilience thinking to planning processes and tools is the subject of intense and recurring debate and first experiments. The leading global policies and international agreements take resilience concerning the role that the concept can assume to guarantee climate protection, enhance ecological diversity, and favour the energy transition.

Following the European Green Deal, the recently approved 2020 climate law promotes a climate-neutral Europe by 2050. In this perspective, the 2013 Climate Change Adaptation Strategy is based on a "mainstreaming approach" to integrate policies and measures to address climate change in ongoing sectoral and development planning and decision-making, promoting interdisciplinary knowledge on territorial vulnerabilities.

In response to systemic shocks and global dynamics of change, this PhD research will deepen the meaning of transformative resilience to set up new paradigms of knowledge and forms of resilient action for the transformation, maintenance, and regeneration of territorial systems.

Research team and environment

The research will be developed in close synergy with the ongoing research activities of the Interdepartmental Centre Responsible Risk Resilience (R3C) of the Politecnico di Torino (www.R3c.Polito.It/clusters). The PhD research will work closely with the R3C research clusters focused on the in-depth study concerning methods, metrics, planning and design of adaptation and regeneration processes of territories fostering resilience.

Suggested skills

PhD candidate to be involved in this project is expected to have interest in theoretical perspective on planning systems and analytical tools for urban and regional planning, competencies in GIS mapping and methods for environmental evaluation.

Curriculum: 3. Technology and Territory scholarship code **C07**

Integrated techniques and instruments for deformation monitoring of natural and built environment

Research keywords:	Deformation monitoring Integrated systems Built and natural environment
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics PE6_8 Computer graphics, computer vision, multimedia, computer games PE10_14 Earth observations from space/remote sensing
Reference SDGs:	GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities GOAL 17: Partnerships to achieve the Goal
Reference person:	Capra Alessandro (alessandro.capra@unimore.it)
Host university:	University of Modena and Reggio Emilia *Department of Engineering Enzo Ferrari*

Research topic

The development and sustainability of the built environment in relation to structures and infrastructures and their impact on the territory is an essential goal of nowadays research. The survey and monitoring of the territory, the natural environment and the built environment is a remarkable activity in order tio understand development and sustainability;Worldwide a range of buildings and infrastructure assets (e.g. Roads, tunnels, dams, aqueducts, etc) are exposed to damage caused by various factors including extreme variations in key climate variables, aging of materials and poor construction protocols. Adequate monitoring methods for understanding and managing the damage must be implemented in order to achieve timely repair and maintenance. Furthermore, the need to extend technological innovation in growing urban contexts, require efforts to find alternatives to traditional monitoring operations implementing smart systems. Recent developments in geomatics technologies in terms of hardware and software and innovation in transmission and communication networks offer the opportunity to develop reliable and intelligent monitoring schemes. The combined use of space-borne and terrestrial shown benefits for a range of applications (Sohn and Dowman, 2007; Del Ventisette et al., 2015; Dammann et al, 2018; DAmico et al., 2020). Recent technological advances allow to use multi-temporal observations with satellite and ground-based technologies to characterize structural damage by measuring displacements on a range of scales (Chen et al., 2021). Synthetic Aperture Radar (SAR) can provide accurate displacement maps (potential to measure centimeter to millimeter-level change) with weekly to monthly updates (Ferretti et al., 2000). The ability to observe extended area allow to identify areas more susceptible to damage. Ground-based datasets collected with terrestrial laser scanning (TLS) and photogrammetric and computer vision techniques, can potentially fully assess critical building and infrastructure conditions though the generation of highly accurate 3D models. In addition, the use of Global Navigation Satellite Systems (GNSS) can provide critical positional information to validate satellite-based observations and georeferenced terrestrial measurements (Chen et al., 2021). In this context, the adoption of Internet of Things (IoT) including latest Internet services and cloud computing technology, can play a key role in implementing real-time collection, transmission, processing and analysis and visualization of data. Such combination of technologies, including the integration between satellite and ground-based techniques in a modern IT technology architecture has the potential to lead towards time and cost-effective monitoring procedures of the built environment.

Moreover, the implementation of monitoring system by the IoT paradigm permits new technologies to be adopted to improve the reliability of the developed system, an approach which is deeply integrated in the development of smart cities where sustainability and security play a major role.

Research team and environment

Laboratory of Geomatics -Dief Dept., CRICT Interdipartimental Centre , UNIMORE EGEA interuniversity Centre (UNimore, UNIBO).

Suggested skills

Engineer with preparation in surveying , mapping, specifically in applied geomatics for deformation monitoring either of natural environment (landslides, subsidence,..) and bot environment (structures, infra-structures)
Background on instruments and measurement and data processing.
Expertise on analysis and interpretation of change detection in perspective of development and sustainability of the built environment in relation to structures and infrastructures and their impact on the territory,GOAL 17

Innovative methodologies in sustainable catalysis towards applied chemistry

Research keywords:	Asymmetric organocatalysis Photocatalysis Synergistic catalysis
Reference ERCs:	PE5_13 Homogeneous catalysis PE5_17 Organic chemistry PE5_16 Supramolecular chemistry
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 9: Industry, Innovation and Infrastructure GOAL 12: Responsible Consumption and Production
Reference person:	Carlone Armando (armando.carlone@univaq.it)
Host university:	University of L'Aquila *Department of Physical and Chemical Sciences*

Research topic

The research topic of the PhD candidate will develop and prosper across different and related areas of asymmetric catalysis, thriving to discover and improve reactivities and methodologies for a sustainable future. We expect the candidate to look into the following areas and carry out their research and growth with the vision of making the developments applicable for a colourful society and circular economy.

Asymmetric organocatalysis is an established platform in modern chemistry, and it is widely employed both in academia and in industry.
Small organic molecules can be used to activate substrates and enable novel synthetic transformations. We aim at devising new transformations and activations, designing more active catalytic systems, and modes of recycling and recovering catalysts. We like to craft new activations and transformations. Furthermore, in order to help it being more utilised in process chemistry, we are also interested in tackling its current issues, by exploiting supramolecular chemistry for more efficient catalytic systems, concocting different approaches to reuse and recycle the catalysts, and designing strategies to activate the system with an external stimulus.

Photocatalysis can be traced back to over a century ago, to Giacomo Ciamician, the founder of photochemistry. Photocatalysis has, however, enjoyed a new life in the last decade or so. We investigate photocatalysis, both with organic and metal catalysts, to design new reactivities and activations. We are also interested to use light to activate a chemical system that would be, otherwise, unreactive or to change the route it takes.

Since the beginning of the millennium, organocatalysis has been gaining a predominant role in asymmetric synthesis and it is, nowadays, a foundation of catalysis. Synergistic catalysis, combining two or more different catalytic cycles acting in concert, exploits the vast knowledge acquired in organocatalysis and other fields to perform reactions that would be otherwise impossible. Merging organocatalysis with photo-, metallo- and organocatalysis itself, we aim to devise new activations, access unprecedented trasformations, and design novel access routes to highly-desirable fragments.

Basic and independent research is crucial for the society and its evolution. At the same time, academia and industry need to talk to each other for a dynamic and global development. Our passion for research and our curiosity in science drive us to apply our knowledge in different settings.

Research team and environment

The PhD candidate will be part of an integrated and cheerful team working in a collaborative atmosphere. The equipment provided is state of the art; besides basic lab equipment such as heating stirring plates, rotavapors, glassware and so on, the team has easy access to chiral HPLC, automated column chromatography, NMR, GCs,

GS-MS, Parr vessel, DSC, fluorimeter, UV, IR, and so on. The PhD candidate will be encouraged to attend and present at international conferences, and take personal development courses for their soft-skills. The team shares working spaces and has regular group activities. Furthermore, group meetings and monthly research reports are part of creating a collaborative and shared research experience. A great emphasis is placed on the communication and the candidate will be expected to communicate in a clear and impactful manner.

Suggested skills

We are looking for an ambitious, yet humble candidate. Someone who recognise their knowledge and limits and knows how to develop and improve on them. We would like to hear from people who thrive to communicate what they do at their best; people who love to collaborate and are not afraid of talking to people they do not know. People who are hungry to devise new projects on their own and are not afraid to put their new best and worst ideas forward to discuss a new project. Someone who is a fantastic group member and can also be a great team leader when needed; someone who will be proactive when needed.

At the same time, we are also looking for chemists, preferably organic chemists, who have experience with asymmetric catalysis, catalysis, organocatalysis, and organic synthesis. People who know how to get around the lab and are comfortable in front of a fumehood. Someone who is skilled at looking up the literature and doing literature search or who will be eager and is inclined to develop in this direction. A very suggested skill is a deep knowledge of organic chemistry in all its aspects.GOAL 12

Analytical methodologies for sustainable, innovative, and greener industrial processes

Research keywords:	Greener industrial solutions and processes High-resolution multidimensional separations for industrial waste characterization and valorization Toxic organic solvent elimination/substitution/reduction waste characterization and valorization
Reference ERCs:	PE4_5 Analytical chemistry PE4_7 Chemical instrumentation PE4_18 Environment chemistry
Reference SDGs:	GOAL 6: Clean Water and Sanitation GOAL 9: Industry, Innovation and Infrastructure GOAL 17: Partnerships to achieve the Goal
Reference person:	Cavazzini Alberto (cvz@unife.it)
Host university:	University of Ferrara *Department of Chemical, Pharmaceutical, and Agricultural Sciences (DOCPAS)*

Research topic

The research will focus on the application and development of innovative technologies to monitor, advance, and shift industrial practices towards a green-circular economy and security for both environment and human being. The motivation of the current PhD research scholarship proposal lies on supporting two main pillars for an environmentally and industrially sustainable transition, specifically, the improvement and innovation of existing processes and the valorization of waste products through reuse.

Three main research tracks will be pursued in parallel, revolving around:
I) the reduction, substitution and/or elimination of toxic organic solvents used in the chemical and pharmaceutical industry. This will support the shift from solvent- to sorbent-based extractions and towards the development of innovative industrial processes based on greener solvents or available gases.
II) the development of innovative methods based on continuous or semi-continuous chromatography to be implemented industrially, with the aim of designing highly efficient sustainable processes for the purification of highly valued molecules (including therapeutic peptides, monoclonal antibodies, biosimilars, etc.).
III) the detailed fingerprinting of complex chemical samples (e.g. Pyrolysis oils and waste products) using cutting-edge, high-resolution analytical techniques. Here, multidimensional chromatography coupled to multiple selective detectors, among which mass spectrometry, are ideally suited for the characterization of challenging samples.
The goals are specifically tailored to address the current industrial challenges for a sustainable and affordable transition.

The knowledge and the experience acquired during the PhD period will allow the candidate to face and answer analytical, environmental, and industrial challenges. The candidate will also develop the critical thinking and practical expertise to exploit advanced analytical instrumentation and support the implementation of green industrial processes.

Research team and environment

The research will be mainly carried-out at the Department of Chemical, Pharmaceutical, and Agricultural Sciences (DOCPAS) of the University of Ferrara. The team is internationally recognized in the field of separation sciences and it is composed by 2 full professors, 2 assistant professors, 2 post-docs, 7-12 PhDs, together with graduate and master students. The team is currently involved in national and international research programs, as well as research collaboration with international industrial partners. The PhD candidate will be stimulated by a continuous knowledge exchange and share mentality inside the group, working in close collaboration with

other early-stage researchers and under the direct supervision by one or more experienced researchers and professors.

Suggested skills

The ideal candidate is passionate and highly motivated to work in a dynamic and multidisciplinary team. He/she has knowledge of chemistry and separation sciences (extraction process and technologies, chromatographic theory, mass spectrometry). An additional and valuable technical skill is the familiarity in the use of univariate and multivariate statistics to extrapolate the information from the dense data matrix obtained through the various analytical platforms.

Existing experience on instrumental analytical chemistry (liquid and gas chromatography) is an asset.

Other desirable skills: accountability, willingness to learn and acquire new compentecies, multitask and positive mentality. Scientific English and communication skills are highly valuable.GOAL 17

Curriculum: 3. Technology and Territory scholarship code **C10**

Sustainable production of solar fuels from CO2 using artificial leaves

Research keywords:	CO2 utilization Artificial leaf Solar fuels
Reference ERCs:	PE4_10 Heterogeneous catalysis PE4_12 Chemical reactions: mechanisms, dynamics, kinetics and catalytic reactions PE4_4 Surface science and nanostructures
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Centi Gabriele (centi@unime.it)
Host university:	University of Messina *ChiBioFarAm (Chemistry, Biology, Pharmaceutical and Environmental Chemistry)*

Research topic

To accelerate the transition to the replacement of fossil fuels and close the carbon cycle, it is necessary to develop devices called artificial leaves to produce solar fuels in a distributed approach capable of integrating more effectively with the territory and its resources, enhancing its resilience, and with a direct boosted contribution to reduce the emissions of CO2 (both reusing this molecule and using solar energy for its conversion) and the territory impact on climate changes. This objective requires a holistic system approach, which integrates fundamental knowledge of applied, engineering and industrial, and socio-economic aspects. The proposed research integrates fundamental studies on materials and mechanistic aspects, with the technological and engineering development of the devices, with analysis also of socio-economic aspects related to the use of these devices and their impact on the mitigation of CC and the replacement of fossil fuels.

The study will address the development of artificial leaves to produce solar fuels to be used for local renewable energy chains, a priority indicated in recent national priorities to promote sustainability of regions in the south of Italy. Specifically, the aim is a decentralized production / storage to boost the transition to "intelligent" forms of energy generation and distribution.

Artificial leaves are devices that using solar energy to convert molecules such as H2O, CO2 and N2 (widely available) into solar fuels (H2, methanol, NH3, respectively), acting as chemical energy storage molecules for transport and distributed use of renewable energy (solar) replacing the need of fossil fuels, therefore drastically reducing greenhouse gas emissions, with an enhancement of local renewable energy resources , overcoming the limits associated with fluctuations in demand and load imbalances in the renewable energy production. Artificial leaves (photoelectrocatalytic devices that are inspired by the processes in nature present in leaves) are systems that by their design are ideal for smart systems and grids in regions such as Sicily, but which are also at the center of vast initiatives in Europe and in the world, in which the proposing group participates through various European and international projects, as they represent one of the development frontiers for the energy transition.

The reference person, and associated research group, currently coordinates a European project on these devices, and participates in another one on artificial leaves, as well as coordinating / participating in several other European and international projects on this issue, and other similar projects on the electrocatalytic conversion of CO2. He is also on the board of major European initiatives such as SUNERGY. In addition, the PhD student will be inserted in a highly international environment, where other PhDs, part of an international Doctorate with industrial character on renewable energy, or post-docs in the frame of various EU projects, including an ERC Synergy grant, will operate, thus allowing to further expand the interdisciplinary character of the SSCC National Doctorate, providing in additions direct links with frontier research and companies in the area of energy transition.

Research team and environment

The research team where the PhD student will operate is composed by two full professors, one associate professor, 5 researchers and about 10-20 PhD/post-docs on aspects related to the development of sustainable processes for chemistry and energy (are industrial chemistry and engineering), with an interdisciplinary approach combining chemistry, material science, engineering, and physics. The research team has many running international EU projects, including an ERC Synergy, and well established international (worldwide) collaborations and networks with research centers and companies in the area of catalysis for clear energy and CO2 conversion, sustainable processes and technologies beyond fossil fuels. The students will operate at the CASPE center (Laboratory of Catalysis for Sustainable Production and Energy) of the University of Messina (and reference center for the InterUniversity Consortium INSTM on science and technology of materials, which has spaces and advanced equipment (ww2.Unime.It/catalysis) suitable for carrying out the planned research. The spaces available to the CASPE center, following the recent renovation, are approximately 550 m2 (in five modules, two of which are dedicated to laboratory systems for catalytic testing (including photo and electrocatalytic systems), three for the instrumental characterization of catalysts and their synthesis. The research will deal on the development (synthesis, characterization, and testing) of the nanomaterials/electrodes for the artificial leaf device, their study and engineering, the assessment of the technology. PhD students will typically operate in close collaboration with other early-stage researchers, a direct supervision by one or more experience researchers, and one professor.

Suggested skills

Scientific/technical knowledge on: chemistry, material science, industrial chemistry and catalysis, engineering of devices, characterization of solids, testing of photo/electro materials, analysis of the mechanisms of solar-induced processes in nanomaterials, assessment methodologies.

Transferable skills: team working in an international context, a problem-solver approach and critical thinking, research skills from fundamental to applied and industrial, capability of autonomous operations and leadership, managing and report in international projects, communication skills.GOAL 13

Safety oriented design for bicycling and pedestrian mobility

Research keywords:	Pedestrian and bicycling Road safety Road design
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics SH7_7 Cities; urban, regional and rural studies SH7_9 Energy, transportation and mobility
Reference SDGs:	GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities GOAL 3: Good Health and Well-being
Reference person:	D'Apuzzo Mauro (dapuzzo@unicas.it)
Host university:	University of Cassino *Dipartimento di Ingegneria Civile e Meccanica, DICEM*

Research topic

Sustainable mobility falls under objectives 9, 11 of sustainable development. The recent pandemic emergencies have highlighted the limits of local public transport (which in the past represented one of the architraves of sustainable mobility), towards the more widespread promotion of individual urban mobility of the cycle-pedestrian type which, thanks to the aid of electric micro-mobility or hybrid, it can guarantee the necessary efficiency. At national level, recent amendments introduced in road code has increased the confusion on this topic and a dramatic increase of accident involving vulnerable road users has recently marked several Italian municipalities.

The growing widespread diffusion of these new technologies and of new mobility paradigms requires nowadays the development of new, engineering-based, methodological approaches, especially in relation to the evaluation of road safety impacts. On the other hand, if a risk-based approach is to be undertaken the new micro-mobility demand has to be evaluated and long-term economic and financial sustainability issues of sharing services, which so far have shown a life limited only to the financed period, deserve more attention.

The goal of the doctorate is to develop new engineered methods for assessing the safety level of road infrastructures with respects to vulnerable users mobility (pedestrian and bicycling) that should be based on the assessment of the demand for this new type of mobility by means of a multi-disciplinary approach in order to develop new design methodologies that can be employed in the upgrade process of existing road networks towards a real ecological transition in the use of existing rural and urban road infrastructures.

Research team and environment

Highway Design and Traffic Engineering Research team at University of Cassino is leaded by prof. Mauro D'Apuzzo and is composed by a Post Doc Research Fellow and by a PHD student. A strong research partnership is currently active with Highway Engineering Research Team of Second University of Rome "Tor Vergata" and with several foreign research institutions.

Suggested skills

Skills on 1) road infrastructure design and management 2) road safety evaluation methods 3) transport network modellingGOAL 3

Integrated approaches for the seismic and energetic retrofit of existing buildings

Research keywords:	Seismic vulnerability of existing buildings Seismic risk mitigation Energy efficiency of buildings
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics PE8_6 Energy processes engineering
Reference SDGs:	GOAL 11: Sustainable Cities and Communities
Reference person:	Da Porto Francesca (francesca.daporto@unipd.it)
Host university:	University of Padova *Department of Geosciences*

Research topic

The research will focus on the development of strategies for reducing the emissions and improving the sustainability of the existing built heritage. The approach takes into account all the life-cycle phases of buildings, with an emphasis on their residual life. The analyses will be aimed at defining the environmental impact of stocks of constructions located in areas characterized by medium-high seismic hazard, such as the Mediterranean basin, therefore they will take into account not only aspects related to the energy efficiency of buildings, but also the effects of damage and losses due to the occurrence of seismic events. Probabilistic models for the development of risk scenarios will be implemented in the analyses, and considerations on the energy efficiency will be integrated, in order to formulate new decision support systems to prioritize the interventions in a sustainable perspective. Based on the agreement with the supervisor, it will be also possible to shift from the scale of the stock of buildings to the single building scale, carrying out energetic simulations in a quasi-static and dynamic regime, and seismic vulnerability evaluation based on non-linear analyses, with the aim of developing integrated systems of seismic and energy retrofit.

Research team and environment

The research team is composed by Prof. Da Porto and by a group of 5 post-doc researchers (full- and part-time) and about 15 PhD students and post-graduate students working on several research projects which mainly focus on the seismic vulnerability evaluation and mitigation of buildings and territorial contexts. In the framework of these projects, recently a research program focusing on the integrated seismic and energy retrofit of existing buildings was started. The research group works in the Department of Geosciences, a very lively department where a wide spectrum of research subjects, ranging from the secrets of the Deep Earth to the management and exploitation of georesources and knowledge and management of risks related to natural hazards is encompassed. The research carried out by Prof. Da Portos research team is also strictly connected with ongoing programs and colleagues in other structures, such as the depts. Of Cultural Heritage and of Civil Engineering at UNIPD, the Department of Civil Protection (DPC), the Laboratories University Network of Seismic Engineering (ReLUIS) and many other Italian and International Universities and Research Centres.

Suggested skills

The candidate should have a strong background in civil/building engineering, particularly in the field of seismic risk analyses and methods and models for the evaluation of seismic vulnerability of existing structures.

Sustainability of Cyber Physical Social Systems for the resilience of territories

Research keywords:	Cyber Physical Social System Territorial Resilience Sustainabile Development
Reference ERCs:	PE8_12 Naval/marine engineering PE8_10 Manufacturing engineering and industrial design PE8_4 Computational engineering
Reference SDGs:	GOAL 1: No Poverty GOAL 8: Decent Work and Economic Growth GOAL 11: Sustainable Cities and Communities
Reference person:	Dassisti Michele (michele.dassisti@poliba.it)
Host university:	Politecnico di Bari *Department of Mechanic Mathematic and Management*

Research topic

Cyber Physical Social Systems (CPSS) can be defined as a system consisting of cyberspace, physical space and human knowledge socio-cultural elements. Knowledge from cyberspace interacts with physical and mental spaces in the real world, as well as the artificial space mapping different facets of the real world. The potential areas of application of Cyber-Physical Social System (CPSS) in the near future are potentially really wide (energy systems, electricity networks, intelligent production, distributed manufacturing, smart cities, precision farming, etc.).

The design and the management of CPSS is still a challenging task because of the heterogeneity of subcomponents, of software complexity and hardware entities, since there is a lack of effective theories and design approaches to enable an unified structure. The research area of CPSS applications to the social systems (territorial systems, urban systems, industrial symbiotic systems,) is still immature as it is the appraisal of the effect of their entire life-cycle to the systems influenced. The extraction and the analysis of data/information/knowledge related to activities of social system (say, complex systems) derived from sensors and/or measuring systems is still on relatively early stage, lacking in the managing methods of large data at a wider scale. Finally, their sustainability (i.E. Their effect on sustainable development of the social systems where these are used) is still unexplored topic to be faced, as well as their support in the improvement of territorial resiliency.

Final purpose of the doctoral thesis will be the identification of the operational and management features of CPSS as decisional support in the management of complex territorial systems (namely, the systems of systems above mentioned) to support their organization and management to improve their sustainability and hopefully resilience. The complexity of the research topic is high, as the CPSS are a novelty as structured tools for large-scale decisional tasks.

The use of the corpus of knowledge in systems engineering, since this is the keystone that in recent years is providing a structured approach to the definition and resolution of problems on a large scale, can help researchers to find new paths, also in the assessment of the sustainability of the CPSSs themselves in the sense before mentioned.

One of the effects of research is to create an innovative and resilient framework to design sustainable CPSS for resiliency improvement, allowing for informational stability and proactivity in the development of systems at regional level, since these tools are going to reshape our lives, values and the quality and usability of services for people.

Research team and environment

The candidate will be part of a working teams of Department of Mechanics Mathematics and Management (DMMM) of Polytechnic University of Bari. The research team comprises 14 permanent staff members: 5 Full professor, 4 Associate Professors, 2 Senior Researcher and 4 Junior Researcher. The research fields of the

members of the team are manufacturing technologies, processes, additive manufacturing and sustainability and the research team has been involved in several research projects in Additive Manufacturing (AM) and Sustainability. The Ph.D candidate will have access to public interdisciplinary lab named RIAPRO-Lab connecting all the labs of the 4 Apulian public Universities born to support decision-making public bodies, including government bodies, in order to understand and support any industrialization, to map critical aspects for the Apulian territory, such as industrial conversion, industrial conversion, vulnerabilities of production systems, opportunities for increasing industrial resilience, opportunities to encourage process innovations through productions of a native Apulian character. The candidate may also will have access to Zero Emission Research Option (LabZERO), a multi-disciplinary public research laboratory funded by the Italian Ministery of Research and Education part of the Apulia applied research system. LabZERO integrates networked laboratories, industrial clusters and the entrepreneurs, supporting the development of the Green Technologies Pole.

Suggested skills

Management engineering; computational methods; system engineering; manufacturing systems and technologies; statisticsGOAL 11

Hierarchical architected materials for energy and environmental applications

Research keywords:	Nanomaterials Heterogeneous Catalysis CO2 conversion
Reference ERCs:	PE4_10 Heterogeneous catalysis PE5_6 New materials: oxides, alloys, composite, organic-inorganic hybrid, nanoparticles PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 13: Climate Action
Reference person:	Fornasiero Paolo (pfornasiero@units.it)
Host university:	University of Trieste *Department of Chemical and Pharmaceutical Sciences*

Research topic

Hierarchically architected materials (HAMs) are an emergent class of flexible materials with advanced new properties. The possibility to tune the final material properties by a careful assembly of nano-building blocks, is opening new perspectives for sustainable photo-and photoelectro- catalytic conversion/activation of small molecules. In particular, it has been demonstrated that it is possible to perform the reduction of CO2 to solar fuels and chemicals, the activation of N2 to ammonia or water splitting to hydrogen as a clean energy vector. The project will be based on the design, synthesis and characterization of advanced HAMs and their use in photo-assisted catalytic processes of small molecules activation, with high impact on sustainable energy conversion and on environment.

Research team and environment

The work will be carried out at Materials, Environment and Energy Lab at the University of Trieste (http://meeresearch.Weebly.Com/) under the supervision of Prof. Paolo Fornasiero in the framework of a multidisciplinary team with local (including the Nanomaterials and Energy lab at DIA Prof. V. Lughi), national and international collaborations. Access to synchrotron facilities and to advanced laboratories for transmission electron microscopy will be part of the PhD activities.

Suggested skills

Knowledge of Chemistry, Chemical Engineering and/or Physics with background on (nano)materials synthesis and/or heterogeneous catalysis, and/or materials characterization techniques, and/or chemical engineering processes. Knowledge of scientific English.GOAL 13

Curriculum: 3. Technology and Territory scholarship code **C15**

Sustainable management of water resources in a changing climate

Research keywords:	Community-based participatory research Water resources Climate adaptation
Reference ERCs:	PE10_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution SH7_6 Environmental and climate change, societal impact and policy SH7_5 Sustainability sciences, environment and resources
Reference SDGs:	GOAL 4: Quality Education GOAL 6: Clean Water and Sanitation GOAL 11: Sustainable Cities and Communities
Reference person:	Grossi Giovanna (giovanna.grossi@unibs.it)
Host university:	University of Brescia *Department of Civil Engineering, Architecture, Land, Environment and of Mathemetics*

Research topic

The main goal of the research is the implementation of the sustainability and climate change adaptation approach to the management of water resources within the boundaries of the watershed of the Po River, the longest major Italian river, the basin of which includes most part of Northern Italy.

On the one hand, land planning at the basin scale aims both at the land protection and at satisfying water demand by several stakeholders, on the other the sustainability of the resource management requires a stronger engagement of local communities together with a deeper analysis of the uncertainties of future climate scenarios and their effects.

Starting from the analysis of the socio-economic, regulatory and cultural context, at the local and regional level, the research aims at selecting adaptation measures and actions, tailored to the analysed territory. Moreover, the upcoming start of a new Knowledge for Change Hub (https://www.Unescochair-cbrsr.Org/k4c-2/) coordinated by University of Brescia is an excellent opportunity to frame actions aiming at citizens and local communities engagement in the development of adaptation strategies and action plans, where they play the role of main actors, aware of future transformations.

Research team and environment

The research activity will take place at University of Brescia, at DICATAM - Dept. Of Civil, Environmental, Architectural Engineering and Mathematics and will be set in the framework of WatShop (www.Watshop.It), a science shop born during the development of the European SciShops project (www.Scishops.Eu) and the upcoming Knowledge for Change Hub (https://www.Unescochair-cbrsr.Org/k4c-2/). The expertise of the whole WatShop staff and K4C network will provide valuable support to the research activity.

Suggested skills

The candidate skills that are expected to boost the performance of the PhD research project are mainly those gained through the completion of a master degree programme in a technical-scientific area. The PhD candidate is expected to have: interest in participatory research, community engagement and cost-benefit analysis; competencies in hydraulics, hydrology, GIS mapping and environment monitoring technologies; ability and willingness to work in a collaborative, multi-disciplinary environment, with an inter-disciplinary approach and interestGOAL 11

Resilience of production systems: Additive Manufacturing at the service of manufacturing sustainability

Research keywords:	Additive Manufacturing Resilience of innovative technologies Materials and processes sustainability
Reference ERCs:	PE8_12 Naval/marine engineering PE8_9 Production technology, process engineering PE8_10 Manufacturing engineering and industrial design
Reference SDGs:	GOAL 9: Industry, Innovation and Infrastructure GOAL 12: Responsible Consumption and Production
Reference person:	Lavecchia Fulvio (fulvio.lavecchia@poliba.it)
Host university:	Politecnico di Bari *Department of Mechanic Mathematic and Management*

Research topic

Main aim of the research topic is the functional characteristics definition of Additive Manufacturing (AM) technologies in order to transform traditional production in sustainable manufacturing methods. One of the goals must be the resilience definition of production systems and its relationship with manufacturing sustainability resulting from additive technologies, identified through multiple parameters.

The study of the manufacturing sustainability of Additive Manufacturing processes will be carried out by evaluating the technological and economic potential, the cost/benefit relationship of the transformation processes optimization, considering the product life cycle, evaluating its potential with respect to specific realities territorial. The use of innovative sustainable materials (e.g. Obtained from industrial waste, biomaterials) will be studied, to explore the new frontiers of Additive Manufacturing technologies evolution to enhancing the territories resources and the capacity for symbiotic interaction between different players and manufacturing sectors.

The research value to the community is the AM best practices definition for increasing the resilience of local companies.

The feasibility of the conversion paths for specific sectors will be analysed; these paths will be defined in order to test the effectiveness of resilience capacity in crisis situations. In these situations, it will be possible to produce small series of customized parts with a reduction in both time and resource consumption.

According to the sector analysed, the best performing AM technologies will be evaluated to optimize the resources and economic capabilities of the sector, measuring the sustainability of the entire production process for both new and existing products. For the chosen technology, the process parameters for the use of sustainable materials (slice height, distance between Toolphats, operating temperatures, etc.) will be analysed and optimized.

Research team and environment

The candidate will be part of a working teams of Department of Mechanics Mathematics and Management (DMMM) of Polytechnic University of Bari. The research team comprises 14 permanent staff members: 5 Full professor, 4 Associate Professors, 2 Senior Researcher and 4 Junior Researcher. The research fields of the members of the team are manufacturing technologies, processes, additive manufacturing and sustainability and the research team has been involved in several research projects in Additive Manufacturing (AM) and Sustainability. The Ph.D candidate will have access to public research laboratories of Additive Manufacturing, Reverse Engineering and Microtronic where he will be able to use AM equipment to test new sustainable materials and to improve process parameters, as well as to the sustainability manufacturing lab Zero Emission Research Option (LabZERO), a multi-disciplinary public research laboratory funded by the Italian Ministery of Research and Education part of the Apulia applied research system. LabZERO activities aim at integrating

networked laboratories, industrial clusters and the entrepreneurs, supporting the development of the Green Technologies Pole.

Suggested skills
Scientific/technical knowledge on: additive manufacturing processes, management engineering, sustainable manufacturing, materials science, CAD/CAM systems,

Health and energy implications of climate change in buildings design and refurbishment

Research keywords:	Building energy efficiency Heat waves and health Building renovation
Reference ERCs:	PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage PE8_6 Energy processes engineering PE7_3 Simulation engineering and modelling
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 7: Affordable and Clean Energy GOAL 11: Sustainable Cities and Communities
Reference person:	Manzan Marco (manzan@units.it)
Host university:	University of Trieste *Department of Engineering and Architecture*

Research topic

The European building heritage and, in particular the Italian one, is characterized by its obsolescence with poor thermal characteristics of the envelope with HVAC (Heat Ventilation Air Conditioning) systems characterized by high energy consumption. This has led the EU to force Member States to implement policies that encourage the renovation of buildings in order to limit energy consumption and dangerous emissions into the atmosphere. However, all the activities that could be implemented have to deal with the problem of climate change and the different environment in which the buildings are expected to operate. Another aspect to consider is the health of the inhabitants who can be seriously affected by extreme weather conditions, for example in the presence of heat waves with high temperatures and humidity, especially for a large number of consecutive days. Therefore, health conditions and reduced energy consumption must be studied at the same time with particular attention to future climate scenarios that show a constant increase in temperature and a greater frequency of extreme conditions that can lead to a higher level of risk for the vulnerable population.

The strategies that could be implemented must always be sustainable while minimizing their environmental impact. Global and regional circulation models (GCM-RCM) can provide the designer with future environmental projections of climate data such as temperatures, solar radiation and humidity, which can be used to develop scenarios for energy and environmental numerical simulations of buildings and HVAC systems with future data. The research will develop by addressing the energy modeling of buildings and HVAC systems using dynamic simulation systems such as EnergyPlus and esp-r, that require at least hourly meteorological data. The required data will be obtained by morphing techniques using both measured historical data and future data obtained from GCM-RCM models available in the literature. A significant effort will be dedicated to the exploration and application of new solutions for HAVC plant systems with particular attention to the sustainability of technologies, the exploitation of renewable sources and perfect integration with the building fabric. The building renovation will be addressed taking into account at the same time different aspects of the problem such as environmental impact, economic feasibility and health conditions, also taking into account the effects of uncertainty due to economic and meteorological data.

The available climate data will be used for the generation of extreme scenarios to analyze the response of the building system to heat waves in order to evaluate the effect on the most vulnerable population to excess heat, for example the elderly, infants, young children and people with chronic health problems. Appropriate strategies will also be evaluated with the aim of identifying adequate mitigation actions.

Research team and environment

The research will be carried out using the facilities of the Energy Efficiency in Buildings Lab of the University of Trieste. The laboratory uses both numerical and experimental methodologies. The numerical approach uses

dynamic simulation codes for the study and optimization of the buildings alongside the possibility of performing CFD simulations. The laboratory provides PhD students with various calculation codes with the relative licenses and the necessary IT tools. The experimental facilities allow the researcher to perform various measurements related to the performance of the building fabric and HVAC systems. The measurements can be carried out on site in the university laboratory or in a climatic chamber created to measure the efficiency of the renovation of the building envelope. The student will be placed in an environment with other post-doctoral students and researchers as well as structured research staff.

Suggested skills

The candidate must possess the ability to manage heat exchange equations, experience in the field of energy efficiency in buildings with particular attention to the use of dynamic simulation techniques. Previous experience in using dynamic simulation codes such as EnergyPlus, Trnsys and ESp-r is highly appreciated. The candidate must possess computational skills with particular ability in learning programming languages for writing scripts.GOAL 11

Urban Sustainability in practice. An integrated approach to the regeneration of contemporary cities

Research keywords:	Urban Regeneration Sustainable Mobility Evaluation Models
Reference ERCs:	SH7_6 Environmental and climate change, societal impact and policy SH7_7 Cities; urban, regional and rural studies SH7_9 Energy, transportation and mobility
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Meloni Italo (imeloni@unica.it)
Host university:	University of Cagliari *Department of Civil and Environmental Engineering and Architecture*

Research topic

The proposed research project aims to define methodologies and tools for the analysis and assessment of urban sustainability by integrating space characteristics, desires, requirements, and social behaviors. The main goal is to improve knowledge and inform ordinary planning and design decision-making processes.
This requires an integrated and transdisciplinary approach especially by including:
(i) accessibility and mobility: the PhD candidate will investigate methods and techniques for the analysis of travel behavior characteristics in order to implement innovative policies, programs, actions and interventions oriented to the development of active and sustainable mobility (public transport, cyclability, walkability);
(ii) public spaces, goods, and services: the PhD candidate will have to study appropriate evaluation methodologies for the enhancement of the public city in order to reduce barriers and obstacles to equal accessibility, especially for people with special needs in a perspective in which citizens are right holders, rather than interest holders.
(iii) urban environmental resources: the PhD candidate will have to develop strategies for the safeguard and the enhancement of biodiversity and ecosystem services by the implementation of nature-based solutions that help urban areas become healthier, more resilient to climate change, more productive in terms of food production, more sustainable in relation to resources management.
Instead of using the traditional sectoral approach for each of these themes, this research project proposes a systemic vision that will facilitate the PhD candidate to develop diversified skills needed for planning, management of sustainable urban transformations.

Research team and environment

The systemic approach promoted by this research project needs a range of knowledge inputs from sustainable mobility and urban evaluation disciplines to other academic and practitioner spheres such as economics, environmental psychology, urban geography, and urban sociology. The PhD candidate will work with the support of a multidisciplinary team of professors and research assistants. In particular, the PhD candidate will be able to use equipment and spaces of the Research Center on Mobility Models (CriMM) of the University of Cagliari, which owns the license of some of the most advanced and specialized software for travel behaviour and transport systems analysis and modelling, and where important research projects on sustainable mobility are underway. Furthermore, the PhD candidate will collaborate in the development of the research project SOSLabs. Action-Research laboratories for urban sustainability" funded by the Ministry of Ecological Transition to support the Sardinia Region in the development of the Regional Sustainable Development Strategy (SRSvS). In particular, the PhD candidate will participate in the activities of the Laboratory SOS Lab2 aimed at the improvement of an urban sustainability assessment model which will be made available to public administrators to provide objective data useful in the decision-making process regarding planning and urban design policies and guidelines definition.

Suggested skills

In addition to the interests and experiences on specific research topics, the candidate must have an aptitude for the use of models and methods of evaluation, processing of geographical data, as well as data analysis, also with the use of software tools (e.g. R package, Python, GIS tools).GOAL 13

The role of spatial dimension in modelling decarbonised energy systems

Research keywords:	Energy systems modeling Decarbonisation scenarios Geographical distribution of: energy demand, supply and infrastructures
Reference ERCs:	PE8_6 Energy processes engineering SH7_6 Environmental and climate change, societal impact and policy SH7_9 Energy, transportation and mobility
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Motta Mario (mario.motta@polimi.it)
Host university:	Politecnico di Milano *Department of Energy (DENERG)*

Research topic

The relative position of supply, demand and infrastructure in an energy system has a significant impact on the viability of some of the key technological solutions for the decarbonization. Some examples are: the development of the electricity network, the gas network and the district heating networks; solutions to improve the efficiency of building envelopes and heat generation; the capture, use and storage of CO2; the development of industrial districts and local hydrogen networks; the production of biogas, biomethane and synthetic methane and the choice between placing it on the grid or use on site; electric vehicles and the impact of recharges on the distribution network; the environmental impact of local pollutants. In the creation and use of models of energy systems, the demand, technologies and energy carriers undergo in most cases a process of aggregation, in terms of geography and technological affinity. However, the need for greater spatial disaggregation is increasingly evident in modeling practice. The research project is therefore aimed at: (a) identify and analyze the dynamics in which spatial disaggregation may be relevant for the decarbonization of the modeled energy system; (b) search for a methodology that is able to objectively and transparently define the optimal level of spatial aggregation in the various areas of interest, given certain boundary conditions, the availability of data and the computational limits of the tools used; (c) develop modeling solutions that can take into account optimal spatial aggregation levels, that are transparent in mathematical formulation and publicly available.

Research team and environment

The RELAB group, at the department of energy of Politecnico di Milano, is composed of an international and multidisciplinary team of professors, researchers, technicians, PhD students and research fellows. More than 30 graduate specialists from various thematic areas work in the following fields: thermally driven cycles, district heating and cooling, smart districts, LCA, national and regional energy systems energy scenario analysys. The latter branch of the group, managed by Fabrizio Fattori, will be the one where the candidate will be integrated. See more at: http://www.Relab.Polimi.It/

Suggested skills

The candidate would desirably be enthusiastic, passionate and with a deep interest in the subject of the research. Should show problem-solving attitude and capabilities of finding logical solutions to problems. It is suggested to have the ability to plan and prioritize work, meet deadlines and deliver work on time; to have organizational skills being capable to pay attention to details and setting clear goals.GOAL 13

Curriculum: 3. Technology and Territory scholarship code **C20**

Integrated Sustainable Energy and Climate Action Plans (SECAP)

Research keywords:	Institutional Capacity Multilevel Governance Integrated Sustainable Energy Planning
Reference ERCs:	SH7_8 Land use and planning SH7_7 Cities; urban, regional and rural studies SH2_1 Political systems, governance
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Pezzagno Michele (michele.pezzagno@unibs.it)
Host university:	University of Brescia *Department of Civil Engineering, Architecture, Land, Environment and of Mathemetics*

Research topic

Planning for energy transition is an interdisciplinary and urgent issue, requiring the integration of the energy theme into the everyday work of public administration, including spatial planning transport policies, waste management, human health etc. Doing so not only begs an integrated approach, but also a participatory and multilevel governing process. Tensions between interests and stakeholders often rise without an adequate resolution strategy. These tensions may hinder the transition once plans and policies become concrete in action plans, projects, and implementation. Such tensions manifest themselves as social conflicts and in failures to implement plans and policies.

Effective and efficient planning for the energy transition, thus, can greatly benefit from allowing an open and creative process of confronting formal decision-making with the places, stakeholders, and communities they aim to affect or activate. This goes beyond investigating how objectives and ambitions of plans might be translated into the fine-grained realities of places and communities (CBR - community-based research approach). It also goes beyond investigating how stakeholders and communities can provide input into formal policies. It is explicitly about activating and utilizing local and regional stakeholders and communities to be active participants in the energy transition. The creation of an institutional environment (i.E. A governance structure) that can combine the democratic legitimacy and legal power of formal plans and policies with the creativity, energy and social capacity of (bottom-up) initiatives, entrepreneurship and community involvement will definitely add great value to the energy transition and ensure its success.

The research aims to complement and integrate the approaches available in relation to sustainable energy and climate planning, i.E. Plan with the Society (participatory planning), Plan for the Society (create added value from energy projects), and Plan with Places (integrate various interest in an area based setting) with the concept Plan to be Implemented by the Society (utilize and activate local action and engagement) as an integral and distinct part of the SECAP development. Such a Holistic Planning Approach strengthens the capacity for the SECAPs implementation since it increases its feasibility by: (a) reducing societal resistance to energy projects due to citizens participation in planning, projects and the pursuit of added value to local/regional development with energy projects (e.g. Jobs, funds, regeneration), (b) activating the involvement and leadership of local communities in SECAP implementation by identifying appropriate institutional tools and measures, (c) considering actions and projects in the SECAP that involve private sector parties and thus, have greater visibility and overall bankability and (d) using knowledge, resources, and instruments from various policy sectors by transforming SECAPs further to integrated various urban/regional plans and policies.

Research team and environment

The Department of Civil Engineering, Architectural, Environmental and Mathematics (Dipartimento di Ingegneria Civile Architettura Territorio Ambiente e di Matematica - DICATAM) of the University of Brescia accounts about 70 professors and researchers working in various fields of the civil engineering, including environmental engineering, architecture, transport engineering and urban planning. The research group in Town and regional

planning of the University of Brescia is concerned, within the framework of the teaching and research activities, with the themes which traditionally deal with the city. The research group main focus is related to: Environmental impact studies: criteria and procedures in order to estimate the impact Land and environmental planning framework in Italy Greenways, ecological networks and infrastructures Planning in areas at risk Land take phenomena, soil sealing and innovative related planning tools Accessibility, sustainable mobility and road safety in urban and suburban context.

Suggested skills

In order to perform successful research, a master's degree in a technical-scientific area is needed. The PhD candidate is expected to have: interest in theoretical perspective on planning systems and analytical tools for urban and regional planning, competencies in GIS mapping and methods for environmental evaluation; ability and willingness to work in a collaborative, multi-disciplinary environment, with an inter-disciplinary approach.

AI techniques for assessing the sustainability of Public Administration processes

Research keywords:	Artificial Intelligence Public Administration Process Assessment
Reference ERCs:	PE6_7 Artificial intelligence, intelligent systems, natural language processing PE6_9 Human computer interaction and interface, visualisation SH3_11 Social aspects of teaching and learning, curriculum studies, education and educational policies
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 5: Gender Equality GOAL 8: Decent Work and Economic Growth
Reference person:	Pirlo Giuseppe (giuseppe.pirlo@uniba.it)
Host university:	University of Bari *Dipartimento di Informatica*

Research topic

The ability to respond to the social and environmental challenges of our time makes digitalization one of the main drivers in the transition process towards sustainable development at local and global level. Among the sectors where digital transformation will take on increasing importance and generate ever greater impacts is that of the management of cities and territorial systems. Over the years, Italy has equipped itself with tools and plans for the digitization of the Public Administration (PA) in line with indications at the European level. However, the level of digitization and the ability of Italian PAs to effectively adopt new technologies remain limited. This limit has strong and evident repercussions on the sustainability of the processes that are generated precisely in the PA.

The PhD project aims to define, through the use of AI, new models and tools for the management of PA processes that will allow the contemporary to promote the double revolution (digital and sustainable) to which the country and cities are called. The AI models and tools will be tested with reference to specific local and territorial bodies, such as Regions, Metropolitan Cities, Municipalities, ASL, etc. , in order to make PA processes more effective and sustainable.

Research team and environment

The research activity will take place mainly within the team active at the Dipartimento di Informatica and the Centre of Excellence on Sustainability of the University of Bari, also with reference to the already existing formal partnerships with local and territorial bodies (like for instance the Puglia Regions, Bari Metropolitan Citiy, etc.).

Suggested skills

The candidate shoud have strong abilities in Computer Science and Math,GOAL 8

Strategies for the circular city and implementation of sustainable models

Research keywords:	Circular city Governance Action plan
Reference ERCs:	PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage
Reference SDGs:	GOAL 11: Sustainable Cities and Communities
Reference person:	Pirlone Francesca (francesca.pirlone@unige.it)
Host university:	University of Genoa *Department of Civil, Chemical and Environmental Enginnering - DICCA*

Research topic

The goal of the research is to define strategies for the circular city and implement sustainable models.
Today cities are protagonists in the global transition towards a circular economy, as they represent centers of consumption but at the same time they are also centers of innovation, production and economic-social relations. Agenda 2030 introduces a circular approach at the urban level aimed at increasing inclusive and sustainable urbanization. A circular city is an urban system designed to be regenerated, accessible and resourceful. Transforming our realities into circular cities means revisiting and managing the different existing urban planning tools by involving the various stakeholders for a shared strategy. In the circular model, the central role is played by the citizen (the person not only inhabits the city, but the latter is designed around the person); the world of research, companies and startups are essential components; the Public Administration is the primary actor for development.
The main urban issues to be explored in the perspective of a circular city include: urban regeneration, sustainable mobility, sustainable waste management, sustainable tourism, green and blue infrastructures, renewable and efficiency energy, resilience and technological innovation.

Research team and environment

The research activity will take place at the DICCA of the University of Genoa, within the "Urban Planning" team. Main research topics developed are: Urban and territorial regeneration (with enhancement of internal areas) Environmental, social and economic sustainability Strategic planning Urban resilience (from natural and anthropogenic events) Port planning and waterfront renewal Sustainable Mobility Sustainable waste management Sustainable and slow tourism Sustainable Energy Promotion of the territory and creation/accompaniment of start-ups These researches are and have been carried out through European and National programs and research contracts with Public Administrations. In particular, the team's teachers are part of the "Sustainable UniGe" working group and Francesca Pirlone is the UniGe responsable in the Circular City.

Suggested skills

The suggested profile is a student who has completed a degree in Civil or Building or Environmental engineering and who has knowledge about urban planning tools and circular economy, learned in courses, internships or degree theses.
Other technical skills required: AutoCAD or GIS.

Decarbonisation of local energy systems

Research keywords:	Decarbonisation Energy transition Local sustainability
Reference ERCs:	PE8_6 Energy processes engineering SH7_5 Sustainability sciences, environment and resources SH7_10 GIS, spatial analysis; big data in geographical studies
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Poggio Alberto (alberto.poggio@polito.it)
Host university:	Politecnico di Torino *Department of Energy (DENERG)*

Research topic

The energy transition foreseen by 2050 in the Long Term Strategy of the European Union requires new actions for achieving the goal set to zero climate-changing emissions. In the UN Sustainable Development Agenda 2030, Targets 7.2 and 7.3 state that the economy, the society and the production processes will face a change in the direction of a significant reduction in energy consumption and their full satisfaction with renewable sources. In order to achieve these objectives, the transformation of local (especially urban ones) energy systems is essential. A wide-ranging energy transition must address many key issues:

- in-depth knowledge and constant updating of energy spatial data at different levels of detail (e.g. Consumption of energy carriers, building construction data or information on energy installations)
- analysis and modelling tools, for the definition, evaluation and choice of transition scenarios on different levels (technological, regulatory and incentive)
- ability to plan transition paths and constantly monitor their evolution (such as the development of renewable energy sources, the transition from one energy carrier to another or the promotion of energy efficiency among end-users)

The PhD research will focus on developing multidisciplinary approaches for locally integrated energy planning along four main steps:

1. Mapping - at different levels of detail - of energy information sets available in databases and information flows from national bodies or local authorities (e.g. National energy balance sheet, data bases on energy installations, etc.) as well as the definition of methodologies for the estimation of additional energy information without traceability (e.g. Woody biomass consumption)
2. Definition of the architecture of a main information platform for the integration and the correlation - at different geographical and temporal scales of all the energy information and data, to be used for modelling energy transition scenarios
3. Study of evolution scenarios for the implementation of the energy transition on a local scale, with targets for reducing energy consumption and increasing the share of renewable energy and efficient generation (cogeneration, district heating)
4. Comparative analysis of the achievement of scenario objectives, in terms of planning decisions and actions, financial and technical support, implementation barriers and regulation constraints in force

The characterization of local energy demand will be carried out for different types of users and time scales, including also the analysis of the potential to reduce energy consumption. This profiling will be cross-referenced with information on the availability of renewable energy sources. Knowledge of key energy technologies and energy efficiency solutions will be integrated into advanced tools for data processing and spatial representation. The new calculation and analysis methodologies will be applied on local scale to study energy trends and scenarios for the achievement of National and European decarbonisation targets. The correlation with air quality data and constraints will also be examined.

Research team and environment

Politecnico di Torino carries out education, research, technological transfer and services in all sectors of architecture and engineering. The Department of Energy is the point of reference in Politecnico di Torino for the areas of knowledge concerned with energy and sustainable development. The candidate will join the Sustainable Energy Analysis (SEA) research group that works on local energy planning. SEA has been operating for many years in research projects and support activities for local authorities and energy operators, within the framework of consolidated collaborative relationships. The main research topics addressed concern: energy transition at urban and regional scale, energy analysis of industrial processes and cogeneration plants, sustainable supply chains for wood biomass energy, renewable heat for district heating. SEA team integrates a knowledge of energy technologies with multi-scale analysis, from the individual user or plant up to an entire territory, and a multidisciplinary approach, including issues related to climate change, air quality, territorial management, local development. Through synergies with the Urban Sustainability & Security Laboratory for Social Challenges (S3+Lab) of the Politecnico di Torino, further transdisciplinary approaches are activated. Currently SEA is engaged in activities with the Piemonte Region for the definition of the Energy Action Plan, the implementation of the measures of the Air Quality Plan and the analysis of the Strategy for the Sustainable Development. SEA is also involved in the energy management of universities buildings and infrastructure, within the sustainability initiatives at Politecnico di Torino (Green Team) and the Italian University Network for Sustainable Development (RUS).

Suggested skills

Good knowledge on: energy systems modelling, energy data analysis, energy generation and distribution, cogeneration, district heating, energy self-production at user scale (prosumer), renewable energy resources, technologies and supply chains (e.g. Wood biomass, solar thermal and photovoltaic, hydrothermal and aerothermal by heat pumps).

Base knowledge on: data processing, data analysis and spatial representation software (e.g. Excel, Matlab, R studio, GIS)GOAL 13

Desing and advanced characterization of innovative materials for the next generation batteries

Research keywords:	Lithium and Post Lithium Batteries Electrochemistry and energy storage Materials science
Reference ERCs:	PE4_1 Physical chemistry PE4_8 Electrochemistry, electrodialysis, microfluidics, sensors PE5_6 New materials: oxides, alloys, composite, organic-inorganic hybrid, nanoparticles
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities
Reference person:	Quartarone Eliana (eliana.quartarone@unipv.it)
Host university:	University of Pavia *Department of Chemistry*

Research topic

Climate change is the challenge facing the world today. Europe is committed to achieving a climate-neutral society by 2050, as stated in the European Green Deal. This transition requires fundamental changes in the generation and use of energy, based on sustainable, safe, ultra-performing and affordable strategies. Batteries represent a key enabling technology to accelerate "the transition to sustainable and intelligent mobility, the supply of clean, affordable, safe energy and the mobilization of industry for a circular economy" (UN Sustainable Development Goals). Batteries are strategic for combating CO2 emissions from the electricity, transport and industry sectors. However, to achieve these goals, future batteries must have very high performance (power and energy), exceptional durability, greater safety, environmental sustainability and scalability at low cost. All this will be possible with neutral chemistry approaches for the development of advanced materials capable of increasing the electrochemical performance of batteries. UNIPV, through the EMEC-lab group (Chemistry Department), boasts twenty years of experience in the field of Li and post-Li batteries. The research environment brings together complementary skills in chemistry and materials science, offering an ideal position to address issues of a theoretical, technical and methodological nature, necessary for the optimization of such devices.
The research project will focus on the development of innovative materials (polymeric and inorganic) for electrolytes and electrodes in the batteries of the future with high power and energy. The study will focus on the synthesis of new systems that integrate intelligent functionalities (eg self-healing) and the characterization with advanced methods, above all by operating, in order to fully understand some mechanisms still not fully defined, at the basis of the device's operation (growth of dendrites at the anode, interfacial reactions of formation/evolution of the cathode/electrolyte interface, ion transport) and to visualize the role of the electron in interfacial reactions. Understanding and optimizing these processes contribute to achieving high electrochemical performance as well as improving the safety and durability of the battery itself.

Research team and environment

The work will be carried out at the Chemistry Department of the University of Pavia, whose research environment brings together complementary and interdisciplinary skills in all the branches of chemistry, physics and materials science. The EMEC_Lab research team (https://chifis.Unipv.It/quartarone/) is typically composed of 6-8 people, including one Associate Professor (Eliana Quartarone, Group Leader), one Assistant Professor, PhD, graduate and master students, which grow in a very stimulating environment, spiced up by excellent relationships and frequent teams collective activities. EMEC_lab is strongly involved in the development of advanced materials for energetics and in the context of national and international projects, mostly focused on lithium batteries and fuel cells. The research team has skills in electrochemistry and material chemistry, specifically in the synthesis of functional materials (polymers, organic or inorganic compounds) in the form of bulk, thin films and nanomaterials. The groups lab is equipped with the latest instrumentation for the material

characterization such as, electrochemical, micro- and macroscopic, structural, thermal equipment and also benefits frequent access to large synchrotron facilities. The Chemistry Department hosting EMEC_Lab is an INSTM Reference Center PREMIO (Center for the preparation of innovative materials with optimal chemical and physical properties) and a research unit of the INSTM research group GISEL (Italian Group of the electrochemical energy storage). As a GISELs partner, EMEC_Lab group is member of the Battery European Partnership (BEPA). The team average publication number is about 10-15 articles/year, most on top and high-impact international journals.

Suggested skills

Skills in chemistry, physics and materials science with some expertise in synthesis and chemical-physical characterization of materials.GOAL 11

Sustainable Energy Communities

Research keywords:	Sustainable energy Energy Communities Data analytics
Reference ERCs:	PE8_6 Energy processes engineering PE7_3 Simulation engineering and modelling PE6_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities
Reference person:	Raugi Marco (marco.raugi@unipi.it)
Host university:	University of Pisa *Department of Energy Systems Construction and Technology Engineering*

Research topic

The object of the research is the identification of solutions of complete self-sufficiency for energy communities through innovative methods for the integration of electrical and thermal systems, powered only by renewable sources produced locally (solar, wind, geothermal, biomass, etc.). ICT technologies and artificial intelligence will be adopted. Future scenarios are studied in which it is not sustainable to use the electricity and gas grid and the energy needs of civil, industrial and agricultural buildings must be satisfied with only renewable sources to be produced on site. In this scenario, it is necessary to study a completely innovative case in which it will be necessary to adapt the energy demands of users (negotiating consumption for civil uses with those for industrial use) with the energy available in terms of both overall consumption and hourly distribution. This perspective induces a radical change in current habits and lifestyles in terms of citizens' consumption and productive activities. Specific research topics are: integration of storage systems, renewable sources, utilities with ICT technologies and electronic platforms to maximize sustainability and energy efficiency. Development of artificial intelligence systems based on the monitoring of energy consumption and climatic conditions of buildings and plants to provide an information system to aid decisions. Socio-economic investigation, also through gamification techniques, to obtain profiles of energy needs in the prefigured context and understand their social acceptability.

Research team and environment

The research team is composed by professors of the Department of Energy Systems Constrction and Technology Engineering, in particular Prof. Daniele Testi, Prof. Marco Raugi and Prof. Mauro Tucci. The candidate will also operates in the very stimulating framework of the Interdipartmental Research Centre on Energy for Sustainable Development https://ciress.It/ where many experts on Electric Engineering, Electronic Engineering, Computer Science, Thermal Engineering etc etc will dialogue, help and guide the student activities.

Suggested skills

The candidate should have a good mathematical background and computer programming skills.
Energy systems and energy systems integration knowledge and understanding will be considered as preference titles. If necessary the candidate will be formed on these topics during the first year.
Computer programming skills are necessary. Big data analytics and artificial intelligence methods (neural network, machine learning etc) will be considered as preference titles. If necessary the candidate will be formed on these topics during the first year.
The candidate should be open minded and able to dialogue with colleagues with socio economic skills in order to undestand the socio-economic interactions into an Energy CommunityGOAL 11

Eco-design of materials and technologies for sustainable energy production and storage

Research keywords:	Life Cycle Sustainability Assessment Renewable energy sources Energy production and storage
Reference ERCs:	PE4_18 Environment chemistry PE4_1 Physical chemistry PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities
Reference person:	Sinicropi Adalgisa (adalgisa.sinicropi@unisi.it)
Host university:	University of Siena *Department of Biotechnology, Chemistry and Pharmacy*

Research topic

The PhD project aims to develop an innovative protocol for the environmental, economic and social sustainability assessment based on the life cycle approach to support the eco-design from cradle to grave of materials and technologies for sustainable energy production and storage. A particular attention will be paid to the identification of the main environmental hotspots, in terms of materials and production processes, that hinder the development of sustainable technological solutions.

Research team and environment

The project will be carried out at the Research on Renewable Energy and Sustainability Laboratory (R2ES Lab, www.R2eslab.Com) at the Department of Biotechnology, Chemistry and Pharmacy of the University of Siena, which has wide international scientific experience in various fields of physical and organic chemistry, especially for environmental applications.

Suggested skills

The candidate should have a scientific/technical background and a strong interest in energy issues. Candidates should have a Master degree in a relevant science subject or in engineering. The candidate would ideally have experience and technical competence in the use of methodologies for the sustainability assessment and resource efficiency analysis of renewable energy.

To be successful in this role he/she should:

Have good analytic and quantitative skills to analyse information, manage large amounts of data and interpret results;

Speak and write clearly in English;

Have good interpersonal and communication attitudes.GOAL 11

Supermachines: superconductivity in the electromechanical conversion.

Research keywords:	Superconducting Electrical Machines High Temperature Superconductors High Power Density Electromechanical Conversion
Reference ERCs:	PE7_2 Electrical engineering: power components and/or systems PE3_6 Macroscopic quantum phenomena, e.g. superconductivity, superfluidity, quantum Hall effect PE8_6 Energy processes engineering
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure
Reference person:	Tenconi Alberto (alberto.tenconi@polito.it)
Host university:	Politecnico di Torino *Department of Energy (DENERG)*

Research topic

From relatively small power size (1-10 MW), the use of superconducting materials with critical temperatures above 40 K, which can be cooled by liquid hydrogen or liquid nitrogen, allows to increase the efficiency in the electromechanical conversion.

Even more important is the dramatic reduction of weight and volume of the electrical machines, with a disruptive potentiality to decrease at of the weight compared to state-of-the-art machines.

The Energy transition is based on both the electric energy generation from renewable sources and the electrification of the energy final uses.

Hence, the efficiency in the production and utilization is necessary for the energy saving as well as for the possibility to reach high power density electrical machines that are essential to fully exploit the transportation electrification, in particular in the aircraft propulsion.

Within this framework, the Ph.D candidate will have to acquire and develop knowledge on a variety of disciplines: the physics of superconductors, the electromechanical and thermal design techniques for the development of superconducting electrical machines, the related cryogenic balance of plant and the electric grid interface (distribution grid or on-board grid). Furthermore, the management of innovation to study the introduction processes of the new technologies will be relevant, in particular in technologically mature and strongly regulated industrial sectors. Finally, the candidate will have to deal with the development of tools and models for the study of the reliability in complex systems for safety critical applications.

The main goal of the research activity will be the study and realization of virtualization tools (experimentally validated in reduced scale) for the development di superconducting rotating electrical machines and their digital twins. This result is the basic requirement for the technology transfer/sharing with industrial players potentially interested in the supermachines production.

Research team and environment

The proposed topic is inserted in a research activity that involves the scientific cooperation among research staff belonging to different departments (in particular the Department of Energy and the Department of Applied Science and Technology). The research has experiences in different scientific and disciplinary sectors; in particular, the research group has experience in electrical machine design, modeling and testing, and in physics of superconductivity. Furthermore, the research group has available FEM simulation tools and two main experimental laboratories: the enertronic lab where is possible to test rotating machine prototypes and the superconductivity lab where the superconducting wires can be tested ad characterized in different temperature and electro-magnetic conditions.

Suggested skills

The candidate is suggested to have a well founded knowledge in the electromagnetism, as well as a good knowledge of MATLAB, Simulink and MS Office Suite.

E-mobility and smart grids

Research keywords:	Electric mobility Energy storage Power electronics
Reference ERCs:	PE7_2 Electrical engineering: power components and/or systems PE7_12 Electrical energy production, distribution, applications PE8_14 Automotive and rail engineering; multi-/inter-modal transport engineering
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 12: Responsible Consumption and Production
Reference person:	Testa Antonio (atesta@unime.it)
Host university:	University of Messina *Department of Engineering*

Research topic

The scholarship will deal with possible solutions to fill technological gaps hampering synergic interactions between electrification of mobility and the evolution of electric power system towards smart grids. These two processes, which are both fundamental pillars of decarbonization, are strictly correlated, because on one side electric propulsion is about to become a new major form of electricity end use, and on the other side, smart grids will become a key energetic source for transport means. The expected boom of the electric energy demand for transportation will fuel in the next decade the transition towards smart grids integrating large charging infrastructures. However, some major issues associated with grid monitoring, management and control must first be resolved to maximize the exploitation of available generation and storage resources, while ensuring flexibility, resilience, efficiency, reliability and environmental sustainability.

Short range and long charging times issues of electric vehicles could be addressed in the near future through smart grids incorporating so-called e-roads, with charging lanes equipped with wireless inductive coupling systems capable of supplying energy directly to moving vehicles. However, some important issues need to be resolved first, addressing the efficiency and reliability of wireless charging systems, as well as optimal coverage and location of charging lanes, and ultimately arbitration and management of charging operations.

Electrification of vehicular mobility will give the chance to turn electric vehicles into active elements of smart grids, making available new storage and regulation resources. According to the Vehicle to Grid approach parked electric vehicles, connected to the grid via bidirectional charging stations, are remotely managed to sell highly valued demand response services. This however require the development of efficient and cost-competitive bidirectional power converters, specific communication protocols and suitable business models.

Charging stations are rapidly spreading around the world as side effect of mass electrification of road transport and the rush to reduce charging times has fueled the development of ever more powerful chargers, however some practical problems arise not only related to the negative effects of high currents on battery safety and lifetime, but also to threats set in terms of power quality and grid stability.

Over the next few years, the problem of disposing of large quantities of lithium-ion batteries having exceeded the expected operating lifetime on electric vehicles will dramatically arise. Since recycling Li-ion batteries to recover strategic raw materials is not cost competitive with mining, a possible alternative is to reuse them in stationary "second life" applications, such as energy storage systems embedded in smart grids. This demands the development of methodologies for estimating the battery health status and suitable tools for analyzing case by case the practical benefits in terms of cost and environmental impact.

The scholarship will start with a deep insight on the above mentioned technological gaps. Viable solutions will be then identified and studied case by case. One among the solutions identified will be exhaustively addressed from a theoretical point of view and finally practically assessed in laboratory and/or on field.

Research team and environment

The scholarship will take place at the Department of Engineering (DI) of the University of Messina, where the PhD student will be supported by the power electronics group, which has a consolidated experience on power converters and electric motor drives, assessment of EV batteries reliability and development of energy management techniques for naval applications. The PhD student will be introduced to the laboratory of electric drives and power electronics of the DI, where researches are accomplished in the fields of industrial automation, power converters, electric mobility, exploitation of renewable energy resources and Li-ion batteries storage systems. Relevant collaborations on research topics of interest for the scholarship are in place between the power electronics group of the DI and researchers of other departments of the University of Messina and other Italian universities, as well as, with CNR, ENEA, ST-Microelectronics, Caronte &Tourist, Intermarine and other Italian firms.

Suggested skills

Basic skills in electrical, electronic or industrial engineering.GOAL 12

Multidisciplinary approaches to define the sustainability of territorial transformations

Research keywords:	Sustainable territorial development Urban rent Common good
Reference ERCs:	SH7_7 Cities; urban, regional and rural studies SH7_8 Land use and planning SH7_5 Sustainability sciences, environment and resources
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 15: Life on Land
Reference person:	Tira Maurizio (maurizio.tira@unibs.it)
Host university:	University of Brescia *Department of Civil engineering, Architecture, Land, Environment and of Mathematics*

Research topic

The research will wonder about the key urbanization trends that could develop in the coming years, the environmental implications in terms of loss of ecosystem services, existing urban services and the resilience issues that arise from extreme natural events and climate change. In particular, the research intends to deepen, with a multidisciplinary approach, the possible solutions to sustainable territorial developments.

Land regimes, planning systems and the role of institutional actors largely depend on the constitutional and legal frameworks that characterize the different countries and regions. Furthermore, the role of municipalities is growing in importance, since they are assigned numerous competencies from a multidisciplinary perspective. For example, property rights and land regimes are fundamental aspects in the real estate market and, at the same time, in defining the regulatory role of public actors. Therefore, regulation is a general practice and is carried out through different tools, also in planning, to realise a more efficient land market and an effective provision of land for different uses - private and public - with particular regard to collective needs. The contents of property rights and how they can be used are defined by the public using rules, plans, policies and actions. In this perspective, different processes can be activated and planning models adopted, in particular, passing from a "passive planning" (regulation and control) to a "proactive planning", through which the public collaborates with the landowner to decide the land use, project features and charges.

The study, therefore, intends to investigate how to manage this epochal change through the search for a balance between the market (urban rent), the conservation of resources (the project of a more sustainable land) the private interest and the common good (the ethics perspective). A system to support public body setting a tool to evaluate territorial development from economic, social and environmental point of view also to ask private developers about the urban charges (in term of money, urban space quality or natural/agricultural value improvement) will be implemented. Furthermore, the realisation of the 2030 Agenda (and the related targets proposed in the 17 Sustainable Development Goals) implies the need to balance economic and development policies capable of taking into account the effective applicability of the objectives at the local scale. In particular, areas with high anthropogenic pressure, i.E. Densely populated or characterized by intensive agricultural production, need actions aimed at reducing the tension linked to the use of the land as a private good from which to continuously profit in favour of the growth of the value of the resource not (or hardly) renewable as it is limited. Therefore, the topic will be explored in-depth to decline a possible equilibrium between the city and the non-city, also and above all understood as a rural system, as an essential component for achieving the sustainability of territorial transformations.

Research team and environment

The Department of Civil Engineering, Architectural, Environmental and Mathematics (Dipartimento di Ingegneria Civile Architettura Territorio Ambiente e di Matematica - DICATAM) of the University of Brescia accounts for

about 70 professors and researchers working in various fields of environmental engineering including civil engineering, architecture, transport engineering and urban planning. The research group in Town and regional planning and Transport of the University of Brescia is concerned, within the framework of the teaching and research activities, with the themes which traditionally deal with the city. Since 1988 in the University of Brescia, has focused the research activities on different thematic among which, those most related to the call are in the areas of: Territorial and urban planning The environmental impact studies: criteria and procedures to estimate the impact Accessibility, sustainable mobility and road safety in urban and suburban context Analysing Planning Support System also GIS-base oriented Sustainable development of settlements

Suggested skills

A master's degree in a technical-scientific area is needed to perform successfully the research. The PhD candidate is expected to have: interest in theoretical perspective on planning systems, urban and rural dynamics and framework of planning policy; competencies in GIS mapping, tools for urban and regional planning and methods for environmental assessment; ability and willingness to work in a collaborative, multi-disciplinary environment, with an inter-disciplinary approach. Excellent or good knowledge of Italian and English is needed.

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D01**

The challenges of sustainability: transgenerationality, technology, environment

Research keywords:	Transgenerationality Technology Environment
Reference ERCs:	SH5_10 Ethics and its applications; social philosophy SH5_9 Metaphysics, philosophical anthropology; aesthetics SH2_7 Political and legal philosophy
Reference SDGs:	GOAL 5: Gender Equality GOAL 11: Sustainable Cities and Communities GOAL 16: Peace and Justice Strong Institutions
Reference person:	Andina Tiziana (tiziana.andina@unito.it)
Host university:	University of Torino *Department of Philosophy and Educational Sciences (DFE)*

Research topic

The world in which we live is neither determined nor unified: ecological crises and emerging complications are forcing us to continually translate and rewrite the terms of existence in this thin biofilm no thicker than a few kilometres which lies on the surface of the Earth. In addition, recent changes due to technological development, the health crisis and obvious transgenerational imbalances indicate that we need to rethink our relationship with natural and social reality as a whole.

The line of research will address the study of the main theoretical, ethical and semiotic issues related to climate change and sustainable development. Particular attention will be given to the conceptualisation of technology, to issues related to waste, biodiversity and health, as well as to the study of the problems opened up by transgenerationality: the transgenerational pact, the formulation of intra- and intergenerational justice criteria, as well as the modalities of their transfer to the social and political spheres. Issues of post-truth and how it emerges in public debates about climate change and environmental and social sustainability will also be examined.

Research team and environment

The research activity will take place within the Department of Philosophy and Educational Sciences (DFE) of the University of Turin (UniTo), which is one of the most ancient and prestigious universities in Italy. Awarded Excellence funding from the Italian Ministry of University, the DFE offers an innovative and interdisciplinary approach in teaching and research. Academic staff members include prominent scholars in philosophy, education, semiotics, communication and sociology. Key areas in these fields are studied with reference to both their historical development and influence on contemporary culture. The researcher will have the opportunity to collaborate with research centres belonging to the Department. In particular, with Labont Centre for Ontology (www.Labont.It), an interdepartmental research centre specialised in ontologies; with Circe, the Centre for Interdisciplinary Research on Communication (https://www.Circe.Unito.It/en/), which brings together semioticians and scholars from various fields with the aim of developing interdisciplinary analyses and promoting theoretical and empirical research on communication and culture; and with Scienza Nuova (http://www.Scienzanuovainstitute.Com), a research centre involving researchers from the University and Turin Polytechnic, which aims to develop researches with a strong interdisciplinary character in which the social transformations produced by digital technologies are addressed through collaboration between the humanities and technology.

Suggested skills

- Knowledge in the humanities, especially in philosophy
- Predisposition for interdisciplinary research
- Research and information management

- Self-management and interpersonal skillsGOAL 16

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D02**

Institutions and governance of climate change

Research keywords:	Intitutions Interdisciplinarity European Green Deal
Reference ERCs:	SH2_1 Political systems, governance SH7_6 Environmental and climate change, societal impact and policy SH7_5 Sustainability sciences, environment and resources
Reference SDGs:	GOAL 13: Climate Action GOAL 16: Peace and Justice Strong Institutions
Reference person:	Beretta Ilaria (ilaria.beretta@unicatt.it)
Host university:	Università Cattolica del Sacro Cuore *Scuola di dottorato in Istituzioni e politiche*

Research topic

The PhD program in 'Institutions and governance of climate change' focuses on the central role that institutions must play at all administrative and territorial levels in the transition to a sustainable and resilient society in front of climate change. Faced with the threat of increasing global risks, from health and environmental risks to financial and geo-political risks, the PhD program point to the creation of new administrative and business cultures based on a systemic interdisciplinary vision, which can drive innovative governance approaches and methods. The PHD in 'Institutions and governance of climate change' aims at generating the interdisciplinary skills (socio-economic, legal, political, administrative, methodological) that are essential to manage complexity and to adopt integrated perspectives for the governance of transformations related to climate change and sustainability. The PhD has a specific focus on the 'sustainable transition' led by the European Green Deal of the European Commission, which pursues climate neutrality by 2050, and to its implementation through the different levels of government and through the involvement of the actors from industry and finance.

Research team and environment

Universit Cattolica is one the largest non-state universities in Europe, with more than 41.000 students enrolled and 1.293 professors and researchers in 5 campuses (Milan, Brescia, Piacenza, Cremona and Rome). The professional academic staff helps students to connect learning and desired career path. The range of campus facilities and services ensures that every student has access to all of the support, information and mentoring they need. Universit Cattolica offers 98 courses for 1st and 2nd level laurea degrees and 147 post-graduate masters, as well as 17 doctoral schools with 21 PhD programs in the ten disciplinary areas in which Cattolica is active. At present, the research portfolio includes more than 300 active projects getting funds from competitive calls. In 2014-2019, Cattolica has been partner or leader in 58 Horizon 2020 projects, including 14 MSCA and 2 ERC grants in humanities and social sciences. Universit Cattolica pursues multidisciplinary and interdisciplinary approaches to scientific research, in particular aiming at a synthesis between the responsible use of methodologies of empirical sciences and speculative knowledge. The research team for the PhD program includes political scientists, sociologists, economists, and research methodologists. Part of the research team is affiliated to ASA Alta Scuola per lAmbiente, a postgraduate school that Universit Cattolica created 13 years ago to gather competencies on the environment existing in different faculties and departments.

Suggested skills

Strong motivation, flexibility, resourcefulness; no specific disciplinary backgrounds will be excluded; previsous research and work experiences on environment/climate change /sustainability will be preferred

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D03**

Governing Sustainable Development and Climate Change: Theories and Regulation

Research keywords:	Law and Regulation Public Policies Ecological Transition
Reference ERCs:	SH2_1 Political systems, governance SH7_6 Environmental and climate change, societal impact and policy SH7_5 Sustainability sciences, environment and resources
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 16: Peace and Justice Strong Institutions
Reference person:	Chiti Edoardo (edoardo.chiti@santannapisa.it)
Host university:	Sant'Anna School of Advanced Studies Pisa *Institute of Law, Politics and Development*

Research topic

We welcome projects addressing legal issues concerning the theories and regulation of sustainable development and climate change. In particular, we encourage ambitious submissions based on wide ranging theoretical foundations and relying on a plurality of approaches, including international law, transnational regulation, legal analysis of regional and national policies and remedies; further relevant fields of research include the transition to agri-food sustainability, the use of AI protocols and insurance mechanisms. We encourage interdisciplinary research projects, directed to the advancement of legal knowledge and research, but capable of benefiting from and possiblycontributing to other disciplines, includingphilosophy.

Research team and environment

The research will be carried out in the intellectually stimulating and highly engaging academic environment of the Sant'Anna School of Advanced Studies and in the wider network of the scholars and institutions participating in the PhD Curriculum in 'Theories, Institutions and Culture'. At the Sant'Anna School, the research will be developed within the Institute of Law, Politics and Development (DIRPOLIS). The Institute conducts innovative research in the fields of law, political science, development economics, moral and political philosophy. Its multidisciplinary approach allows for a comprehensive representation of complex legal, political, social and economic phenomena. Its manifold projects and activities on environmental-related issues, carried out within a cooperation network gathering a number of scholars from various European and non-European universities, promote high level scientific researches in the field of climate change and sustainable development.

Suggested skills

The research will be carried out in the intellectually simulating and highly engaging academic environment of the Scuola Superiore SantAnna (Dirpolis) and in the wider network of the scholars and institutions participating to the PhD Curriculum in Theories, Institutions and Culture.GOAL 16

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D04**

Epistemology, science and rationality: towards a philosophy of sustainable choice.

Research keywords:	Decision-making and Sustainable choice Rationality and Mind Epistemology and Philosophy of Science
Reference ERCs:	SH4_12 Philosophy of mind, philosophy of language SH4_13 Philosophy of science, epistemology, logic SH7_5 Sustainability sciences, environment and resources
Reference SDGs:	GOAL 5: Gender Equality GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Di Francesco Michele (michele.difrancesco@iusspavia.it)
Host university:	IUSS Pavia *Department of Humanities and Life Sciences*

Research topic

How can we make reliable scientific predictions and take action on their basis when faced with complex data and uncertainty? What is the role of philosophical analysis in the evaluation of current global challenges such as climate change and sustainability and in the development of informed solutions to them?

The public debate on such global challenges is most of the time lacking in rigor. Reliable sources of information are often hard to individuate, and threats for an informed and reasoned decision can come from skepticism towards science and scientific truth, and more generally from an incomplete, and sometimes even mistaken, understanding of the proper features of the scientific enterprise.

The successful PhD candidate will be expected to investigate how, in such complex scenarios, rationality can be defended and made to serve public decision and action through sustainable choices. Ideal research projects will investigate how traditional issues in the study of scientific methodology, rational choice and decision-making should be framed in the renewed context of global challenges, especially when complexity and richness of data, uncertainty in outcomes, severe risk and public responsibility are at stake.

The research can focus on one among the many areas of philosophy involved in such problems, although interactions between the following disciplines will be encouraged: philosophy of science, epistemology, theories of rationality and behavioral economics, philosophy of cognitive sciences and cognitive psychology, decision-making theory, philosophy of technology, and public ethics. Other possible interdisciplinary research areas which will be positively considered are: philosophy of language, critical thinking and argumentation theory, informal and formal logic, formal epistemology. Impact on public information and education will also be considered relevant within the research areas.

Research team and environment

Team members: Prof. Michele Di Francesco, Full Professor Michele Di Francesco is full professor of Logic and Philosophy of Science. Past Rector of IUSS, Past President of the European and Italian Societies for Analytic Philosophy and of the Italian Society of Neuroethics and Philosophy of Neuroscience. His main research is in the philosophy of mind and cognitive science. Prof. Andrea Sereni is Associate Professor and Head of the Department of Humanities and Sciences at IUSS. His teaching and research cover several topics in epistemology, philosophy of mathematics and philosophy of language and logic. He coordinates the Italian Network for the Philosophy of Mathematics. Prof. Alfredo Tomasetta specializes in philosophy of mind and analytic metaphysics (especially the metaphysics of human persons). In addition to these primary areas of research, he is also interested in philosophical logic, philosophy of language, epistemology and classical Indian philosophy. Dr. Giulia Piredda is a Lecturer in philosophy at IUSS. Her primary research interests are in the philosophy of mind,

philosophy of cognitive science and philosophy of language, with particular attention to the situated, embodied and extended views of mind and affectivity. The research activity will be developed at IUSS, a competitive and internationally-oriented school of advanced studies, home to the PhD program and located in an intellectually stimulating context in one of the oldest Italian university towns. Connections with related areas within IUSS research (from linguistics to the neuroscience of decision) will be encouraged.

Suggested skills

Candidates should be intellectually curious and have a special interest in philosophy of science, epistemology and the study of how the human mind works when we have to make decisions in complex contexts, especially in relation to issues such as the nature of rationality, decision-making, and the impact of cognitive sciences. Students should be prepared to intense reading and learning, and open to explore novel lines of research in a multi-disciplinary environment. Rigor in arguments and in discussion will be encouraged, with particular focus on its application to the public debate on global challenges, where the impact of, and responsibility for public actions are at stake.GOAL 13

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D05**

Sustainable finance and green-washing: from transparency to financial education, financial intermediaries conduct duties and organizational measures

Research keywords:	Green-washing Sustainable investments ESG information
Reference ERCs:	SH2_4 Legal studies, constitutions, human rights, comparative law SH2_8 Big data in political and legal studies SH1_5 Corporate finance; banking and financial intermediation; accounting; auditing; insurance
Reference SDGs:	GOAL 8: Decent Work and Economic Growth GOAL 16: Peace and Justice Strong Institutions GOAL 17: Partnerships to achieve the Goal
Reference person:	Macchiavello Eugenia (eugenia.macchiavello@unige.it)
Host university:	University of Genoa *Department of Law, Jean Monnet Centre of Excellence on EU Sustainable Finance and Law (EUSFiL)*

Research topic

The research pertains to the European legal framework in the area of sustainable finance with special regard to ESG information and offering of investment products to facilitate the transition towards a more sustainable economic system. Starting with the European Commissions sustainable finance Action Plan (2018), the EU Regulator has been particularly active in the adoption of measures conceived to allow investors to take informed decisions also from a sustainability point of view. Intense information duties on financial operators, labels (e.g. EcoLabel and green bond standard), legal definitions and standards aim to limit green-washing behaviours (i.E. The presentation of economic activities as sustainable when this is not the case) and national regulatory fragmentation, and to achieve a higher level of comparability of sustainable products. Nonetheless, also financial operators duties in terms of organization, risk management and conduct, currently under review with the view of taking into account sustainability factors, will have a significant impact on the integration of ESG factors (i.E. Pertaining to environmental, social and governance issues) in investment decisions. The candidate will critically examine European and national laws in the area of sustainable finance, already adopted or currently reviewed/discussed, to assess the effectiveness and adequacy of such regulatory policies and choices, as well as socio-economic implications deriving from sustainability-oriented financial choices, organizational structures and models as well as relative regulation. Particular attention will be reserved to the link between corporate non-financial information and financial intermediaries duties, to the role of ESG ratings and the impact and possible contribution of digital finance and technologies to sustainable finance advancement and overcoming of current obstacles and solution of critical aspects.

Research team and environment

The candidate will join a stimulating environment for conducting research in the area of sustainable finance and corporate governance. The University of Genoa presents a rich portfolio of courses in the area of sustainability in different sectors as well as interdisciplinary courses on sustainability (https://unigesostenibile.Unige.It/Educazione). Moreover, the Department of Law of the University of Genoa has a long traditional of excellence in legal studies and its Jean Monnet Centre of Excellence on European Union Sustainable Finance and Law (Eusfil) specifically focuses on the research about the legal implications of the integration of sustainability factors in the financial sector. In this respect, the Centre brings together a European team of experienced scholars with a very high profile in their field of work (corporate social responsibility, corporate governance, financial regulation, law and economics, etc.), conducting research in the area of CSR and/or sustainable finance. The activities are performed in collaboration with other well-known international research centres (e.g. Centre of Competence for Sustainable Finance of the University of Zurich) and involve also

scholars from other fields (e.g. Economists). Professor Eugenia Macchiavello is an internationally recognized expert in the area of Fintech regulation, regulation of alternative and inclusive finance, responsible banking and sustainable finance. She is a member of the Italian Association of Professors in Economic Law (ADDE) and of the Expert Working Group on FinTech of the Italian Capital Markets Authority (Consob). Before joining the University of Genoa, she has been a visiting Research Fellow at the New York University Center of Financial Institutions.

Suggested skills

The ideal candidate would have a strong background in law or in law and economics (experience in comparative or empirical research would be a plus), mindfulness of legal determinants both of financial markets and companies management, good knowledge of the English language and, preferably, other foreign languages. The candidate we are looking for should also show intellectual and interdisciplinary curiosity, critical thinking, commitment, passion for research, team-working skills and motivation in participating in an international network of young scholars.GOAL 17

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D06**

Market regulation and sustainable investment policies: a comparative law perspective

Research keywords:	Comparative Law Market Regulation Long Term Investments
Reference ERCs:	SH2_4 Legal studies, constitutions, human rights, comparative law SH2_5 International relations, global and transnational governance SH2_2 Democratisation and social movements
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 16: Peace and Justice Strong Institutions
Reference person:	Monti Alberto (alberto.monti@iusspavia.it)
Host university:	IUSS Pavia *Department of Science, Technology and Society*

Research topic

The polymorphism of the concept of sustainability requires the identification of criteria for assessing the consistency of the regulatory approach to long-term investment policies as well as the effectiveness of legal and fiscal tools seeking to govern the gradual transition towards sustainable development models in line with the goals set out by the United Nations (Agenda 2030).

A backward-looking analysis of certain recent pieces of legislation, for example in the field of renewable energies, shows how, under the label of sustainability, short-term speculative forms of investment have been encouraged, forms of investment hardly in line - and in some cases even contrasting - with the announced goals. Drawing from recent regulations at EU level, such as the Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment (the so-called Taxonomy Regulation) and the Regulation (EU) 2019/2088 on sustainabilityrelated disclosures in the financial services sector (the so-called Sustainable Finance Disclosure Regulation), the research aims at identifying, in a comparative perspective and using the tools of economic analysis of law, the cornerstones of a regulatory approach consistent with long-term investment policies effectively oriented towards sustainability.

Research team and environment

IUSS mission is to provide advanced education to undergraduate and graduate students, as well as fundamental and applied research in the fields of Science, Technology, Engineering and Mathematics (STEM), and Human, Social and Life Sciences. At IUSS, PhD candidates will find an open multi-disciplinary environment offering real opportunities for developing academic and professional tools for facing the challenges arising from increasing complexity and fast changes in the society and the environment. IUSS is always and actively committed towards internationalisation, diversity and inclusion. The selected candidate will join the Legal Science Research Group (LSRG) at IUSS led by Prof. Alberto Monti and will work in a pluralist and multi-disciplinary academic environment. The LSRG conducts policy-oriented research studies applying the methodologies of comparative law and economic analysis of laws and institutions; in the specific field of climate change, the LRSG collaborates with the IUSS research centre on Climate change impAct studies for RISk MAnagement (CARISMA), as well as with other international research institutions.

Suggested skills

Legal background, preferably in comparative law; intellectual curiosityGOAL 16

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D07**

The role of energy communities in the transition towards zero-carbon society

Research keywords:	Fossil capitalism Social theory Community
Reference ERCs:	SH3_1 Social structure, social mobility, social innovation SH7_6 Environmental and climate change, societal impact and policy SH3_4 Social integration, exclusion, prosocial behaviour
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Padovan Dario (dario.padovan@unito.it)
Host university:	University of Torino *Department of Culture, Politics, and Society*

Research topic

Energy transition is widely acknowledged as the key to fight the global change and to go out the fossil society and economy. Bur the energy transition is a multifaceted effort. Many are focusing mostly on the technological aspects of this transition whereas a more socially oriented approach is needed. Historically, the energy system has often moulded the road of societal occurring processes creating constraints, opportunities, and conflicts. This proposal focusing on energy communities suggests an approach that transcends the emphasis on energy transition as a mere technical or economic problem, connecting it to social theory and issues such as equality, collective action, commons, cooperation. Energy communities are widely acknowledged as an emergent phenomenon able to provide opportunities for citizens to actively participate in the energy transition needed to mitigate carbon emissions feeding climate change. Energy communities are thus becoming a crucial object of research for social sciences because they can help the transition towards RES changing the form and extent to which energy is produced. It is widely recognized that for the energy transition to be effectively pushed, the active engagement of various social actors in designing and implementing renewable sources and technologies play and should play - a crucial role. This is true both in the designing and implementation, as well as in grasping and satisfying social needs related to energy. But a truly significant commitment can be achieved by challenging the current energy regime through strategies and processes that could reduce the enormous influence exerted by large energy producing and distributing companies and the technical systems they mobilize. The proposal asks to investigate the following aspects:

- Energy and social evolution
- Fossil energy, capitalism, imperialism, and colonialism
- Fossil fuels and climate change
- Energy transition theories
- The tragedy of the energy commodity
- Collective action and commons
- Theoretical perspectives on energy communities.
- Historical trajectories of energy communities
- Forms of energy communities
- The future of energy communities

Research team and environment

The PhD candidate will find an extremely innovative and creative environment in which to carry on her/his research activity. Our research environment is made by the following organizations: Unesco Chair in Sustainable development and territory management; IRIS: Interuniversity Institute for Interdisciplinary Research on Sustainability; Interuniversity School on Ecology, politics, and society; Culture of Sustainability Journal. Our current H2020 research projects are the following: 2020-2025 LEAP-RE - Long Term EU-Africa Partnership for

Research and Innovation actions in renewable energy. 2020-23 E-CREW - Establishing Community Renewable Energy Webs - Rolling out a business model and operational tool creating webs of households that jointly manage energy to improve efficiency and renewables uptake. 2019-2022 COMETS - Collective action models for Energy Transition and Social Innovation. Moreover, we are developing research on the following topics: socio-ecological metabolism of cities; Anthropocene; extractive capitalism; energy, value, work, and nature; the impact of technics on climate change.

Suggested skills

Preferred skills are the following:
Good competences on social theory
Quantitative and qualitative social research competences
Historical research competences
Preliminary competences on the social aspects of energy
Preliminary competences on the social causes and consequences of climate changeGOAL 13

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D08**

The environment between philosophical conceptualisation and environmental aesthetics

Research keywords:	Nature and culture Anthropocenic transformations Environmental aesthetics
Reference ERCs:	SH4_12 Philosophy of mind, philosophy of language SH5_9 Metaphysics, philosophical anthropology; aesthetics SH5_6 History of art and architecture, arts-based research
Reference SDGs:	GOAL 5: Gender Equality GOAL 11: Sustainable Cities and Communities GOAL 12: Responsible Consumption and Production
Reference person:	Perissinotto Luigi (lperissi@unive.it)
Host university:	University Ca' Foscari of Venice *Department of Philosophy and Cultural Heritage*

Research topic

The research background problematizes, on the one hand, concepts such as 'world' and 'environment' and, on the other, the opposition between 'natural' and 'cultural'. The starting point is the recognition that the dichotomies between culture and nature, natural sciences and humanities, as well as their respective epistemological ideals have crumbled under the environmental crisis and the anthropogenic transformation of the earth system.

The research lines are four:

(1) a contextualization of the topic of animality in light of a conception of environmental sustainability that avoids its widespread anthropocentric connotation.

(2) A reflection on the Anthropocene capable of, on the one hand, holding geological and historical time together in a non-dualistic way and, on the other, of soliciting an analysis, on a planetary level, of the environmental dimension of human action, sciences, and technologies.

(3) A revival of environmental aesthetics to pragmatically rethink the exchanges between humans and the environment beyond the paradigm of disinterested contemplation of nature. This analysis embraces an environmental aesthetic approach anchored in a post-subjectivity perspective and in a pragmatically oriented conception of the interactions between living beings and the environment.

(4) An examination of how artistic practices influence behavior (especially through virtual/augmented reality and pre-/re-enactment and embodiment practices) and affect widespread sensitivity in view of an "eco-aesthetics critical of environmental exploitation.

Research team and environment

The research activity will take place at Ca' Foscari Universiity, Department of Philosophy and Cultural Heritage. Specific collaborations are implemented with the Department of Humanities, Claves Center (Center for Cognition, Language, Action, and Sensibility), the FARE EarlyGeoPraxis project (Grant of the Italian Ministry of University and Research, cod. R184WNSTWH), and the Max Planck Partner Group The Water City.

Suggested skills

Basic knowledge in philosophy (possibly philosophy of language, aesthetics, epistemology).

Attitude towards transdisciplinary researchGOAL 12

Curriculum: 4. Theories, Institutions and Cultures

scholarship code D09

Ethical-political profiles of sustainable development and climate change

Research keywords:	Theories of Justice Ethics of Climate Change Political Theory of Climate Change
Reference ERCs:	SH5_10 Ethics and its applications; social philosophy SH2_7 Political and legal philosophy SH7_6 Environmental and climate change, societal impact and policy
Reference SDGs:	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 16: Peace and Justice Strong Institutions
Reference person:	Pirni Alberto (alberto.pirni@santannapisa.it)
Host university:	Sant'Anna School of Advanced Studies Pisa *Institute of Law, Politics and Development*

Research topic

Proposed projects address philosophical issues that fall within the thematic area of sustainable development and climate change. In particular, projects are expected to contribute to contemporary ethical and theoretical-political debates related to sustainability, environmental ethics, theories of justice (including intergenerational) and global political theories, through a critical discussion of issues such as allocation of responsibilities, potential redistribution of benefits/disadvantages, mitigation of discrimination and inequalities resulting from climate change, at supranational and global level. Interdisciplinary research projects are encouraged, addressing issues relevant to the advancement of philosophical knowledge and research, but capable of benefiting from and possibly contributing to other disciplines, including law.

Research team and environment

The research will be carried out in the intellectually stimulating and highly engaging academic environment of the SantAnna School of Advanced Studied and in the wider network of the scholars and institutions participating in the PhD Curriculum in Theories, Institutions and Culture. At the SantAnna School, the research will be developed within the Institute of Law, Politics and Development (DIRPOLIS). The Institute conducts innovative research in the fields of law, political science, development economics, moral and political philosophy. Its multidisciplinary approach allows for a comprehensive representation of complex legal, political, social and economic phenomena. Its manifold projects and activities on environmental-related issues, carried out within a cooperation network gathering a number of scholars from various European and non-European universities, promote high level scientific researches in the field of climate change and sustainable development.

Suggested skills

Candidates are expected to have a robust philosophical background, a strong attitude for critical thinking and team-working skills.GOAL 16

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D10**

Climate change litigation in a comparative law perspective

Research keywords:	Comparative law Climate change Litigation
Reference ERCs:	SH2_4 Legal studies, constitutions, human rights, comparative law SH2_5 International relations, global and transnational governance SH2_2 Democratisation and social movements
Reference SDGs:	GOAL 5: Gender Equality GOAL 13: Climate Action GOAL 16: Peace and Justice Strong Institutions
Reference person:	Pozzo Barbara (barbara.pozzo@uninsubria.it)
Host university:	University of insubria *Department of Law, Economics and Cultures*

Research topic

Climate change has undergone a process of international regulation, which has experienced its ups and downs, with international diplomacy devoting more and more attention to the phenomenon.

From the 1992 United Nations Framework Convention on Climate Change (UNFCC), to the Kyoto Protocol, which came into force in February 2005, the alternating phases of the institutional debate have established an international binding legislative framework for action, setting the objectives (mitigation and adaptation), and the tools (emissions trading, clean development mechanism, joint implementation) for facing the challenge of climate change.

After the 18th Conference of the Parties (COP) held in Doha, Qatar, the complex structure taken on by international negotiations has become self-evident. The idea of a single binding international agreement, which would have favored the prorogation and extension of the Kyoto Protocol has been given up. After that, an attempt was made to cope with the various problems arising out of climate change on the different working tables, but the outcome of these efforts is not easily assessed.

International negotiations have very likely become so complex because of the will to encourage the participation and involvement of all the industrialised and newly industrialised countries as much as possible.

The complex evolution of the international regulation has led to the development of alternative policy architectures for addressing the threat of global climate change, and to very heterogeneous results in the various regions, which highlights the existing tension between local law and global law.

In the last decades, we are witnessing the development of a body of rules, which tend towards a progressive approaching in the development of principles addressing environmental problems. This certainly derives from the fact that environmental problems have affected all legal systems in an almost contemporary way, and at the same time - is suitable to involve by its very nature multiple countries.

Nonetheless, although climate change protection is a global issue, the implementation of climate change policies remains a local issue, giving rise to different protection regimes that render comparative law analysis a suitable tool to investigate on the differences existing in the various legal systems.

The research project aims at investigating the different approaches of the United States and the European Union as far as climate change is concerned, tackling the different perspectives on litigation and regulation. The core of the research will concerns the recent wave of climate change litigation, originated in the U.S., which seems to have gained terrain also in the European context, where Courts in several national jurisdictions have uphold the action brought by environmental associations and other NGOs in order to induce States and agencies to adopt major mitigation and adaption measures.

In this perspective, the research project will also take into conideration the various actors involved, with a particular attention to gender issues.

The spreading out of climate change litigation appears to be an interesting field or comparative law research. In this perspective, comparative law tools could enhance the understanding of legal transplants in environmental law and provide a new approach to the development of global environmental law.

Research team and environment

The Department of Law, Economics and Cultures has established the ENVIRONMENTAL AND TERRITORIAL POLITICS STUDIES CENTRE (https://www.Uninsubria.It/siti-tematici-o-federati/centri-di-ricerca/centro-di-ricerca-centro-studi-sulle-politiche-ambientali), to promote research, teaching and dissemination of knowledge, including scientific divulgation in the field of environmental and climate change policies (in all operational areas: public law, private law, comparative law, European law, international law, criminal law, procedural law, economics, philosophy), carrying out and promoting interdisciplinary research and training activities and projects aiming at such purposes. Further, every year, the Department of Law, Economics and Cultures also promotes the International Summer School in Comparative Environmental Law, organized in Como with the collaboration of the University of Marseille/Aix-en-Provence (F), Opole University (PL) and Utrecht University (NL). Finally, since 2019 the Department of Law, Economics and Cultures has been awarded an UNESCO Chair on Gender Equality and Women's Rights, which aims at studying gender equality and women rights, including challenges arising from violation of human rights that might derive also from climate change. The team will be composed by comparative lawyers acting at the Department: Prof. Pozzo, Prof. Jacometti, Dr, Fanetti.

Suggested skills

Legal background, with some knowledge of comparative law.GOAL 16

Curriculum: 4. Theories, Institutions and Cultures

scholarship code D11

Social theory and research for sustainable development and global health

Research keywords:	Health Artificial Intelligence Sustainability
Reference ERCs:	SH3_1 Social structure, social mobility, social innovation SH3_2 Inequalities, discrimination, prejudice SH3_14 Social studies of science and technology
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 10: Reduced Inequality GOAL 1: No Poverty
Reference person:	Sannella Alessandra (alessandra.sannella@unicas.it)
Host university:	University of Cassino *Department of Human Sciences, Society and Health*

Research topic

The research must have as its primary objective to provide, within the epistemological framework characterized by the paradigm of sustainable development, the analysis of the impact of the various "health actions" in the socio-health environment. The study should be distinguished by its transdisciplinary character. The intertwining among the different scientific perspectives will be the glue for innovative research linked to multiple research structures. A mixed-methods methodological approach will be fostered. Among the research priorities, it will be possible to identify phenomena deriving from the emergencies of the acceleration of climate change; the redefinition of the quality of life of citizens on eco-sustainable projects; the measurement of actions launched at the institutional level, aimed at the Health of communities and citizens (goal 3). The analysis will have to consider the IV Industrial Revolution tools, such as Artificial Intelligence and robotics, to develop contexts of social and technological innovation aimed at reducing inequalities and promoting social justice and Health, especially towards populations at most significant risk of vulnerability. It will be possible to propose sustainable health tools in light of One Health's principles (WHO 2017) through innovative policies. In this way, polycentric scientific advances, and desirable health promotion educational models for sustainable development will be exploited.

Research team and environment

Lecturers of the University of Cassino and social and health structures in the area

Suggested skills

No oneGOAL 1

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D12**

The role of corporate governance in transitioning towards a sustainable economy and finance

Research keywords:	Green-washing Non-financial information Sustainable corporate governance
Reference ERCs:	SH2_4 Legal studies, constitutions, human rights, comparative law SH2_5 International relations, global and transnational governance SH7_6 Environmental and climate change, societal impact and policy
Reference SDGs:	GOAL 8: Decent Work and Economic Growth GOAL 9: Industry, Innovation and Infrastructure GOAL 16: Peace and Justice Strong Institutions
Reference person:	Siri Michele (michele.siri@unige.it)
Host university:	University of Genoa *Department of Law, Jean Monnet Centre of Excellence on EU Sustainable Finance and Law (EUSFiL)*

Research topic

The research pertains to the review and adaptation of the institutional context conceived to orient companies decisions and disclosures about sustainability in terms of environmental, social and corporate governance issues to move towards a sustainable economic system. Such issues have been managed so far through sustainability codes, transparency (see Directive No. 2014/95 about non-financial reporting - NFRD) and other voluntary measures, at most incentives-based (see Shareholder Rights Directive II) and currently under review at the European level with the objective of expanding the coverage and effectiveness of information duties (e.g. Increasing the categories of companies covered by the NFRD, introducing information verification and a common digital registry also for such information) and further contrast green-washing (i.E. The presentation of economic activities as sustainable when this is not the case). However, the topic is undergoing an intense debate at European level following the recent Proposals and strategies presented by the European Commission, entailing a general rethinking of corporate governance principles and relevant revisions also in terms of board members fiduciary duties. The candidate will examine the current and prospective legal framework at EU and national levels, also in the light of other European policies (digitalization and small and medium size enterprises) in order to assess the effectiveness and adequacy of current and proposed regulatory choices as well as social and legal implications of regulatory measures aimed at transitioning towards more sustainable business models.

Research team and environment

The candidate will join a stimulating environment for conducting research in the area of sustainable finance and corporate governance. The University of Genoa presents a rich portfolio of courses in the area of sustainability in different sectors as well as interdisciplinary courses on sustainability (https://unigesostenibile.Unige.It/Educazione). Moreover, the Department of Law of the University of Genoa has a long traditional of excellence in legal studies and its Jean Monnet Centre of Excellence on European Union Sustainable Finance and Law (Eusfil) specifically focuses on the research about the legal implications of the integration of sustainability factors in the financial sector. In this respect, the Centre brings together a European team of experienced scholars with a very high profile in their field of work (corporate social responsibility, corporate governance, financial regulation, law and economics, etc.), conducting research in the area of CSR and/or sustainable finance. The activities are performed in collaboration with other well-known international research centres (e.g. Centre of Competence for Sustainable Finance of the University of Zurich) and involve also scholars from other fields (e.g. Economists). Professor Michele Siri, director of the Eusfil centre, is a leading expert in the area of company law and insurance law. He is an academic member of the Board of Appeal of the European Supervisory Authorities, of the Technical Working Group of the EU Ecolabel criteria for Financial Products at the European Commission and of the Stakeholders Group of the Italian Securities and Market Commission (chair of the working group on sustainable finance).

Suggested skills

The ideal candidate would have a strong background in law or in law and economics (experience in comparative or empirical research would be a plus), mindfulness of legal determinants both of financial markets and companies management, good knowledge of the English language and, preferably, other foreign languages. The candidate we are looking for should also show intellectual and interdisciplinary curiosity, critical thinking, commitment, passion for research, team-working skills and motivation in participating in an international network of young scholars.GOAL 16

Curriculum: 4. Theories, Institutions and Cultures

scholarship code **D13**

Changing the (Cultural) Climate. The Ecological Humanities, Ecocriticism and Cultures of Sustainability

Research keywords:	Ecological Minds Empowerment Agency
Reference ERCs:	SH5_2 Theory and history of literature, comparative literature SH7_5 Sustainability sciences, environment and resources SH7_6 Environmental and climate change, societal impact and policy
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 13: Climate Action GOAL 16: Peace and Justice Strong Institutions
Reference person:	Spinozzi Paola (paola.spinozzi@unife.it)
Host university:	University of Ferrara *Studi Umanistici*

Research topic

THEORIES AND METHODS

We will start by exploring the theories and methodologies of the Ecological Humanities and Ecocriticism. We will study the Planetary Boundaries and Circles of Social Life; ecological footprints and indicators; the development of ecological thought throughout the centuries and in a transnational perspective.

CORPUS

We will examine representations of un/sustainable societies in utopia and dystopia, post/apocalyptic and climate fiction, nature poetry, ecological theatre, and the media to understand how interactions between humans and the environment, the impact of anthropogenic phenomena and forms of resilience, adaptation and regeneration are rendered by contemporary authors and artists through specific modes of expression and are perceived by different types of audiences.

QUESTIONS

How do ethics, aesthetics and ideology define discourses, representations and narrations of the Anthropocene and the climate crisis? How can the construction, communication, circulation, and reception of ecological thought generate empowerment and agency of individuals and communities?

AIMS

Training a new generation of researchers to understand that: 1. The Ecological Humanities and Ecocriticism do not only generate new theoretical, methodological, and critical approaches to literatures, the arts, and cultures, but also, and more importantly, foster new cultural mindsets by appreciating works of art as engaged responses to the ecological crisis; 2. Humans must act as responsible recipients and actors, consumers and producers who invest in eco-innovation while preserving the diversity of biological and cultural ecosystems; 3. Environmental sustainability and the im/material wellbeing of living organisms require the acquisition of skills rooted in the humanities and open to inter- and trans-disciplinarity; 4. Sustainable cultures and lifestyles incorporate the potentialities and limits of the post-Anthropocene and transhumanism.

Research team and environment

The research environment is strongly interdisciplinary, interdepartmental, and international thanks to the activities of the PhD programme in Environmental Sustainability and Wellbeing, http://www.Unife.It/studenti/dottorato/it/corsi/riforma/environmental-sustainability-and-wellbeing. Scholars and scientists involved in the programme are grouped according to four macro-areas: 1. The Humanities and the Social Sciences; 2. Economics and Law; 3. Architecture, Urban Planning and Engineering; 4. Life, Chemical and Biomedical Sciences.

Suggested skills

Ability to reflect and work on literatures and the arts as systems of knowledge and representation; theory, critique, and history of literatures from a comparative and transnational perspective; ecological thought; cultures of sustainability; interconnectivity; speculative fiction; climate narratives.GOAL 16

Curriculum: 5. Agriculture and Forestry scholarship code **E01**

Dairy cattle adaptation to heath stress: modeling and management

Research keywords:	Thermoregulation Cow requirements Data analysis and modeling
Reference ERCs:	LS9_10 Veterinary and applied animal sciences PE2_15 Thermodynamics PE7_5 (Micro- and nano-) electronic, optoelectronic and photonic components
Reference SDGs:	GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Atzori Alberto Stanislao (asatzori@uniss.it)
Host university:	University of Sassari *Department of Agricultural Sciences*

Research topic

Adaptation to climate represents an important challenge for livestock species, for the future livestock productions and especially for food from animal products. In particular, dairy cows in intensive production systems are continuously increasing their production level with high feed intake and metabolic efforts. It particularly exposed dairy cows to heat stress, due to their difficult to dissipate the endogenous heat production. For this reason heat stress highly affects dairy cows performance and welfare in the short term (as response to heat peaks) and in the medium term (in reproduction and seasonality of productions). The quantification of biological response to environmental temperatures, the definition of indicators to heath tolerance and the finding of adequate adaptation strategies to climate change are topics of relevant priority at international level. The PhD research will focus on the study of nutritional and managerial factors influencing the adaptation of dairy cattle to heat stress.

Particular focus will be devoted to: i) dynamic modeling of biological and thermodynamic processes that control the animal thermoregulation in response to environmental conditions of dairy cattle barns (temperature and humidity); ii) definition of heat stress indicators and definition of protocols for the reduction of heat stress in dairy farms based on the information available at farm level, including those provided by managerial software and sensors used to monitor animal performances.

The research activity will include the participation in a research project management, literature reviews, designing of experimental trials in commercial farms to study effect of meteorological variables on cow requirements, modeling of biological processes that determine variation in animal performances, quantification of animal response to heath stress, testing of farm strategies to reduce heat stress of dairy cows.

The PhD is conceived to promote the multidisciplinary interaction to integrate the biological and technical skills of students with animal sciences background with expertise from other disciplines of the PhD-SDC including physics for modeling the animal thermoregulation, data analysis and management focused to optimization of farm production processes and climate change adaptation of livestock farming systems.

Research team and environment

The PhD activity will be based on the Department of Agriculture of the University of Sassari. In particular the student will participate to the activities of the Nutrition group of the Section of Animal Science. The research group includes the PhD tutor, other faculties and a group of graduate and undergraduate students currently involved in other research projects. It is also part of a broad group of 8 Professors and 15 graduates student working on other animal science disciplines (genetics, product quality, monogastrics, etc). The research team will include expertise of different researchers specialized in animal production and mathematical modeling applied to animal science. The research focus will be integrated within the activities funded by the Sardinia Rural Development Program 2014-2020 of the project "Climalat: innovative management processes for reduction of heat stress and adaptation to climate change in dairy cattle farming". The activities will include data collection in several commercial farms, located in Sardinia, Arborea area (Or), equipped with high automation and digitalization (automatic milking systems, barn cooling systems, managerial software, etc) and will require

interaction with farmers and extension services for the implementation of new managerial protocols to reduce heat stress. Abroad periods will include collaborations with international groups specialized in dairy cow management and modeling.

Suggested skills

The candidate should have a degree in Agricultural Sciences and Technologies (LM-69) or Animal Production Sciences and Technologies (LM-86) or equivalent.
Previous experience in experimental trials on field and software for dynamic modeling is also appreciated.
Previous knowledge of dairy cattle management with experience in farm softwares use for farm, management, reproduction, automatic milking systems will be also positively evaluated.
Collaborative aptitude and pleasure to work in teams will favor the participation in the project activities.
The candidate should have passion for animal science, aptitude and curiosity versus applied modeling and other interdisciplinary approached that could help to have a broad view of the research focus and a productive interaction with experts from different domains.
Fluent English, Italian driver license class B and availability for driving cars will be needed to carry out the experimental activities.GOAL 15

Using stable isotopes to analyse soil-vegetation-atmosphere water transport in the Critical Zone

Research keywords:	Critical Zone Soil-Vegetation-Atmosphere water transport Stable isothopes
Reference ERCs:	PE10_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution PE10_4 Terrestrial ecology, land cover change LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology
Reference SDGs:	GOAL 6: Clean Water and Sanitation GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Borga Marco (marco.borga@unipd.it)
Host university:	University of Padova *Department of Land, Environment, Agriculture and Forestry*

Research topic

Understanding and predicting water availability and associated ecosystem services in the critical zone (CZ), which is the domain where the water cycle connects the subsurface to vegetation and atmosphere, controlling water quantity and quality, is essential to provide effective solutions for sustainable land and water resources management. Vegetation is a fundamental element of the CZ, as connects water from different storages in the subsurface zone with water in the lower atmosphere, therefore regulating water fluxes among different compartments. Several studies in the last few years have examined water mixing processes in the soil-vegetation-atmosphere system. However, the large spatio-temporal variability of subsurface water movement and the capability of plants to access water from both deep and shallow sources, result in highly-complex feedbacks in water exchanges between vegetation and other eco-hydrological compartments. Therefore fundamental scientific questions on the effect of vegetation on the hydrological cycle, especially under different climatic forcing and land-use conditions, remain unanswered.

The main objective of the project is to advance the understanding of water mixing in the CZ by investigating eco-hydrological processes of water exchange between vegetation and surface and subsurface water compartments. The project has a specific focus on forested sites in Italy and aims to:

1) assess the description of water mixing process across the CZ by using integrated high-resolution isotopic, geophysical and hydrometeorological measurements from point- to stand- and catchment-scale;

2) test water exchange mechanisms between subsurface reservoirs and vegetation, and to assess eco-hydrological dynamics by coupling the high-resolution data set with advanced eco-hydrological models at multiple spatial scales.

The project is based on high-resolution and detailed experimental observations, such as environmental tracers (stable isotopes of hydrogen and oxygen), hydro-meteorological data and advanced geophysical measurements already collected from different study sites in Italy. The data will be complemented with observations collected during the project in a consistent way across the study sites to identify water pools potentially involved in eco-hydrological exchanges and root water uptake dynamics. The high-quality data collected in the field and the experimental results will serve as a basis to implement and apply new-generation, robust, reliable and realistic eco-hydrological models aiming at assessing water mixing and exchange mechanisms between subsurface reservoirs, vegetation and atmosphere at the root-plant scale and the stand and catchment scale.

Research team and environment

The PhD project will be based at the Department Land, Environment, Agriculture and Forestry of the University of Padova (Prof. Marco Borga, Prof. Giulia Zuecco), with strong collaborations with the Department of Agricultural, Food and Forestry Systems of the University of Florence (Prof. Daniele Penna) and the Faculty of Science and Technology at Free University of Bozen-Bolzano (Prof. Francesco Comiti). This will provide access to

three experimental sites (located in the Italian Alps, in the Pre-alps and in the Tuscan Apennines) equipped for hydro-meteorological, isotopic and geophysical monitoring. The Departments include experimental facilities for i) isotopic analysis by means of laser spectroscopy; ii) geophysical monitoring of soil and root properties; iii) xylem water transport monitoring. The Department runs a Forest Hydrology lab, with equipment for soil water retention, soil permeability at saturation and physical-chemical water analysis. The PhD project will develop upon high-resolution and detailed experimental observations, such as environmental tracers (stable isotopes of hydrogen and oxygen), hydro-meteorological data and advanced geophysical measurements already collected in the frame of the WATZON (PRIN) National Project.

Suggested skills

Applicants should have knowledge on plant water relations and stable water isotope ecology. Experience in handling large data sets is a bonus. We encourage applications from enthusiastic dedicated individuals with strong quantitative skills as well as good writing and communication skills in English. Candidates should be willing to conduct field work at a nearby forest site, show team spirit, flexibility, high motivation and the ability to work independently.GOAL 15

Curriculum: 5. Agriculture and Forestry scholarship code **E03**

Ecosystem services of urban agriculture and climate change

Research keywords:	Urban green areas Mitigation and Adaptation Urban climate
Reference ERCs:	LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology LS8_14 Ecophysiology, from organisms to ecosystems LS8_5 Biological aspects of environmental change, including climate change
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Dalla Marta Anna (anna.dallamarta@unifi.it)
Host university:	University of Firenze *Department of Agriculture, Food, Environment and Forestry*

Research topic

Urban green areas are key elements to strengthen the resilience and the adaptive capacity through ecosystem services as C assimilation and storage, air pollution removal, and microclimate amelioration. However, benefits are indirect and difficult to quantify. So far, some attempts have been carried out by using dendrometric, crop and micro-meteorological models to quantify benefits of urban agriculture, urban forestry and green areas. A better linkage of benefits to plant physiology is needed for accurate quantification. Similarly, accurate data are missing to quantify the amount of latent heat dissipated by transpiration.

Such data could improve the quantification of the cooling effect of the green cover against the urban heat island, which is up to date mostly founded on the trees shading effect. The project aims at integrating physiological, crop and dendrometric data and innovative technologies to derive empiric and process-based models to quantify CO2 assimilation, PM removal, transpirational cooling, resource use efficiency, among others.

The research will be carried out in different European municipalities. In situ measurement campaigns will be carried out to assess growth and biometric parameters; Leaf Area Index; CO2 assimilation; transpiration; PM accumulation, biogenic volatile organic compounds among others.

Research team and environment

Research will be carried at the Department of Agriculture, Food, Environment and Forestry of the University of Florence. The PhD candidate will work in collaboration with a multidisciplinary research group, which main activities are related to ecophysiological, biophysical, and plant production measurements, GHGs monitoring and sustainability assessment. Equipped laboratories for analysis on plant organs as well as on soil characteristics, and field measurements devices, are available for research.

Suggested skills

The successful candidate is expected to be highly organized, able to work both independently and in a team environment, so as to engage and collaborate with colleagues, as well as having interpersonal and written communication skills. The candidate must also have a good command of English, an above-average interest in academic studies and an analytical mind. A doctoral programme primarily involves research. The candidate must enjoy getting the teeth into a subject and exploring it in depth and as he/she pursues his/her research further, it is important to be able to distinguish between primary and secondary issues and to make connections between the data obtained and the insights acquired.GOAL 13

Sustainability assessment of agri-food processes with the Water-Energy-Food Nexus approach

Research keywords:	Agri-food processes Water Energy Food Nexus Life Cycle Assessment
Reference ERCs:	SH7_5 Sustainability sciences, environment and resources PE8_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology
Reference SDGs:	GOAL 2: Zero Hunger GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Del Borghi Adriana (adriana.delborghi@unige.it)
Host university:	University of Genoa *Department of Civil, Chemical and Environmental Engineering - DICCA*

Research topic

The research concerns the evaluation of the sustainability of agri-food processes aimed at quantifying their footprint along the life cycle. The research will be carried out along the supply chain and will follow an approach based on the Water-Energy-Food (WEF) Nexus, evaluating the interconnection between food, water, energy and climate change. The methodology will be consistent with the international standards governing the Life Cycle Assessment (ISO 14040-44) and the principles of the Circular Economy. The basis of the WEF Nexus is an attempt to balance different uses of ecosystem resources (energy, water, land, soil and socioeconomic factors) on the assumption that there are clear interactions between water, food and energy that can result in synergies or trade-offs between different sectors or interest groups. The FAO definition of WEF Nexus explicitly addresses the interactions and feedback between human and natural systems, focuses on the resources we depend on for the achievement of social, environmental and economic objectives related to water, energy and food. The research aims at carrying out a multi-variable optimization of agri-food processes in which the optimum point will be defined by the "best compromise" between water footprint, energy consumption, global warming potential and agricultural yield of the crop.

Research team and environment

The PhD will take place at the Department of Civil, Chemical and Environmental Engineering (DICCA) of the University of Genoa. The PhD student will be integrated into the "sustainable development of processes" research group, a team that has been operating for almost 20 years within the CE.Si.S.P. (Interuniversity Centre for the Development of Product Sustainability) The main research activities concern: GHG inventories and strategies, GHG calculation and monitoring, mitigation and adaptation strategies for industries and communities, Carbon Capture and Storage R&D, EU-ETS application, development, validation and verification of CDM projects, development of VER projects Carbon offsets, Carbon footprints, Life Cycle Assessment studies, Eco-Design and environmental labels, circular economy.

Suggested skills

In order to perform a successfully research in this topic, a master's degree in a technical-scientific area is required that guarantees adequate knowledge of the concepts related to the assessment of environmental impacts and the definition of environmental indicators. The candidate should be familiar with data analysis and process engineering. A further skill is represented by the knowledge of the LCA methodology, its applications and use of the main calculation models used in the LCA studies.GOAL 13

Climate change and water resources for crops: impact and adaptation strategies

Research keywords:	Water resources Crop modelling Adaptation strategies
Reference ERCs:	LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology SH7_5 Sustainability sciences, environment and resources LS8_5 Biological aspects of environmental change, including climate change
Reference SDGs:	GOAL 2: Zero Hunger GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Ferrise Roberto (roberto.ferrise@unifi.it)
Host university:	University of Firenze *Department of Agriculture, Food, Environment and Forestry*

Research topic

Future climate scenarios in the Mediterranean areas predict an increase in the frequency and intensity of heat waves, and a significant decrease in rainfall during summer. This will lead crops to lose more and more water due to increased evapotranspiration. These losses will not always be replenished due to the concomitant decrease in water availability, thus leading to drought and thermal stress. These conditions will likely change crop water consumption, thus water requirements from the agricultural sector, which in turn may lead to increasing conflicts with other sectors for the use of water resources. In-depth knowledge of the processes linked to this changes plays a significant role in the management of water resources in relation to the ongoing climate change.

The research activities of the doctorate will focus on improving the knowledge relating to water consumption, and the processes that determine it, of the main irrigated crops in conditions of abiotic stress (drought / heat). To this end, field trials related to the application of deficit irrigation strategies, advanced monitoring tools and modeling simulations will be conducted in parallel to evaluate the effectiveness of these strategies in a context of climate change and adaptation.

Research team and environment

The research will be carried out in a team that has been long engaged in several experimental and modelling national and international research projects to investigate climate change impacts on agricultural and natural systems including ecosystem vulnerabilities for adopting feasible adaptation and mitigation strategies. The expertise concerns the use of innovative tools and approaches (e.g. Crop simulation models, statistical classification models, global and regional circulation models, weather generators, geographical information systems, and remote sensing technologies) to monitor, reproduce and predict the response of the agro-systems to the climatic and environmental factors (e.g. Climate, soil, water, crop and irrigation management, etc.). The department is able to provide the doctoral student with access to databases, instrumentation and equipped laboratories, and the technical and instrumental assistance necessary for carrying out the research activities. Finally, the PhD student will be able to benefit from an extensive network of collaborations, providing the opportunity to be included in an international network of scholars and experts with whom comparing and improving his/her knowledge and skills.

Suggested skills

The successful candidate is expected to be highly organized, able to work both independently and in a team environment, so as to engage and collaborate with colleagues and farmers, as well as having interpersonal and written communication skills. The candidate must also have a good command of English, an above-average interest in academic studies and an analytical mind. A doctoral programme primarily involves research. The candidate must enjoy getting the teeth into a subject and exploring it in depth and as he/she pursue his/her

research further, it is important to be able to distinguish between primary and secondary issues and to make connections between the data obtained and the insights acquired.
Specific skills related to the thematic include agronomy, plant ecophysiology, crop modelling and irrigation management as well as statistics.
Familiarity with Microsoft Office and programming environment (R, pyton, etc.) might facilitate the research activity.GOAL 13

How to preserve the planet: technologies for sustainability

Research keywords:	Food Waste Process
Reference ERCs:	PE8_2 Chemical engineering, technical chemistry LS9_5 Food biotechnology and bioengineering PE5_11 Biological chemistry and chemical biology
Reference SDGs:	GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
Reference person:	Fino Debora (debora.fino@polito.it)
Host university:	Politecnico di Torino *Applied Science and Technology*

Research topic

Sustainability is the first goal towards which the actions of all components of society must strive to build our "home" of tomorrow. What will be the role of technology? The proposed path raises questions about how technology can contribute to the construction of a more sustainable future, trying to give some concrete answers to these questions:

- What will the buildings and the built environment look like?
- How are we going to dress?
- What are we going to eat?
- How will we manage the waste?
- What about our energy needs?
- What will the new new professions be?

Research team and environment

The general objective of the research group CREST, Catalytic Reaction Engineering for Sustainable Technologies, is the study of innovative chemical processes that pursue the aim of developing a more sustainable model of society. The tool is expressed in five types of approach: i) the biorefinery, that is the exploitation of biomass in order to produce fuels or chemicals with high added value of renewable origin, ii) re-use and enhancement of waste or the containment of the environmental impact of conventional processes, iii) the monitoring of the quality and safety of products in the agri-food industry, iv) the development of innovative catalytic processes for applications in the energy and environmental fields, v) the development of technologies that use renewable resources for the mitigation of CO2 emissions and its enhancement by using it as a raw material for the production of other chemicals and / or fuels.

Suggested skills

We seek to recruit an individual who investigates fundamental questions addressing at sustainable green techniques.

We expect that you:

- embrace the responsibility to plan and execute modelling and experimental research;
- are interested in chemical and biochemical processes, and are eager to explore new research areas;
- have excellent engineering skills and an analytical mindset;
-are motivated to contribute to technology enabling sustainable products ;
- appreciate teamwork and have the ability to interact and collaborate with researchers and laboratory technicians a very crossdisciplinary environment.GOAL 13

Curriculum: 5. Agriculture and Forestry scholarship code **E07**

Forest ecosystem services under climate change

Research keywords:	Forest ecosystems Sustainable forest management Climate change and natural disturbances
Reference ERCs:	SH7_6 Environmental and climate change, societal impact and policy LS8_1 Ecosystem and community ecology, macroecology PE10_4 Terrestrial ecology, land cover change
Reference SDGs:	GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Freppaz Michele (michele.freppaz@unito.it)
Host university:	University of Torino *Department of Agricultural, Forest and Food Sciences (DISAFA)*

Research topic

Forest ecosystems provide supporting, regulating and cultural services such as wood and non-wood products, carbon sequestration, water provisioning, protection from floods, biodiversity or climate regulation. Ongoing changes in climate and disturbance regimes (e.g. drought, fire, storms) raise concerns regarding the future ability of forests to provide these and others services to society. Sustainable forest management can increase the resistance and resilience of forest ecosystems services under global change.

The PhD candidate will investigate both the influence of climate variability on forest ecosystem functioning (e.g. tree reproduction, mortality) and adaptation to climate change by sustainable forest management practices (e.g. silvicultural systems that prevent or mitigate drought, fire and storm impacts). The research will deepen how climate, disturbances, and competition influence long-term forest demography and interact to control change in European forests, and will develop and test innovative forest management strategies to adapt to changing disturbance regimes and maintain key ecosystem services in mountain forests (protection from rock-falls, carbon stock, and sustainable wood production).

By making use of data collected in experimental forests as well as climatic and ecological spatio-temporal data provided by large public databases, the candidate will learn how to formulate hypotheses, design experiments and apply statistical techniques to address specific research questions. The research program includes the calibration, validation and use of forest modeling systems that simulate both disturbances and cascading ecological processes, as well as the effect of forest management practices. An internship of at least 6 months as visiting researcher in an international forest research center will complement the training.

Research team and environment

The DISAFA is a leading academic institution that undertakes strategic research at the forefront in agricultural, forest and food systems. The campus includes cutting-edge research labs and greenhouses equipped with advanced instruments for the analysis of complex and structured matrices for specific topics (e.g. Dendrochronology, physiology and plant genetics, plant pathology, soil, wood technology). A network of experimental farms and forests, and field research sites, complement campus facilities. The DISAFA research environment attracts leading international scientists and collaborations with EU and global research institutes. However, the research center is also committed to engaging with end-users, policy makers and key stakeholders at local and national levels. The campus is located near the city of Torino to which it is well connected by an underground line (15 minutes ride), and school buildings sit side-by-side with libraries, sports facilities (e.g. Outdoor pool), and ample green areas and meeting points. The candidate will become part of the Forestry and Wood research unit, which carries out studies in: (i) Forest ecology and silviculture; (i) Natural disturbances ecology and management of natural hazards; (iii) Wood technology and forest operations. The research group involves several researchers (e.g. Prof. Renzo Motta, Prof. Davide Ascoli) and focuses on natural disturbance regimes and their ecological role in Alpine, Temperate and Mediterranean ecosystems, plan forest management and silvicultural treatments to mitigate climate change impacts, monitor post-disturbance ecosystem dynamics and restoration treatments to guarantee ecosystem services in mountain regions. For more information visit:

https://en.Disafa.Unito.It/do/home.Pl/View?doc=/research/research_lines/forestry_wood.Html Prof. Renzo Motta: https://www.Sfa.Unito.It/do/docenti.Pl/Alias?renzo.Motta#tab-profilo Prof. Davide Ascoli: https://www.Sfa.Unito.It/do/docenti.Pl/Show?_id=dvascoli#tab-profilo

Suggested skills

Candidates should preferentially have the following skills:

- brightness with a good dose of common sense for teamwork in a research group
- passion and intellectual curiosity for natural ecosystem dynamics and processes
- ability in organizing and planning the work and meeting deadlines
- writing and language skills and the ability to express and organize ideas in English
- data analysis with tools for statistical computing and graphics (e.g. R)
- capacity to manage and critically analyze new and complex concepts and develop own questions and pursue lines of thought
- have strong work ethics, discipline, focus, efficiency and professionalism
- being ambitious, show leadership qualities and being not afraid to take responsibility
- perseverance and commitmentGOAL 15

Curriculum: 5. Agriculture and Forestry scholarship code **E08**

Improving fruit crop resilience to climate change through precision farming and breeding

Research keywords:	Remote sensing Genomic tools Castanea spp.
Reference ERCs:	LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology LS2_1 Genetics LS9_2 Applied genetics, gene editing and transgenic organisms
Reference SDGs:	GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Lovisolo Claudio (claudio.lovisolo@unito.it)
Host university:	University of Torino *Department of Agricultural, Forest and Food Sciences (DISAFA)*

Research topic

European chestnut (Castanea sativa Mill.) faces the challenge of environmental and climate change. An increase of mean temperature is expected in temperate regions and this will impact both on phenology and on water use efficiency of the trees, highlighting the need for stress tolerant cultivars. Furthermore, climate change can favor chestnut pathogen infections.

In this light, acquiring genetic and agronomic information about the species is a priority for managing the above threats and facilitating the breeding and selection of productive genotypes, enhanced for resistance traits and adaptability to specific environments.

In order to better manage the crop in the face of a changing climate the research topic deals with: 1) testing innovative techniques and innovative strategies for orchard management, and the use and development of new non-invasive devices capable of detecting parameters useful for defining the functional status and the health of the crop; 2) using genomic tools to identify loci and genes related to environmental adaptation to further the understanding of molecular processes.

Monitoring systems applied to the tree, to determine parameters related to the trees physiological and functional state, proximal sensing, or remote mapping, will be used; these approaches will able to detect the state of health and the different needs (water, nutrition, etc.) of the orchard in general and the individual trees, in order to prevent the development of stress or imbalances.

The need for quantitative and qualitative production at competitive levels, in a context of climate change, requires the development of sustainable cultivation techniques and technologies that enable the efficient use of water and fertilizers.

The use of vegetation indexes detection systems (e.g. Vitality/stress crop indexes based on chlorophyll fluorescence) will allow to tailor crop management to the plant requirements and to the harmonious development of orchard. Techniques will be developed for the acquisition of data concerning the plant vigor in different phenological phases, through the use of drones and/or remote sensing, with multispectral cameras for the calculation of representative indexes of the state of the plant. These algorithms will be validated with data acquired in the orchard, at ground level.

In particular a Castanea spp. Progeny of 200 samples segregating for resistance to gall wasp and phenological and nut traits will be used to validate data and to analyze the different performance of different genotypes. Morphological, phenological and genetic data will be useful to investigate new performing genotypes in a changing environment and to plan breeding strategies. In particular loci and genes related to pathogen response and involved in response to abiotic stresses will be tested to assess their role in genotypes with different susceptibility. Genes related to biotic and abiotic stresses will be selected from previous research and from literature. RT-qPCR platforms will be used to assess the expression level of the studied genes in chestnut genotypes.

The research will connect genomic and agronomic tools to decipher the basis of complex traits that are related to the adaptive value and resilience of chestnut trees.

Research team and environment

The candidate will become part of the two research units, which carries out studies in sustainable tree crops systems, ecosystem services, biodiversity and breeding of nut and fruit tree species. The research group involves several researchers (e.g. Prof. Roberto Botta, Gabriele Loris Beccaro, Prof. Daniela Torello Marinoni) and focuses on multidisciplinary and innovative approaches to enhance the sustainability of tree crops systems. The research group addresses major issues in modern arboriculture approaching sustainability aspects directly or indirectly connected with crop management; research is also aimed at favoring the sustainable cultivation of fruit and nut tree species through the study and use of genetic resources and the use of breeding strategies based on genomic knowledge and on the application of advanced technologies. The research team deals with the DISAFA Chestnut R&D Center. The Center supports scientific research and innovation in chestnut cultivation. The research activity will take place at DISAFA and in the experimental plots of the Chestnut R&D Center, which includes a Castanea progeny and experimental high density C. Sativa orchards. The progeny has been obtained crossing C. Sativa cultivar Madonna and the Euro-japanese hybrid Bouche de Btizac (C. Crenata x C. Sativa), respectively susceptible and resistant to Dryocosumus kuriphilus (Yasumatsu). For more information visit: Https://en.Disafa.Unito.It/do/home.Pl/View?doc=/research/research_lines/groups/crop_science/sustainable_tree_crops_systems_and_ecosystem_services.Html
Https://en.Disafa.Unito.It/do/home.Pl/View?doc=/research/research_lines/groups/plant_genetics_physiology/biodiversity_and_breeding_of_nut_and_fruit_tree_species.Html Prof. Gabriele Beccaro: Https://www.Disafa.Unito.It/do/docenti.Pl/Show?_id=gbeccaro#tab-profilo Prof. Daniela Torello Marinoni: https://www.Disafa.Unito.It/do/docenti.Pl/Show?_id=dmarinon#tab-profilo

Suggested skills

The candidate should have agricultural sciences, technological and laboratory skills related to tree crops, be able to design an experiment, plan, or model that deals with tree crops systems. Being able to integrate data and derive insights from a multidisciplinary approach.

Curriculum: 5. Agriculture and Forestry scholarship code **E09**

Climate change, food production and nutritional quality

Research keywords:	Climate change Agriculture Molecular processes
Reference ERCs:	LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology LS9_5 Food biotechnology and bioengineering LS9_7 Environmental biotechnology and bioengineering
Reference SDGs:	GOAL 2: Zero Hunger GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Lucini Luigi (luigi.lucini@unicatt.it)
Host university:	Università Cattolica del Sacro Cuore *Department for Sustainable Food Process*

Research topic

Growing evidence is highlighting that climate change drives a series of emerging risks in the agro-food chain. Evidence about the impact of climate change on crops and livestock, including food security and food safety, is growing fast. To date, most of reseach has focused on specific cases and several molecular processes underlying plants and animal stress are still poorly understood. Moreover, the relationship between climate change and nutritional quality has not been investigated in depth. The issues related to climate change are difficult to be characterized since they require a multidisciplinary approach where biochemistry, agricultural chemistry, plant science, animal science and principles of sustainability need to be combined. The advent of more comprehensive assessments, as provided by omic sciences, may be of support in this sense.

Given the constrains on natural resources, circular initiatives may also represent a valuable approach to tackle the challenge of ensuring a sustainable supply of food and feed within the context of changing climatic conditions. In fact, circular economy solutions are increasingly being used to cope with the growing demand for food, in a framework where the need to reduce pressure on natural resources is getting well consolidated.

Research team and environment

The research activities will be carried out at the laboratory of metabolomics and proteomics, Research Centre for Nutrigenomics and Proteomics (PRONUTRIGEN), Universit Cattolica del Sacro Cuore (Piacenza, Italy). The research team includes a balances group of professors, post-doc, PhD students and early stage researchers carrying out research in the framework of plant science, animal science and food science. The team uses high-resolution mass spectrometric approaches for untargeted metabolomics and proteomics, working on the molecular and biochemical bases of response(s) to abiotic factors, stresses, environment and plant/animal/food management conditions.

Suggested skills

The candidate is suggested to have a background in analytical chemistry (including chromatography and mass spectrometry), plant and animal biochemistry, and biology. The ability to statistically interpretate raw data, and a good attitude towards laboratory activities, are also recommended.

A previous experience in metabolomics is not a prerequisite, and the candidate should be rather motivated in acquiring specific competence in this field. The candidate is expected to team work in a dinamic environment, and is supposed to acquire skills on data production, interpretation and on the subsequent dissemination of results.GOAL 15

Early diagnosis and biostrategies against mycotoxigenic fungi in Mediterranean crops

Research keywords:	Plant pathology Mycotoxins Hyperspectral detection
Reference ERCs:	LS9_9 Plant pathology and pest resistance LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology LS9_12 Ecotoxicology, biohazards and biosafety
Reference SDGs:	GOAL 2: Zero Hunger GOAL 3: Good Health and Well-being GOAL 12: Responsible Consumption and Production
Reference person:	Nali Cristina (cristina.nali@unipi.it)
Host university:	University of Pisa *Department of Agriculture, Food and Environment*

Research topic

Climate change (CC) is a complex issue and represents the main challenge facing world society. The increase in temperatures, the reduction of available water resources and the growing problems related to air pollution cause considerable damage in terms of quality and quantity to crops for the production of food and feed. It is necessary to know how this phenomenon affects crops and their interactions with biotic agents. Particular attention is paid to the possible impact of CC on the reproduction and growth of some microfungi (Aspergillus, Fusarium and Penicillium) and their production of mycotoxins. These substances are secondary metabolites, which are toxic to humans and other warm-blooded animals. It is known that in the presence of peculiar microenvironmental conditions, these microorganisms proliferate in crops, both in pre- and post-harvest. Mycotoxin contamination is a priority socio-health issue closely related to CC. Given the extent of the present and especially future issues, numerous researches are in progress in order to identify new strategies for early diagnosis and develop new applied techniques. Both objectives will be pursued in this project which will range from experimental activities conducted on cereals in the open field and in controlled environment (post-harvest). Early diagnosis of infections will be developed through the use of vegetation spectroscopy. Unlike traditional techniques, this innovative approach is fast, non-destructive, relatively inexpensive and scalable from in situ leaf analyses to remote sensing data collections from drones, aircrafts and even satellites. Sustainable strategies to counter the accumulation of mycotoxins in pre- and post-harvest will include the use of eco-friendly approaches such as the use of fungal strains as biocontrol agents (Trichoderma spp.), free radicals and biogenic compounds (melatonin). Finally, the project will also have the purpose of analyzing the socio-economic and managerial implications related to the practices of reduction of mycotoxins, with special attention to market opportunities.

Research team and environment

Research topics covered by the Plant Pathology Research Unit of the University of Pisa include: molecular bases of differential responses of plants to ozone and other oxidative stresses; ecophysiological responses of plants to abiotic and biotic stresses; chemical ecology and tritrophic relationships in the urban environment; early diagnosis and biostrategies against mycotoxigenic fungi; biological control of plant pathogens. The group has expertise in: phytopathological mycology, physiological plant pathology, post-harvest pathology, wood pathology, phytopathological molecular diagnostics, IPM. The group includes Prof. Giacomo Lorenzini (co-PI), Prof. Elisa Pellegrini (plant resistance/tolerance to stress and plant-pathogen-environment interactions), Dr. Lorenzo Cotrozzi (use of vegetation spectroscopy with the aim of advancing the concept of spectral phenotyping in plants exposed to environmental constraints), Dr. Sabrina Sarrocco (biopesticides, contamination by mycotoxins of plant products and food). Three PhD students, two post-doc fellows and six technicians complete the team. The group is fully equipped of greenhouses, fully-controlled walk-in growth chambers and ozone-exposure facilities, as well as field and lab equipment for morpho-physiological and biochemical analyses (e.g.

Full-range spectroradiometer, photosynthetic gas-exchange systems, fluorometer, pressure chamber, vapour pressure osmometer, microplate reader, HPLC, GC-MS). In addition, the scientists of the group belong to the interdisciplinary center of the University of Pisa in charge of the management of large facilities and instrumentations. The key-qualities of this group are: clear communication among all team members; consensus among all team members; problem solving ability; positive, supportive working relationships among all team members; national and international connections with other research teams; good capability of fund raising.

Suggested skills

Successful candidates are expected to have: knowledge of basic biology and biophysics laboratories, as well as good theoretical background to execute the above described activities; creative problem-solving ability; open-mindedness; active listening capability; reliability; accountability and attention to detail; desire to learn and learning agility. Applicants would be expected to demonstrate high motivation and to be fluent in English.GOAL 12

Climate change and governance of water resources in coastal agricultural districts

Research keywords:	Water governance Social learning Nitrate vulnerable zones
Reference ERCs:	SH7_6 Environmental and climate change, societal impact and policy LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology SH2_1 Political systems, governance
Reference SDGs:	GOAL 6: Clean Water and Sanitation GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action
Reference person:	Roggero Pier Paolo (pproggero@uniss.it)
Host university:	University of Sassari *Nucleo di Ricerca sulla Desertificazione and Dipartimento di Agraria*

Research topic

Agricultural water management represents over 70% of the freshwater use in Mediterranean countries. Climate pressures, overpumping, water salinity and nitrate pollution represent among the main threats for coastal groundwater resources. This generates apparent and hidden conflicts among interdependent stakeholders, which threaten sustainable development. The PhD research activities are framed in the research pathways to develop climate adaptation strategies to mitigate the impact of climate change and agricultural systems on coastal aquifers of the Mediterranean basin. Half of the PhD activities will be funded by the WP4 (Innovative governance) of the SUSTAIN-COAST PRIMA project (https://www.Sustain-coast.Tuc.Gr). The project's general objectives are (i) to design and test innovative governance approaches for the sustainable management of coastal water resources; (ii) to mitigate water resources pollution by combining decision support systems with innovative governance approaches based on social learning processes. The PhD research will focus on developing systemic innovations based on participatory processes and monitoring, to ultimately improve water resources governance and mediate potential environmental conflicts in rural districts. The PhD students specific activities will include the design and facilitation of new social learning spaces among stakeholders through a living lab approach applied to the SUSTAIN COAST case studies in Italy (Arborea, Sardinia); Greece (Crete), Turkey (Mersin) and Tunisia (Wadi El Bey). The detailed hydrological data collected by the project team in the case studies will inform a decision support tool based on hydrological and agronomic modelling, which will support the design of desirable coastal water resources management options, by identifying the strengths, opportunities and barriers regarding the prevention of groundwater pollution of coastal aquifers. The outcomes of the modelling exercise will inform the social learning process in the living lab, with the aim to explore with stakeholders climate-adaptive pathways taking into account the modelled groundwater flow and pollution transport under different climatic scenarios. The PhD research will be focused on the identification of strategies and tools to ensure the active engagement of concerned stakeholders in a facilitated social learning process to raise awareness and identify opportunities for improved water management systems. The research effort is designed to up-scale the project's outcomes and sustainable governance strategies to other Mediterranean rural districts. A special focus of the research project will be on the identification of agronomic options for improving water resources management in coastal aquifers, with a special attention to threats related to nitrate vulnerable zones and groundwater salinity. Much of the research activity will be based in Sardinia, but collaborative studies will also be developed with the SUSTAIN COAST partners or in collaboration with national and international research teams.

Research team and environment

The PhD student will be based at the Desertification Research Centre (NRD https://en.Uniss.It/nrd) of the University of Sassari (UNISS), an interdisciplinary interdepartmental Centre involving 8 Departments, some 40 professors and 20 staff members among project managers, post-docs and PhD students. The UNISS staff of the

SUSTAIN COAST project includes professors of Agronomy, Hydrogeology and environmental sociology. The PhD student will engage the international and interdisciplinary research team of the SUSTAIN COAST project, involving hydrologists, modelers, agronomists and social scientists and will benefit of some of the courses (all taught in English) offered by the PhD Course in Agricultural sciences at the Department of Agricultural Sciences of the University of Sassari (where NRD offices and labs are located), which ensures an international learning and research environment.

Suggested skills

- Systems thinking attitude and academic background, preferably in an international context
- Certified knowledge/training courses on climate change impacts, mitigation and adaptation
- Relational skills and experience on participatory tools/approaches to design and facilitate social learning spaces and attitude to environmental conflict mediation.
- English language skills (not less than B2)GOAL 13

Innovative and integrated processes for sustainable management of water resources

Research keywords:	Smart agriculture Integrated water management Climate change adaptation
Reference ERCs:	LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology PE10_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution PE10_3 Climatology and climate change
Reference SDGs:	GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action GOAL 17: Partnerships to achieve the Goal
Reference person:	Spano Donatella (spano@uniss.it)
Host university:	University of Sassari *Department of Agricultural Sciences, CMCC-Euro Mediterranean Center on Climate Change Foundation, IAFES Division, Sassari*

Research topic

The CC and the growing demand for sustainable agricultural crops push the sector to a more efficient use of natural resources, especially in the Mediterranean area. The overall goal is to improve the Integrated Water Resource Management and sustainable irrigation through the implementation of innovative tools, smart water services and solutions, for public and private use, while contributing to climate resilience. In particular, a suite of innovative tools will be developed that will allow monitoring and control (IoT), interoperability and standardization (WoT), also through the use of complex dynamic models combined with data analysis, with support tools, decision making and intelligent data visualization. The combination of these tools will allow simulating complex interactions and feedback across different time horizons and multiple related environmental and socio-economic dimensions, to arrive at guidelines and adaptation strategies to CC. All the innovations can be tested on a large scale in basins of some Mediterranean countries (eg, Italy, Jordan, Lebanon and Tunisia) where water efficiency is a prerequisite to cope with water scarcity and CC.

Research team and environment

The research activity will benefit of the facilities of the Department of Agricultural Sciences of University of Sassari and of the research network of the CMCC Foundation. The team will be composed by multidisciplinary researchers, including specialists on climate modeling, crop water management, smart agriculture, sustainable development, and climate change adaptation. The activity will be conducted in the framework of some EU projects recently funded: the PRIMA Project ACQUAOUNT- Adapting to Climate change by QUantifying optimal Allocation of water resOUrces and socio-ecoNomic inTerlinkages; the COST Action ON WATER-ENERGY-FOOD NEXUS FOR A LOW-CARBON ECONOMY IN EUROPE AND BEYOND; the H2020 Project NEXOGENESIS-Facilitating the next generation of effective and intelligent water-related policies utilising artificial intelligence and reinforcement learning to assess the water-energy-food-ecosystem (WEFE) nexus.

Suggested skills

Competences in ecophysiology, agronomy, hydrology, ecosystem/crop processes, and mathematical and programming skills will be recommendedGOAL 17

The Open Green Grow

Research keywords:	Copernicus CAP Earth Observation
Reference ERCs:	PE10_14 Earth observations from space/remote sensing LS9_7 Environmental biotechnology and bioengineering LS8_8 Phylogenetics, systematics, comparative biology
Reference SDGs:	GOAL 12: Responsible Consumption and Production GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Taramelli Andrea (andrea.taramelli@iusspavia.it)
Host university:	IUSS Pavia *Department of Science, Technology and Society*

Research topic

In alignment with the Green Deal goals, the NEW Common Agriculture Policy (NEW CAP) reform endeavours to support sustainability transition and strengthen the efforts of European farmers to tackle climate change and protect the environment. It strives to shift the policy towards greater RESULT ORIENTATION under the umbrella of Member States? (MS) CAP Strategic Plans (CSP). The challenge facing the NEW CAP arises from the fact that the implementation of environmental and climate goals is hindered by the LACK OF MONITORING CAPABILITIES imposed by INSUFFICIENT SETS OF INDICATORS.

The Open Green Grow Project (oGreenGrow) delivers a systemic solution to enable pan-European PLANNING, EVALUATION, SIMULATION and MONITORING of CO2 sequestration and GHG emissions in agriculture:

(1) A new interpretation methodology will be developed, based on the wide employment of Copernicus Earth Observation data, that will enable performance-based transition of agricultural practices towards low-emission farming.

(2) The combination of evidence-based and process-based modelling will enable oGreenGrow to offer an unprecedented level of services. Evidence-based modelling will deliver CO2 sequestration data that significantly surpass the quality of process-based estimations, and process-based modelling will deliver long-term simulation capabilities, allowing to experiment with scenarios involving various Agriculture Practices (AP) and Nature Based Solutions (NBS).

(3) The new interpretation methodology will be translated into an open-source OPERATINAL SERVICE by developing EO MONITORING capabilities and an AUTOMATION framework.

GreenGrow research will not only address CAP governance but will also approach the food-production sector. Farmers will be provided with immediate and simple answers regarding the uptake of CAP instruments and major food-producers will receive a valuable tool to evaluate and improve their agricultural practices.

Research team and environment

IUSS mission is to provide advanced education to undergraduate and graduate students, as well as fundamental and applied research in the fields of Science, Technology, Engineering and Mathematics (STEM), and Human, Social and Life Sciences. At IUSS, PhD candidates will find an open multidisciplinary environment offering real opportunities for developing academic and professional tools for facing the challenges arising from increasing complexity and fast changes in the society and the environment. IUSS is always and actively committed towards internationalisation, inclusion and diversity. The selected candidate will join the research centre on Climate change impAct studies for RISk MAnagement (CARISMA). The CARISMA team is composed by STEM and Social scientists working in the prism of climate change on data analysis including Copenricus and modelling of Earth

System and economic system processes; impact assessment of extreme natural events and anthropogenic activities on human and natural environments; risk assessment and management of natural and anthropogenic hazards; formulation and proposal of new economic, political and legal models of sustainable development. The research activity will be carried out in collaboration with the Space Unit and Data Unit of the The Italian Institute for Environmental Protection and Research (ISPRA) and may include stays at the ISPRA Research Centre (Rome).

Suggested skills

-Knowledge of artificial intelligence approaches (fuzzy logic, Bayesian systems) applied to determine the response of ecosystems both agriculture and forestry to climate change;

- Experience in the implementation of integrated decision support systems for the innovative tool in forestry and agriculltre domain;

-Experience in using the European Earth Observation Program (Copernicus).GOAL 15

Effects of global climate changes on water biota

Research keywords:	Freshwater Phytoplankton Zooplankton
Reference ERCs:	LS8_1 Ecosystem and community ecology, macroecology LS8_13 Marine biology and ecology LS9_12 Ecotoxicology, biohazards and biosafety
Reference SDGs:	GOAL 5: Gender Equality GOAL 13: Climate Action GOAL 14: Life Below Water
Reference person:	Bettinetti Roberta (roberta.bettinetti@uninsubria.it)
Host university:	University of Insubria *Dipartimento di Scienze Umane e dell'Innovazione per il Territorio*

Research topic

There is much evidence that climate is rapidly changing at a global scale, especially regarding mean annual temperatures, precipitations and evaporation. The consequences of this rapid environmental change on freshwater biota are still not clear, but they could be severe. The changes of water temperatures with the consequent diminution of dissolved oxygen concentration and the reduction of available habitats could cause important ecosystems problems. Moreover with the increasing intensity and frequency of extreme events such as droughts, the scenarios could be complicated for the freshwater biota (phytoplankton included), even in Italy. Shifts in life cycles of zooplankton community for example are likely to be expected with changes for the most sensitive species. More tolerant organisms may, on the other hand, enlarge their distribution ranges. Global climate change may also promote and enhance invasions of alien species in freshwater ecosystems.

Research team and environment

This PhD is within the framework of Climate Change Research Center of Insubria University where it will be possible to work in a multidisciplinar team including the CRyosphere Lab (resp. Prof. Mauro Guglielmin) and the Botany and Climate Change Lab (Resp. Prof. Nicoletta Cannone). Our group of Water Ecology and Ecotoxicology Lab (Resp. Prof. Roberta Bettinetti) has a great experience in aquatic ecology and has long-term data on several situations even in remote areas. The Climate Change Research Center of Insubria will have since 2022 the possibility to use the International Branch of Insubria at Barrow (USA, Alaska). The team is working in cooperation of many national and international Instititution like the British Antarctic Survey, the Alfred Wegener Institute, the CNR-ISP, the CNR IRSA, the Trieste University and many other foreigner universities.

Suggested skills

The ideal cadidate has a solid ecological background with a great propensity for field work and laboratory work. Critical skills and good preparation are required, in particular on the already known mechanisms regarding the effects of climate change on ecosystems (even terrestrial, not only aquatic since everything is interconnected)GOAL 14

Holistic analysis of nervous system stressors: from adaptation to pathology

Research keywords:	Stressors Central nervous system Neurodegeneration
Reference ERCs:	LS5_11 Neurological and neurodegenerative disorders LS5_12 Mental disorders LS5_3 Neural development and related disorders
Reference SDGs:	GOAL 3: Good Health and Well-being

Reference person:	Boido Marina Maria (marina.boido@unito.it)
Host university:	University of Torino *Department of Neuroscience "Rita Levi Montalcini"*

Research topic

Starting from prenatal life, our organism is exposed to different types of stress, which shape it and promote its maturation, but could also determine the accumulation of alterations that predispose to the pathology. Nowadays these stressful events are particularly exacerbated by the increased population density, pollutants and environmental/global changes. In the central nervous system (CNS), exogenous factors, pollution and a stressful lifestyle can early lead to cellular, molecular and epigenetic changes in neurons and glial cells, which are currently only partially known.

The aim of this project will be to analyze the stress effects on the CNS. Using experimental models, the research will evaluate how stressors of different nature (social and/or environmental), experienced in different stages of life, can negatively affect the state and functioning of neurons, paying particular attention to i) morphological cell alterations and ii) signaling pathways and chromatin changes. In particular, the etiological nature of these stressors will be also studied to evaluate whether and how they can influence the onset and progression of neurodegenerative and/or psychiatric diseases in experimental models. In addition, thanks to the collaboration with the neurologists and psychiatrists, translational aspects can be possibly explored, to correlate the lifestyle of patients to their pathological conditions.

Overall, the project will shed light on the stressor impact on the CNS and on the predisposition neurological pathologies.

Research team and environment

The research activity will take place within the Dept. Of Neuroscience of the University of Turin, recently awarded as Department of Excellence by the Italian Ministry of University. In particular the experimental research will be carried out at the Neuroscience Institute Cavalieri Ottolenghi (NICO https://www.Nico.Ottolenghi.Unito.It/eng), under the supervision of the reference person (in the group Brain development and disease; https://www.Nico.Ottolenghi.Unito.It/eng/Research/Research-Groups/Brain-development-and-disease). The main goal of NICO research center is to study the fundamental biological mechanisms of nervous system function, whose knowledge is essential for the development of innovative therapeutic approaches for neurodegenerative diseases and psychiatric disorders. The NICO center hosts several laboratories covering a wide variety of multidisciplinary research activities applied to neuroscience, including neuroanatomy, cellular and molecular biology, genetics, cellular physiology, thereby creating a very collaborative and highly stimulating scientific atmosphere.

Suggested skills

The ideal candidate should be skilled in the fields of cellular and molecular biology. Technical competences should include histochemistry, immunohistochemistry, biomolecular analysis, microscopy, and handling of rodents.

Additionally, team working, problem-solving ability, computer skills (Microsoft Word, Excel, PowerPoint) and basic statistical knowledge will be appreciated.

Climate change mitigation through shrub removal in alpine environments

Research keywords:	Alpine vegetation Ecosystem changes Climate change mitigation
Reference ERCs:	PE10_4 Terrestrial ecology, land cover change LS8_5 Biological aspects of environmental change, including climate change PE10_3 Climatology and climate change
Reference SDGs:	GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Cannone Nicoletta (nicoletta.cannone@uninsubria.it)
Host university:	University of Insubria *Scienza e Alta Tecnologia*

Research topic

Mountains are among the most sensitive and vulnerable environment to climate change and the European Alps are one of the three regions characterized by the strongest warming in the period 1950-2000, with relevant impacts on ecosystems, including species upward migration, thermophilization, accelerated vegetation dynamics, shrub and tree encroachment. Shrub encroachment, recognized as a global response to climate change impacts, exerts positive feedbacks to climate change because, beyond its impacts on biodiversity and landscapes, it affects the Carbon cycle, the surface energy balance, soil temperature and moisture, snow cover, surface albedo, active layer thickness, and the hydrological cycle. In the European Alps shrub encroachment was performed by late successional species (e.G., Rhododendron, Vaccinium, Juniperus, Kalmia, Empetrum), with the regression of alpine grasslands and snowbeds occurring from the subalpine to the nival belt. Among the consequences of these processes, there are impacts on the CO2 emissions, as the sink effect of these systems is decreasing due to shrub encroachment, thus requiring urgent mitigation actions. Inedd, climate change mitigation aims to reduce the harmful effects of climate change through the reduction of GHG emissions which can be achieved by increasing the sink capacity of the natural systems to gain and store Carbon through good management practices.

The research topic will focus on a) the analysis of the process of shrub encroachment in mountain vegetation, from the subalpine to the nival belt, to address the mechanisms allowing shrub expansion in response to climate change acceleration, with special reference to new successional pathways ongoing in the Italian central Alps. The research will assess the suitability of specific mitigation actions, aiming to contrast shrub encroachment and promote the recovery of the alpine and nival non woody vegetation, that will be realized in the frame of the project Back from the Future, carried out in the territory of the Stelvio Nationa Park under the scientific coordination and supervision of Insubria University, within the initiative Parks for Climate promoted by the Ministery of the Environment. This project will perform specific mitigation actions to contrast shrub and tree encroachment and their upward migration through their physical removal allowing the recovery of the native alpine non woody vegetation and the conservation of the alpine vegetation communities, and associated ecosystem processes and biodiversity. Within this project will be assessed also the consequences on the compositional, structural and functional (CO2 fluxes) ecosystem processes.

Research team and environment

This PhD is developed within the framework of the Climate Change Research Center of Insubria University, where it will be possible to work in a multidisciplinary team, in particular within the Botany and Climate Change Lab (Resp. Prof. Nicoletta Cannone) working with other experts of vegetation and terrestrial ecology of alpine and polar areas, in particular Dr. F. Malfasi (expertise in Botany and vegetation of mountain and polar areas) and Dr. S. Piccinelli (expertise in dendrochronology). This group performs multidisciplinary research activities, interacting with the Cryosphere Lab (Resp. Prof. Mauro Guglielmin) with a Post Doc (Dr. S. Ponti, expertise in

remote sensing) and two other PhD (Dr. Alessandro Longhi, expertise in soils) and Dr. Silvia Picone (expert in debris flows). This group interacts with the Ecology and Ecotoxicology Lab (Resp. Prof. Roberta Bettinetti) where other experts are working on acquatic ecology. The Climate Change Research Center of Insubria will have since 2022 the possibility to use the International Branch of Insubria at Barrow (USA, Alaska). The research team is working in cooperation of several national and international Instititutions like the British Antarctic Survey, the Alfred Wegener Institute, the CNR-ISP, the Genev University, the Temuco University.

Suggested skills
Basic knowledge on botany, vegetation ecology
Basic knowledge on ecology
Basic knowledge on general topics of environmental sciences

Dynamics of transmission and control of Epidemics: mathematical modeling and simulations

Research keywords:	Epidemics Mathematical Modeling Computer Dynamics Simulations
Reference ERCs:	PE1_20 Control theory, optimisation and operational research PE1_10 ODE and dynamical systems PE1_21 Application of mathematics in sciences
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 9: Industry, Innovation and Infrastructure GOAL 11: Sustainable Cities and Communities
Reference person:	Ferrara Massimiliano (massimiliano.ferrara@unirc.it)
Host university:	University Mediterranea of Reggio Calabria *Dipartimento di Giurisprudenza, Economia e Scienze Umane*

Research topic

The research project aims to make a prediction on the spread of COVID-19, alongside the classic epidemiological model type "SIR", a new fuzzy model. The research is consistent with the objectives of creating sustainable development models, through prediction and containment of pandemic or infectious emergencies on a large scale. These models must be able to identify technological solutions for the implementation of innovative systems integrated in the management of urban areas and collective "intelligent" services.
In particular, in the case of health services, the pandemic has highlighted several shortcomings in the Italian system. This leads to considerable social costs. It is, therefore, strategic to define innovative prevention systems, in order to try to contain - in anticipation of possible future pandemics or health emergencies arising from other causes - the maximum economic damage and consequences on human health. This project aims to generate a new epidemiological-predictive model of COVID-19 infection (and not only) and growth progression defined by the application of fuzzy theory. The progression of the disease in the fuzzy model is determined by the basic reproduction number (number of infected individuals during the incubation period), which is different from that of the standard SIR model. The objective will be the realization of stochastic models to predict if and how the cases of new introduction can generate outbreaks in other areas. To estimate the first transmission dynamics at Wuhan, a dynamic fuzzy transmission model will be adapted to multiple publicly available data sets on Wuhan cases and internationally exported cases from Wuhan. Particular attention will be paid to the role of the environmental reservoir in the transmission and spread of this disease; on the multiple transmission routes in the dynamics of infection. New analytical and numerical simulations will be introduced to indicate that coronavirus infection is endemic, requiring long-term prevention and intervention programs. This project also aims at an important socio-economic result: forecasting models would lead to a significant reduction in capital to invest because work would be limited to a study of "public" data through appropriately chosen software and through the use of computer tools that implement existing equipment through the use of big data. The project is innovative with respect to the topic covered (epidemic from COVID-19); it is for the purpose of the initiative, which aims to define new prevention models in the field of epidemics; It is in the methodologies adopted and in the scientific frontiers of fuzzy logic and Artificial Intelligence.

Research team and environment

The Laboratory of Decision Making Methods and Models for Social Sciences (Decisions_lab) operating in the Department of Law, Economics and Human Sciences (Department of Excellence under Law 232/2016) promote research through the use of quantitative methods for the analysis of individual and collective decisions in economic and social phenomena, with a focus on decision-making strategies, data science & machine learning, big data, project management, economy and management of innovation and knowledge (for more details see http://www.Decisionslab.Unirc.It/it/about-the-lab/). Scientific Coordinator (Manager): Prof. Dr. Massimiliano Ferrara. Main Activities: 1. Promote and support both theoretical and applied research. 2. Encourage innovation

in teaching with experimental content, methodologies and approaches. 3. To promote studies and analyses of policies, programmes and economic and social phenomena. 4. Organize seminars, conferences, courses, workshops, group work and training schools. 5. Promote national and international cooperation for the development of research and projects. 6. Encourage the establishment of spin-offs and start-ups. 7. Provide support and advice for strategic decisions and for the management of programmes, policies and projects. 8. Develop projects for the enhancement of excellence in research and territory. Web site: http://www.Decisionslab.Unirc.It/it/

Suggested skills

The best candidate in our opinion should be selected from the following degrees: Mathematics, Physics, Computer Sciences, Mathematical Engineering, Engineering InformaticsGOAL 11

Biodiversity of communities emerging after the retreat of glaciers analysed through environmental DNA

Research keywords:	Biodiversity Environmental DNA Climate change
Reference ERCs:	LS8_1 Ecosystem and community ecology, macroecology LS8_2 Biodiversity LS8_5 Biological aspects of environmental change, including climate change
Reference SDGs:	GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Ficetola Gentile Francesco (francesco.ficetola@unimi.it)
Host university:	University of Milan *Department of Environmental Science and Policy*

Research topic

Glaciers show a pattern of retreat at the global scale. Increasing areas are exposed and colonized by multiple organisms, but lack of global studies hampers a complete understanding of the future of recently deglaciated terrains. What will be the fate of these areas? How do animals, plants and microorganisms colonize them? Which biotic processes underpinning community dynamics?

The aim of this project is understanding the environmental dynamics that allow the development of communities after the retreat of glaciers, through the analysis of functional traits of soil organisms. Information on the composition of soil communities (protists, arthropods and other soil invertebrates, plants and also bacteria and fungi) will be available through the analysis of environmental DNA metabarcoding. Amplified sequences will be compared with databases to identify the present molecular taxonomic units (MOTUs). For each MOTU, we will identify a number of functional traits representing: dispersal and colonization ability, and trophic role. The functional traits of each MOTU will be extracted from databases and from the literature. Functional traits will be then analyzed through multivariate statistical models to assess the functional diversity of communities and understand how this component of biodiversity changes through time. Functional diversity and trophic traits will be also used to build food webs through a METAWEB approach. This will allow to understand how the extremely poor communities that emerge immediately after the retreat of glacier can evolve into complex food webs.

Research team and environment

The IceCommunities at the Univ. Of Milano is a young and dynamic group of researchers analyzing the impacts of global changes on multiple facets of biodiversity, and is a world leader in the use of emerging tools (e.g. Environmental DNA; modelling) for the study of biodiversity. The team is funded by the European Research Council and by other national and international funding agencies, and currently includes two permanent researchers, four PhD students and four post-doctoral researchers. The researchers work together and share their interdisciplinary and complementary competences. Our team has state-of the art facilities and laboratories for multiple approaches to biodiversity analysis.

Suggested skills

We are looking for young candidates with a strong attitude toward the use of advanced statistical techniques to understand ecological processes. Applicants for the position will be enthusiastic, hard-working, independently motivated and willing to lead a significant part of the IceCommunities Project, and will join a highly-dynamic work group, with a strong emphasis on research excellence.

Experience with Bayesian models, in the use of numerical ecology to assess relationships between environmental variation, or in spatial ecology will be welcomed.

Extinction risk of the groundwater fauna in the Anthropocene

Research keywords:	Groundwater biodiversity Climate change Statistical modelling
Reference ERCs:	LS8_1 Ecosystem and community ecology, macroecology LS8_2 Biodiversity LS8_5 Biological aspects of environmental change, including climate change
Reference SDGs:	GOAL 13: Climate Action GOAL 14: Life Below Water GOAL 15: Life on Land
Reference person:	Galassi Diana Maria Paola (dianamariapaola.galassi@univaq.it)
Host university:	University of L'Aquila *Department of Life, Health and Environmental Sciences*

Research topic

Invertebrates are the dominant component of animal diversity in groundwaters. Crustaceans are the most representative group in terms of species richness, abundance and biomass in these environments, and for this reason, they are used as target group in the bioindication of environmental quality. However, the knowledge of the stress responses of this group as a whole is scanty and the dynamics underlying physiological, metabolic and behavioral responses is almost unknown. The study of the responses of crustacean species to different stress factors both in the laboratory and in the field represents the key aspect of the theme.

The research that the PhD student will have to carry out is focused on the groundwater ecosystems and on aquatic groundwater-dependent ecosystems, with particular regard to the management of big data and the construction of relational databases, in order to be able to conduct analysis of species traits, in the broadest meaning, to include both morphological features (body size, pigmentation, anophthalmy/microphthalmy, etc.) and ecological and physiological characteristics (geographical distribution, microhabitat selection, thermal tolerance, dispersal capacity, etc.). The ultimate goal will be to explore the relationship between species traits and extinction risk in the face of climate change and environmental determinants and pressures that generate real or potential impacts. Knowledge of regression and multivariate statistics and geostatistics are needed (i) to predict the spatial relationships between selected drivers and extinction risk of groundwater species; (ii) to characterize the typical combinations of drivers experienced by different regions at different spatial scales. The objectives also include the need to identify ATCs (Anthropogenic Threat Complexes) and the actual or potential threats posed to the subterranean specialized biodiversity. For the optimal implementation of the research project, field and laboratory activities, ability to sort and rear living organisms, basic taxonomic skills, basic knowledge of the R software, GIS-mapping, and remote sensing applications are recommended. Good propensity to national and international collaborations are required.

Research team and environment

The research activity will take place at the University of L'Aquila, Department of Life, Health and Environmental Sciences (Laboratory of Stygobiology) under the supervision of the reference person, in joint collaboration with the CNR Verbania (Pallanza, Italy) where the research activities will be supported by the working group of Dr. Stefano Mammola. The two research groups have complementary skills that reinforce each other, offering the PhD student an advanced scientific context and at the same time high interactions with the scientific community as a whole. Laboratory equipment is fully available at the University of L'Aquila for field and laboratory analyses. The working groups will work in synergy with the PhD student, giving her/him all she/he may need for implementing the research project.

Suggested skills

The best candidate should have the following key-attributes: 1) independence of thought; 2) perseverance and commitment; 3) time management/organisational skills; 4) ability and interest to learn; 5) creativity and idea generation; 6) Motivation; 7) ability to approach a scientific problem under coarse-grained aspects and broad

patterns, and at the fine-grained level of detail; 7) to be friendly and able to live in harmony with the staff.GOAL 15

Curriculum: 6. Health and Ecosystems scholarship code **F07**

Relationships between Climate Change, permafrost and ecosystems in alpine periglacial, proglacial and glacial environments

Research keywords:	Climate Change Permafrost Periglacial ecosystems
Reference ERCs:	PE10_13 Physical geography, geomorphology PE10_18 Cryosphere, dynamics of snow and ice cover, sea ice, permafrosts and ice sheets PE10_4 Terrestrial ecology, land cover change
Reference SDGs:	GOAL 13: Climate Action GOAL 15: Life on Land
Reference person:	Guglielmin Mauro (mauro.guglielmin@uninsubria.it)
Host university:	University of Insubria *Scienze Teoriche ed Applicate*

Research topic

The research will be focused on the analyses of the impacts of the climate change on the high mountain environment with particular regard to the permafrost and the periglacial, proglacial and glacial environment and the related ecosystems. In these areas permafrost is thawing almost everywhere as well as glaciers are retreating, thinning and covering by debris, both these processes are changing deeply the alpine landscape and are triggering surface instability that interacts with the evolution of the ecosystems and with the CO2 fluxes. The research will be focused on these complex and dynamic relationships.

Research team and environment

This PhD is within the framework of Climate Change Research Center of Insubria University where it will be possible work in a multidisciplinar team including the CRyosphere Lab (resp. Prof. Mauro Guglielmin) with a Post Doc (Dr. S. Ponti, expert in remote sensing) and two other PhD (dr. Alessandro Longhi, expert in soils) and dr. Silvia Picone (expert in debris flows). THis group interacts with the Botany and Climate Change Lab (Resp. Prof. Nicoletta Cannone) in which other experts of vegetation and terrestrial ecology of alpine and polar areas are working and with the Ecology and Ecotoxicology Lab (Resp. Prof. Roberta Bettinetti) where other experts are working on acquatic ecology. The Climate Change Research Center of Insubria will have since 2022 the possibility to use the International Branch of Insubria at Barrow (USA, Alaska). The team is working in cooperation of many national and international Instititution like the British Antarctic Survey, the Alfred Wegener Institute, the CNR-ISP, the Trieste University and many other foreigner universities.

Suggested skills

The candidate should have basic knowledge on the climate change, on the climate change impacts on the cryosphere and on the ecosystems of periglacial, proglacial and glacial environment. Basic knowledge on GIS and statistical analyses are also welcome. The candidates should be ready to work in a dynamic, international context with an important field work activity in high mountain environment.

Curriculum: 6. Health and Ecosystems scholarship code **F08**

Evaluation of the effects of global warming on Nodavirosis

Research keywords:	Nodavirus Teleost Global warming
Reference ERCs:	LS9_10 Veterinary and applied animal sciences LS8_13 Marine biology and ecology LS8_5 Biological aspects of environmental change, including climate change
Reference SDGs:	GOAL 12: Responsible Consumption and Production GOAL 14: Life Below Water
Reference person:	Marino Fabio (marinof@unime.it)
Host university:	University of Messina *Department of Chemical, Biological, Pharmaceutical and Environmental Sciences*

Research topic

Global warming is a widely known environmental problem which is causing severe changes in physical-chemical parameters of the aquatic environment, including changes in the levels of dissolved oxygen, carbon dioxide, salinity and temperature. It is well known how mutations of ecosystem may have influences on the epidemiology of infectious diseases of fish species, both in nature as well as in aquaculture. Temperature plays a key role in defence mechanisms of teleosts, especially those regarding viral infections. Environmental temperature can modulate the capability of fish to protect itself by infections, but also the capability of a pathogen to infect its host. In Mediterranean sea, Nodavirosis, a viral disease due to betanodavirus, represents one among the most important diseases in marine culture, causing severe economic losses. The crucial effect of temperature changes is particularly evident in betanodaviruses, considering that different genotypes show different optimal growth temperature.

Considering the economic significance of Nodavirosis, also called Viral Encephalitis Retinitis (VER) in the field of aquaculture, this project aims at evaluating the effects of temperature increase on the pathogenicity of betanodavirus and on the spreading of epidemic through an in vivo experimental study, usefull to build a predictive mathematical model. One of the focus will be the recombinant strain RGNNV/SJNNV, which recently has been demonstrated to cause several epidemics in sea bream, a fish species previously considered as carrier or asymptomatic one.

Experimental challenges will be carried out at the University of Messina, in the Establishment for Users Centro di Ittiopatologia Sperimentale della Sicilia (CISS), authorized by the Italian Ministry of Health for experimental use of animals .

To evaluate the effects of the temperature increase on Nodavirus pathogenicity, experimental trials will be performed on farmed target species, such as sea bass (Dicentrarchus labrax) and sea bream (Sparus aurata); moreover, the trend of episodic foci of VER will be monitored in a wild species, grouper (Epinephelus marginatus). Target species will be infected in different tanks with different temperatures. The injection of pathogen will be performed under controlled conditions by different steps: virus isolation by spontaneous diseased fish, purification, concentration in marine water and finally injection in farmed species under different temperatures. After the challenge, mortality rate, histology on target organs, such as retina and brain will be performed to detected the typical vacuolations, immunoistochemical (IHC) and molecular RT-PCR analyses will also be performed to confirm the cause of death and quantify the viral charge.

Data obtained in this project will permit to know influences of global warming on the pathogenicity of the virus and on the pathogenesis of disease, will be useful to prevent and manage spontaneous foci of the disease in farmed and wild fish, with sure economic impacts permitting to control and prevent the infection reducing mortalities and economic losses for the farmers.

Research team and environment

The research team is constituted of fish pathologists, marine biologists and ecologists. The group has an Establishment for Users, diagnostic labs for histology, immunohistochemistry and molecular diagnosis.

Suggested skills
Candidates should have skills in fish morphology and pathology, experience in experimental research using fish as models

Marine ecosystems vulnerability to climate change in an altered Mediterranean Sea

Research keywords:	Marine ecosystems' vulnerability to climate change Climate change impacts on biogeochemical processes Marine ecosystems restoration
Reference ERCs:	LS8_1 Ecosystem and community ecology, macroecology LS8_5 Biological aspects of environmental change, including climate change LS8_13 Marine biology and ecology
Reference SDGs:	GOAL 14: Life Below Water GOAL 13: Climate Action
Reference person:	Pusceddu Antonio (apusceddu@unica.it)
Host university:	University of Cagliari *Department of Life and Environmental Sciences*

Research topic

Despite huge conservation efforts and implementation of environmental management measures, the oceans are experiencing unprecedented rates of change, and >40% of the world ocean is exposed to multiple anthropogenic stressors. In addition, current climate change (CC) is severely impairing marine habitats integrity and ecosystems' functioning. We are increasing our knowledge of how CC is changing and will modify physical-chemical characteristics of future oceans. However, to identify societally sustainable solutions aimed at counteracting, wherever possible, or adapting to CC-induced modifications of the oceans, there is an urgent need to understand patterns, intensity, and direction of the CC effects on the different hierarchical levels of ecological organization, from species to habitats and ecosystems. Using a combination of literature systematic analysis, field and laboratory manipulative experiments and modelling exercises, the research aims at investigating the effects of different physical-chemical components of oceans modifications due to CC (warming, acidification, desalination, increasing frequency and extent of heat waves, etc.) in combination with other natural and/or anthropogenic disturbance factors (e.G., eutrophication, pollution) on key Mediterranean habitats (e.G., Posidonia oceanica meadows, coralligenous bio-concretions and incoherent bottoms). By implementing the knowledge of the vulnerability of selected marine species, habitats and ecosystems to CC, the research will also provide science-based insights to make more effective the available marine restoration protocols under variable environmental contexts. Ultimately, the research, while investigating the consequences of climate change on key marine species, habitats, and ecosystems and on benthic biogeochemical processes, aims at providing new science-based solutions to foster marine ecosystems' resilience to CC.

Research team and environment

The enrolled student will work at the Marine Biology and Ecology Laboratory of the Department of Life and Environmental Sciences, University of Cagliari (UniCa). The team, led by a full professor of Ecology, includes senior and young researchers and PhD students with consolidated skills and expertise in the study of marine ecosystems biodiversity and functioning, their quality assessment and vulnerability to natural and anthropogenic disturbance, including climate change. The laboratory is equipped with the most common sampling devices for marine ecological research, multiparametric probes, two instrumented Remotely Operated Vehicles (ROV), a wide array of chemical and biochemical laboratory instruments and tools, batteries of binoculars and microscopes. The team has also access to central facilities at UniCa that include, among the others, a center of advanced instrumentation (CESAR) and a fully equipped enclosure with aquaria for experiments with marine vertebrates (CESAST), both members of the European Marine Biological Resource Centre (EMBRC). The Team, part of a wider group of researchers including also marine zoologists and fishery biology experts, collaborates with European, US, Australian and Tasmanian scholars.

Suggested skills

The enrolled student will take part in field and laboratory activities, using the most common chemical, biochemical and biological methods for the study analysis of marine ecosystems. He/she will have to work in a wide team of young and senior scholars. Thus, the ideal candidate should be not only familiar with basics of general ecology and marine biology but also have a strong ability and propension to work in a multidisciplinary team and with multitasking modalities. The ideal candidate should be also opened to learn and implement the teams skills and competences with new approaches and ideas to tackle the objectives of the proposed research.

The relationship between the exposome, the socioeconomical context and health

Research keywords:	Environmental exposures Socioeconomical factors Life-course epidemiology
Reference ERCs:	LS7_11 Environmental health, occupational medicine LS7_9 Public health and epidemiology
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 10: Reduced Inequality GOAL 11: Sustainable Cities and Communities
Reference person:	Richiardi Lorenzo (lorenzo.richiardi@unito.it)
Host university:	University of Torino *Department of Medical Sciences*

Research topic

It is acknowledged that climate change and environmental exposures threaten human health. However, not all human beings are equally exposed, and some groups, typically the socially and economically disadvantaged ones, experience much higher risks. The overall aim of the project is to explore environmental justice and its health impact in high income countries using a life-course perspective. Specifically, the project will use a socio-exposome approach applied to population and cohort-specific data. Exposures will be assessed prospectively and repeatedly over time at the individual and population level, starting from early life. Information on health outcomes, including cardiometabolic and respiratory health, neurocognitive development and infectious diseases will be available from registries, questionnaires and/or biological samples. They will be studied as single or joint outcomes. Collaborations with international cohorts are foreseen.

Methodological aspects will involve geospatial methods for exposure assessment, statistical methods to deal with multiple environmental exposures data, social epidemiology concepts, and causal inference approaches to explore pathways linking social (e.g. Income, urban/rural residence, social capital) and physical environment (e.g. Air pollution, air temperatures, greenness) to health outcomes. Lastly, the project will evaluate the impact of different policies and mitigation strategies entailing both health and environmental benefits.

Research team and environment

The research team includes a multidisciplinary group working on environmental, life-course, molecular and cancer epidemiology and includes, among others, epidemiologists, biostatisticians, and molecular biologists. The team has access to national birth cohorts, including NINFEA (www.Progettoninfea.It) and Piccolipiu (www.Piccolipiu.It) and is partner of European projects, including LifeCycle (https://lifecycle-project.Eu) and Athlete (https://athleteproject.Eu) that involve a large network of birth cohorts (EU Child Cohort network). Both projects are fully or partly focused on the exposome. The team is also member of the Italian Network for Environmental Health. The research team is based at the Epidemiology Unit of the Department of Medical Science (DMS) of the University of Turin. DMS is a large multi-disciplinary department with research interests that span from basic biological research through clinical application, encompassing 16 medical disciplines, including epidemiology. The DMS has been ranked by the Minister of Education, University and Research (MIUR) as one of the Department of Excellence, and is an ideal place to carry out multidisciplinary projects thanks to the presence of shared facilities and collaborations among scientific domains, within the department and the whole University.

Suggested skills

Multidisciplinary attitude, basic knowledge in quantitative research (biostatistics, epidemiology, statistical software), interest in health inequalities, environmental determinants of human health and public health issues, teamwork, willingness to learn and acquire new skillsGOAL 11

Curriculum: 6. Health and Ecosystems scholarship code **F11**

Exploring the climate exposome to assess the health effects of climate change

Research keywords:	Health impact assessment Exposome Direct and indirect effects
Reference ERCs:	LS7_11 Environmental health, occupational medicine LS4_13 Other non-communicable diseases (except disorders of the nervous system and immunity-related diseases) PE6_13 Bioinformatics, bio-inspired computing, and natural computing
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 10: Reduced Inequality GOAL 11: Sustainable Cities and Communities
Reference person:	Sarigiannis Denis (denis.sarigiannis@iusspavia.it)
Host university:	IUSS Pavia *Department of Science, Technology and Society*

Research topic

Assessing properly the health benefits of policy measures geared towards adapting to the incumbent climate change is a key requirement for accurately assessing the impact of the measures envisaged. In this context, reliable quantification of direct and indirect impacts related to both climate change and to climate mitigation policies and measures is a sine qua non for further climate action. Lack of reliable data and comprehensive integrated assessment models hampers decision-making in government, industry and the financial sector.

The exposome concept accounts for the totality of exposures over an individuals life course, focusing inevitably on age windows of increased susceptibility. Rendering it operational requires development and adaptation of novel tools for exposure assessment (both external and internal). Making use of the exposome for comprehensive health risk assessment on the population scale requires development of advanced statistical and biochemical/pathology models based on a combination of environmental and high dimensional biological data, enhanced by machine learning and big data analytics. In addition, agent-based models help capture the changing socioeconomic dynamics that influence societal vulnerability to climate-induced health stress. Considering the change in environmental pressure and human exposure to health stressors linked to climate change would allow us to construct the climate exposome: namely, the exposome of human population subgroups considering the climate change aspects relevant to the ca. 80 years of the human life course. This will be an invaluable tool for properly assessing the health effects of climate-relevant measures and policies for both adaptation to and mitigation of climate change.

Research team and environment

IUSS mission is to provide advanced education to undergraduate and graduate students, as well as to perform world-class applied research in the fields of Science, Technology, Engineering and Human, Social and Life Sciences. At IUSS, PhD candidates will find an open multidisciplinary environment offering advanced opportunities for developing academic and professional tools that prepare them to face the challenges arising from the increasing complexity and rapid pace of societal and environmental change. IUSS is always and actively committed towards internationalisation, inclusion and diversity. The selected candidate will join the research centre on Complex Risk and Data Analysis (CORDA). The CORDA team comprises world renown experts in risk analysis of complex problems faced by current society. CORDA scientists over the last 5 years have developed advanced methodologies and tools for tackling environmental health risks bringing together state-of-the-art tools for environmental monitoring and human exposure assessment to environmental health stressors coupled with citizen science approaches in the context of living labs. The methodology followed adopts the adverse outcome pathway paradigm of the OECD and couples it with the study of the human exposome in order to produce an unbiased and data-driven identification of the main determinants of the adverse health impacts directly or indirectly associated with climate change. The PhD research will be executed in the frame of the

URBANOME European project, which is developing a citizen observatory of urban health and well-being in the context of medium- and long-term environmental change including climate change and the respective adaptation and mitigation policies.

Suggested skills

The successful candidate should have a good grasp of the issues pertaining to environmental health and to the main methodologies for protecting public health and performing risk assessment of chemical and physical stressors such as air- and waterborne pollutants, chemicals in the environment and industrial and consumer products. Understanding of the links between climate change and environmental degradation through the mobilization of chemicals in the environment induced by the changing climatic conditions would be an added asset.GOAL 11

Curriculum: 6. Health and Ecosystems scholarship code F12

Microplastics and climate change: potential threat to human health.

Research keywords:	Microplastics Climate changes Human health
Reference ERCs:	LS8_5 Biological aspects of environmental change, including climate change LS8_13 Marine biology and ecology
Reference SDGs:	GOAL 3: Good Health and Well-being GOAL 13: Climate Action GOAL 14: Life Below Water
Reference person:	Spanò Nunziacarla (spano@unime.it)
Host university:	University of Messina *Department of Biomedical, Dental, and morpho functional imaging Sciences*

Research topic

Plastic waste pollution is now a widespread problem globally. The inadequate management, the growing production and the exasperated use of single-use plastics has generated an increasing contamination of aquatic environments. The exposure of aquatic organisms to these substances is a problem not only at an ecological level, but also for fishing and the trade in fish products and consequently for humans. It is known that all contaminants (chemical and biological) that remain adhered to the surface of plastic polymers (plastisphere) can cause serious inflammatory and pathological reactions based on the nature of the contaminant itself. Furthermore, the situation could be further aggravated by global warming and the consequent acidification of the oceans. This PhD project foresees the use of bivalve molluscs as experimental models to understand: a) the effect of microplastics on the homeostasis of aquatic organisms in relation to temperature and pH changes; b) the effects of temperature and pH changes on plastisphere composition; c) the effect of adherent contaminants d) the filtration rate and consequent uptake of microplastics in altered environmental conditions e) potential impact on the consumer in terms of abundance of plastic debris ingested.

Research team and environment

The research team is made up of Prof. N. Span Prof. G. Capillo Dott. S. Savoca Dott. M. Albano The research activity will be carried out at the Department of of Biomedical, Dental, and morpho functional imaging Sciences, Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina and Zoological Station Anton Dorhn seat of Messina and Naples.

Suggested skills

Marine Biology

Marine EcologyGOAL 14

Enzyme-based bio-devices for CO2 conversion to chemicals and biofuels

Research keywords:	Biocatalysts CO2 bioconversion Bio-hybrid and photo-activated devices
Reference ERCs:	LS1_2 Biochemistry LS1_7 Molecular biophysics, biomechanics, bioenergetics LS9_1 Bioengineering for synthetic and chemical biology
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 9: Industry, Innovation and Infrastructure GOAL 13: Climate Action
Reference person:	Valetti Francesca (francesca.valetti@unito.it)
Host university:	University of Torino *Department of Life Sciences and Systems Biology*

Research topic

The research aims to exploit biocatalysts such as bacterial enzymes (hydrogenase -CbA5H- and formate dehydrogenase -FDH- from C. Beijerinckii) for GHG effect mitigation via CO2 conversion to chemicals and biofuels. In this perspective it is in line with the curriculum-specific topic concerning the identification and evaluation of possible bio-based climate change adaptation and mitigation strategies, focusing on biotechnological approaches for GHG abatement and recycling.

The biocatalysts will be directly interfaced with photo-activated semiconductors such as titanium and zinc oxides and will be used to develop bio-cathodes that allow the production of bio-hydrogen and the conversion of CO2 to formate by exploiting electrons carried by the semiconductor.

The system works either coupled to an anode capable of generating electrons or via direct solar photo-activation. The coupling of hydrogenase to TiO2 has already been demonstrated and published by our research group. The system also allows a coupling (already tested) of the two enzymes CbA5H and FDH via a soluble mediator (MV) for the generation of formate from hydrogen and CO2.

The advantage of using enzymes is a very low over-potential compared to inorganic catalysts as well as high turnover frequency and mild operating conditions.

To achieve biofuels production (such as bio-methanol) other biocatalysts necessary for conversion of formate to formaldehyde and then to methanol (formaldehyde dehydrogenase or FaldDH, to reduce formate to formaldehyde and a suitable alcohol dehydrogenase -ADH- or methanol dehydrogenase -MDH- capable of converting formaldehyde to methanol) will be immobilized on the cathode layer.

The long-term aim is to propose a bio-based solution combining GHG mitigation and circular bio-economy.

Research team and environment

The Departments of Life Sciences and Systems Biology (DBIOS), and in particular the biochemistry group, led by prof, Gianfranco Gilardi (https://www.Biochemistry-scienze.Unito.It/), is providing expertise in enzyme-based and microbial biocatalysts and industrial biotechnology processes. The research is positioned at the interface between biology, biochemistry, chemistry and engineering, with a strong drive to exploitation for industrial competitiveness and improving society and human health. Facilities: The DBIOS laboratories offer facilities in molecular biology and protein expression (2 x10 L,fermenters, shakers), and purification (Akta and LC chromatography), 2D electrophoresis, HPLC, gas-chromatography, UV-vis and fluorescence spectroscopy, circular dichroism, 3 glove-boxes for microorganisms and enzymes sensitive to oxygen, diode array stopped flow, electrochemistry, Grazing angle FT-IR, contact angle, GPC-UV. The lab is certified ISO foir certain processes and it is certified as a class 1 and 2 microorganism manipulation lab by the Italian Health Ministry. The DBIOS group can also access to all facilities of the centre NIS for nanostructured surfaces and materials and the Openlab facilities of the University of Torino.

Suggested skills

Background in biochemistry, chemistry, material sciences and an interest in the inter-disciplinar field of combining inorganic and photo-active or electro-active material with proteins.

The candidate should be prepared to be challenged with learning different techniques spanning from biology to chemistry and technological application.

Enthusiasm and curiosity for cutting-edge techniques and approaches to research are also useful. The work will also imply using glove-boxes and requires a good degree of precision and dedication, with time-consuming experiments.GOAL 13