

**Call for applications**

**National Doctoral Course in Sustainable Development and Climate Change**

**40<sup>th</sup> cycle – 2024/2025 academic year**

**DEADLINE FOR SUBMISSION 17:00 (Italian Time) 26 July 2024**

**Changes or additions to the call will be published on the**

**“Calls for applications and announcements/Calls for PhD programmes”**

**page of the School’s official website**

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## **Art. 1 - ESTABLISHMENT OF THE DOCTORAL COURSE IN SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE**

The Scuola Universitaria Superiore IUSS, Piazza della Vittoria n. 15 – 27100 Pavia (hereafter “the School”), hereby announces a Call for Applications to enroll in the **40<sup>th</sup> cycle of the National Doctoral Course in Sustainable Development and Climate Change** (hereafter PhD-SDC) for the **2024/2025 academic year**.

PhD Programme Coordinator: **Professor Mario Martina** – [phd-sdc.coordinator@iusspavia.it](mailto:phd-sdc.coordinator@iusspavia.it)

### **1.1 Course Description and Objectives**

The **Doctoral Course in Sustainable Development and Climate Change (PhD-SDC)** has a duration of **three years** and aims to equip talented students with the skills to build a more resilient society – one that will be able to address and manage effectively the problems of climate change. A society capable of rethinking the processes of sustainable development, and the objectives of which are not aimed solely at economic growth. The course is focused on the interrelation of complex issues such as technological progress, availability of natural resources, migration, human rights, climate change, access to food and water and the quality of life of present and future generations.

The combined challenges of sustainability and climate change need to be firmly embedded in university education. Universities should aim to identify and create innovative projects going beyond a traditional, single-discipline approach, so that by effectively combining a variety of abilities, methods and communicative skills, society will be able to manage the present challenges.

The main objective of the course is to provide doctoral candidates with a high-level preparation by coordinating and integrating – in partnership with host universities – a diverse team of high-profile educators, who can offer a full spectrum of disciplinary areas, ranging from ecology, technology, economics and engineering to maths, philosophy, medicine and agriculture. PhD candidates will have the chance to propose effective means of achieving the 2030 Sustainable Development Goals (SDGs) as defined by the United Nations.

The PhD programme offers six curricula, described in detail in the “[Educational Programme](#)”. The six curricula are:

- CU1. Earth System and Environment**
- CU2. Socio-economic Risk and Impacts**
- CU3. Technology and Territory**
- CU4. Theories, Institutions and Cultures**
- CU5. Agriculture and Forestry**
- CU6. Health and Ecosystems**

## 1.2 Affiliated bodies

1. Libera Università di BOLZANO
2. Luiss Libera Università internazionale degli studi sociali Guido Carli
3. Politecnico di BARI
4. Politecnico di TORINO
5. Scuola Normale Superiore di PISA
6. Scuola Superiore di Studi Universitari e Perfezionamento Sant'Anna
7. Università Cattolica del Sacro Cuore
8. Università della CALABRIA
9. Università degli Studi dell'AQUILA
10. Università degli Studi di BARI Aldo Moro
11. Università degli Studi di BERGAMO
12. Università degli Studi di BRESCIA
13. Università degli Studi di CAGLIARI
14. Università degli Studi di CAMERINO
15. Università degli Studi di FERRARA
16. Università degli Studi INSUBRIA Varese-Como
17. Università degli Studi di MESSINA
18. Università degli Studi di MODENA e REGGIO EMILIA
19. Università degli Studi di NAPOLI Federico II
20. Università degli Studi di PADOVA
21. Università degli Studi di PALERMO
22. Università degli Studi di PAVIA
23. Università degli Studi di PERUGIA
24. Università di PISA

25. Università degli Studi di SALERNO
26. Università degli Studi di SASSARI
27. Università degli Studi di SIENA
28. Università degli Studi di TORINO
29. Università degli Studi di TRENTO
30. Università degli Studi di TRIESTE
31. Università IUAV di VENEZIA
32. Università Ca' Foscari di VENEZIA
33. Università Politecnica delle MARCHE
34. Consiglio Nazionale delle Ricerche

### 1.3 Scholarships

The attached [document](#) describes the **78** scholarships available. The number of scholarships may be increased if further funding should be available before the beginning of the PhD course. Each scholarship is linked to a specific research topic, that is, there is a requirement for the recipients to focus their doctoral research on one of the topics listed in the above-mentioned document and to conduct their research activity at the host university. Each individual scholarship can only be assigned to those candidates who are evaluated as eligible by the Selection Board.

Interviews held during the selection process will allow the Selection Board to establish whether the candidates have the necessary knowledge and skills to be admitted to the doctoral course and to study the selected scholarship research topics. For further information on the doctoral course and its “Educational Programme”, please visit the [phd-sdc.it](http://phd-sdc.it) or email [phd-sdc@iusspavia.it](mailto:phd-sdc@iusspavia.it).

### Art. 2 – ADMISSION REQUIREMENTS

Applications are welcome from all qualified candidates regardless of age or nationality. Eligible candidates must have the following academic qualifications:

- a) Master’s degree (Laurea Magistrale or Laurea Specialistica or Laurea Vecchio Ordinamento);
- b) Analogous academic qualification awarded abroad (comparable to an Italian master’s degree, in terms of duration and study content) and recognized by the Selection Board as suitable for application to the course.

Applications from candidates who are still to graduate will be considered pending. These candidates must

submit the relative degree certificate by the start of the course on Friday 13 December 2024.

## Art. 3 - APPLICATIONS

### 3.1 Application Procedure

Applications must be submitted exclusively online by **26 July, 2024 at 17:00 Italian time**. The application fees are 30 euro to be paid before the deadline to avoid exclusion. The application fees cannot be reimbursed under any circumstances.

Please refer to the application procedure described below.

- Go to the following link: <https://pica.cineca.it/iuss/dottorato-40>;
- Log in if you have already registered;
- If you are logging in for the first time, click on "New Registration" and enter the following data:
  - Name
  - Surname
  - Gender
  - Date of birth
  - Fiscal Code (for Italian citizen only)
  - State of birth
  - Place of birth
  - Phone number

Once you have completed registration your login credentials will be sent to the email address provided. You will be able to log in once you receive an email confirming registration.

In order to apply, you have to upload the following documents:

- Curriculum Vitae
- Valid ID (clearly visible)
- Research Proposal
- Letter of Purpose
- Academic qualification (for those candidates who have not yet obtained the required qualification the procedure will require University name and major)
- Other titles

Once all the required documents have been uploaded, click "save" and return to the dashboard.

You will be asked to verify – through "verify" button – the data you entered; only after verifying that the information present is correct, you can continue and finalize the registration payment.

You have to click on "payment" and follow the instructions provided by the platform in order to use the "PagoPA" system. You have to sign the application and submit it.

**Successful submission of the application will be confirmed to the email address provided in the registration details. If you have not yet received a confirmation email after 24 hours please contact the help desk of PICA platform.**

### 3.2 Required Accompanying Documents

|    |   |   |
|----|---|---|
| a) | <b>A scan of a valid form of photographic ID</b>  | <p>Please scan both sides of the document.</p> <p>If the ID document is not written in Latin characters, you must provide a certified Italian translation. <b>Please note that if you do not provide a certified translation your ID document will not be accepted.</b></p>   |
| b) | <b>Curriculum Vitae</b>   | <p>Language: English</p> <p>Length: max 2000 words</p> <p>Must include:</p> <ul style="list-style-type: none"> <li>- academic qualifications and training path;</li> <li>- research and/or work experience (if any);</li> <li>- list of publications (if any);</li> </ul> <p>other relevant qualifications/documents that provide information on the applicant's academic and professional experience.</p>  |
| c) | <p><b>Proof of university degree awards needed for the admission, including the following information:</b></p> <ol style="list-style-type: none"> <li>1. University;</li> <li>2. Degree type;</li> <li>3. Full name of the degree;</li> <li>4. Major;</li> <li>5. Date of graduation (or expected date);</li> <li>6. Final mark/grade;</li> </ol> <p>List of exams undertaken and the associated grade awarded.</p> | <p>Language: Italian, English, French or Spanish. For academic documents in all other languages applicants must provide an official translation provided by the university issuing the degree or by an authorized body or translator. <b>Without a certified translation the documents will not be accepted.</b></p> <p>Type of certificate for degrees awarded in:</p> <ol style="list-style-type: none"> <li>1. <b>Italian public universities:</b> self-declaration* of master's degree award, signed and dated;</li> <li>2. <b>EU and non-EU member state universities:</b> where available, certificates, transcripts of records master's degree or diploma supplement, if available.</li> </ol> |

|    |  |  |
|----|--|--|
| d) | <p><b>Proof of other academic qualifications, including the following information:</b></p> <ol style="list-style-type: none"> <li>1. University;</li> <li>2. Degree type;</li> <li>3. Full name of the degree;</li> <li>4. Major;</li> <li>5. Date of graduation (or expected date);</li> <li>6. Final mark/grade;</li> </ol> <p>List of exams undertaken, the associated grade awarded.</p> | <p>Language: Italian, English, French or Spanish. For all other languages, applicants must provide an official translation provided by the university issuing the degree or by an authorized body or translator. <b>Without a certified translation the documents will not be accepted.</b></p> <p>Type of certificate for degrees awarded in:</p> <ol style="list-style-type: none"> <li>1. <b>Italian public universities:</b> self-declaration* of of bachelor's or master's degree award, signed and dated;</li> <li>2. <b>EU and non-EU member state universities:</b> where available, certificates, transcripts of records of bachelor's or master's degree or diploma supplement, if available.</li> </ol> |
| e) | <p><i>For applicants due to be awarded their master's degree:</i></p> <p><b>Proof of exams taken and grades awarded.</b></p>   | <p>Language: Italian, English, French or Spanish. For all other languages, applicants must provide an official translation provided by the university issuing the degree or by an authorized body or translator. <b>Without a certified translation the documents will not be accepted.</b></p>  |
| f) | <p><b>Research Proposal</b></p>  | <p>Language: English</p> <p>The <b>Research Proposal</b> (1,000-2,500 words) should focus on the scholarship research topic chosen as first preference and must include:</p> <ul style="list-style-type: none"> <li>- Abstract (max 250 words);</li> <li>- Scope of research and questions;</li> <li>- Methodology;</li> <li>- Expected results and impacts.</li> </ul>  |
| g) | <p><b>Letter of Purpose</b></p>  | <p>Language: English</p> <p>The <b>Letter of Purpose</b> (max 500 words) must include your motivations for conducting the proposed research, that is the research topic listed as your first preference, and it must also mention your interest in the other research topics selected (if any) based on relevant skills and experience.</p>  |

\* Current regulations do not recognize certificates issued by other Public Administrations. Qualifications



included in the application must be self-certified if issued by Italian public universities.

With the exception of a), which can be in the original language, and c) and d), and e) which can be in Italian, English, French or Spanish, **all documents must be in English**. For documents issued in a different language, an official translation (into Italian or English, by the issuing university or by an authorized body) must be provided.

**All documents referred to in a), b), c) - or, for applicants due to be awarded their master's degree, in e) - f), g) are strictly required. Failing to submit any of the said documents during application will result in the candidate's exclusion from admission.**

#### **Art. 4 – ADMISSION PROCEDURE**

|                   |   |
|-------------------|---|
| <b>Evaluation</b> | <p>Selection will be based on an assessment of the qualifications listed in the “Qualification Assessment” section followed by an interview. The Selection Board will award a score from 1 to 100.</p> <p><b>1. Qualification Assessment:</b> The Selection Board will assess the applicants' scientific qualifications and determine an overall score up to a maximum of 60 points. Applicants who receive a score of at least 35 will be invited to attend an interview.</p> <p>The Selection Board will award scores based on:</p> <ul style="list-style-type: none"><li>- CV and academic qualifications (Required documents b), c) and d)): up to a maximum of 20 points;</li><li>- Research Proposal and Letter of Purpose (Required documents e) and f)): up to a maximum of 40 points.</li></ul> <p>At this stage candidates may already be determined non-eligible for one or more of the selected scholarships.</p> |
|-------------------|---|

|                                  |  |
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|                                  | <p><b>2. Interview:</b> interviews will be conducted in English via Zoom and will focus on the applicant's scientific background, Research Proposal and Letter of Purpose. The candidate may use slides and the screen sharing option within Zoom. The Selection Board can invite a proven expert for each research topic to participate in the interview. This expert could be a member of the Academic Board. The Selection Board will determine a score for the interviews up to a maximum of 40 points. A minimum of 25 points is required to continue the process.</p> <p>During the interview, the Selection Board will verify that the candidate has the necessary knowledge and skills for attending the doctoral course and will proceed to evaluate the eligibility of the candidate for the research topics selected.</p> <p>At this stage, subject to the candidate's authorization and based on their curriculum, the Selection Board will assess eligibility for scholarships other than their preferred choice(s). If the assessment is positive, eligibility for the alternative scholarship will be taken into consideration only in case of unassigned scholarships after the final ranking.</p> |
| <b>Qualifications Assessment</b> | <ul style="list-style-type: none"> <li>- Curriculum Vitae;</li> <li>- Diploma supplement or transcripts of master's degree grades or levels;</li> <li>- List of publications (if any) as stated on CV;</li> <li>- Research Proposal;</li> <li>- Letter of Purpose;</li> <li>- Any other relevant qualifications listed on the CV that provide evidence of academic and professional experience.</li> </ul>   |
| <b>Assessment Results</b>        | The results of the qualification assessment will be published on the IUSS website – on the "Call for Applications" page, by 6 September 2024.  |
| <b>Interview Schedule</b>        | <p>The interviews will be conducted starting from 9 September 2024 until the 17 September.</p> <p>Candidates will be given reasonable notice of the date and timing of the interview.</p>  |
| <b>Special needs</b>             | People with disabilities can apply for special equipment and/or other aids during the application process.   |

Candidates must be connected on the Zoom platform via both audio and video. Failing to connect at the time and date of the interview or lacking ID proof will be regarded as withdrawal from the application process.

## Art. 5 – SELECTION BOARD

The Selection Board for admission to PhD programmes is appointed by the Rector of the university. The list of the Board Members is published on the School website – “Call for Applications” page. The Selection Board is divided into subcommittees, corresponding to the different curricula. The subcommittees will be responsible for arranging and conducting the relevant interviews and can be joined by experts, for each of the research topics. The experts may also be part of the Academic Board.

## Art. 6 – RANKING AND ASSIGNMENT OF SCHOLARSHIPS

Following the interviews, the final ranking for each curriculum will be published on the School’s website – “Call for Applications” page by **20 September 2024**.

The final ranking:

- Will be in decreasing order of scores (in the event of a tie, the youngest candidate will be given precedence);
- Will confirm the candidate’s eligibility to study the research topics of their choice or additional research topics based on the assessment of the Selection Board.

The scholarships will be assigned according to the following procedure:

1. Each candidate will be notified by email and offered a scholarship in observance of the final ranking and of their order of preference as formally declared at the application stage;
2. Candidates must confirm acceptance by replying to the email within 48 hours;
3. Once scholarships are assigned, they are no longer obtainable by other candidates;
4. Candidates who reject the scholarship or fail to confirm before the deadline will forfeit the right to the scholarship offered and to any further scholarship. The place will be offered to the next eligible candidate.

This procedure will continue until all scholarships are assigned, including any alternative scholarships for which candidates were deemed eligible by the Selection Board during assessment, up until the beginning of the Phd course, subject to any subsequent update regarding deadlines for Ministry of University and Research’s Decrees n. 629/2024 and 630/2023.

## Art.7 – ENROLMENT

### 7.1 Enrolment Procedure

Publication of the rankings on the School's online Official Register (Albo Ufficiale) shall be considered official notification. The Doctoral Course Programme will start on Friday **13 December 2024**.

Successful candidates will be notified of the final date for enrolment – failure to enrol by that date will result in their exclusion from the doctoral course.

The following is a summary of the documents to be submitted to the enrolment office:

- a) tax status form;
- b) for candidates who obtained their master’s degree abroad a Declaration of Local Value (or a copy

of the application to the competent authority) or a Diploma Supplement is required;

- c) for candidates awarded their master's degree ("laurea magistrale") after the deadline for applications to the course but no later than 12 December 2024, a degree certificate or self-declaration of the qualification including grades, date and place of degree awarded must be sent by email to [phd-sdc@iusspavia.it](mailto:phd-sdc@iusspavia.it).

In order to enroll candidates need to complete procedure on Service Esse3 – Reserved Area; more information will be provided you by the secretariat.

Any different form of payment and enrollment from those specified in this document are not accepted.

For any student the actual entrance in Italy and the arrival to the host University must occurred before the **28<sup>th</sup> of February 2025** to avoid exclusion from the PhD course.

## 7.2 Additional Requirements for Visa Applicants

Non-EU students entering Italy should apply for a specific study visa using the online procedure on the [University portal](#) **within 5 days since the acceptance of the scholarship**. Students must apply to the local Police Department ("Questura") within eight (8) days of arriving in Italy for a residence permit for study purposes.

For further information, please go to [IUSS website](#).

## 7.3 Registration Fee

PhD students must pay the registration fee for each academic year. The registration fee includes the regional study tax and the stamp duty.

In case of withdrawal from the doctoral course candidates cannot be reimbursement the registration fee.

## Art.8 – SCHOLARSHIPS

Scholarships will be paid monthly at the end of each month.

The annual amount of the scholarship is € 16,243.00. This sum is exempt from IRPEF (income tax) but is subject to payment to the Italian National Institute of Social Security (INPS), to which the university contributes two-thirds and the student one-third (or "gestione separata").

## Art. 9 – SCHOLARSHIPS FUNDED BY THE NATIONAL RECOVERY AND RESILIENCE PLAN (PNRR)

In accordance with the National Recovery and Resilience Plan (PNRR), the Ministry of University and Research has assigned universities resources (Ministerial Decrees no. 629/2024 and no. 630/2024) for the funding of doctoral scholarships dedicated to:

- "Transizioni digitali e ambientali" (digital and environmental transitions);
- "Tematiche ricerca PNRR" (PNRR research topics);
- "Pubblica Amministrazione" (public administration);
- "Patrimonio culturale" (cultural heritage);

- “Dottorati innovativi” (Innovative doctoral programmes).

The School has selected the research projects to be included in the doctoral courses of the 40<sup>th</sup> cycle, in line with the eligibility criteria defined by the aforementioned Decree, as listed in this call with the label PNRR.

At the end of the selection procedure, the candidates who have been awarded the grants referred to in Ministerial Decrees no. 629/2024 and no. 630/2024 will proceed with enrolment in accordance with the provisions as laid out in art. 7.

Once the scholarships have been assigned, the MUR (Ministry of University) will authenticate the eligibility of the projects for PNRR support. The ANVUR (Italian National Agency for the Evaluation of Universities and Research Institutes) will then verify that the requirements outlined in the aforementioned Decree have been met. Admission to the doctoral course for students awarded the grants referred to in said Decree is therefore to be considered provisional, pending confirmation of their eligibility for ministerial funding.

The acceptance of scholarships labelled as PNRR entails additional obligations to those listed in the Regulations for the School's Doctoral Programs, notably:

- submission of a report every six months outlining the main research activities and respective time frame;
- for PNRR Decree n. 629 “PNRR Research” scholarships: a period of study and research abroad for a minimum of 6 up to 12 months;
- for PNRR Decree n. 629 “Public Administration” and “Cultural Heritage” scholarships: a period of study and research abroad for a minimum of 6 up to 12 months, and periods of study and research in private and public companies, research centers or Public Administrations for a minimum of 6 up to a maximum of 12 months;
- for PNRR Decree n. 629 “Digital and Environmental Transitions” scholarships: a period of study and research abroad for a minimum of 6 up to 12 months, and a period of study and research in a company or research center for a minimum of 6 up to a maximum of 12 months.
- for PNRR Decree n. 630 “Innovative Doctoral Programmes” scholarships: a period of study and research abroad for a minimum of 6 up to 12 months, and a period of study and research in a company for a minimum of 6 up to a maximum of 18 months.

Failure to comply with the above requirements may call for revocation of the scholarship.

#### **Art. 10 – LIMITATIONS ON OTHER EMPLOYMENT**

Admission to the PhD course implies a full-time commitment and no other type of employment is allowed. However, art. 17 of the [“Regolamento in materia di corsi di dottorato”](#) allows the student to occasionally work within strict guidelines for other entities while enrolled in the course. Please refer to the Regulations for more details.

## **Art. 11 – MANAGEMENT OF PERSONAL DATA**

The School, as Controller (piazza Vittoria, 15, 27100 Pavia PV – PEC [direzione@pec-iusspavia.it](mailto:direzione@pec-iusspavia.it)), in full conformance with Legislative Decree n. 196/2003 and with any subsequent updates, and with article 13 of the EU General Data Protection Regulation n. 679/2016, collects and processes personal data in order to manage the application for participation in the doctoral competition.

Data will be kept and may be used after the completion of the selection procedure for operational, administrative, accounting and/or other purposes related to the management of institutional activities and legal obligations, as well as for informing the successful applicants of any opportunities. Any data subjects wishing to exercise their statutory rights as per articles 15-22 of Reg. UE/2016/679 may do so by writing an email to the Controller.

Further information on the management of personal data by the School can be found at: <https://www.iusspavia.it/en/privacy>.

## **Transparent Administration**

The School operates in compliance with Law no. 190/2012 (Provisions for the prevention and repression of corruption and illegality in public administration), applying the measures identified in the “Piano Integrato” that can be found in the “Trasparenza” section (in Italian) on the School’s web site at: <https://trasparenza.iusspavia.it>.

## **Art 12 – REFERENCE RULES**

For any items or information not included in this announcement, please refer to the “[Regulations for Doctoral Courses](#)” issued by the D.R. n. 74/2024 and the “[Regulation for the PhD in Sustainable Development and Climate Change](#)”.

Submission of an application using the procedure described in art. 3 implies acceptance of the regulations contained in this announcement and of those that apply to PhD courses.

## **Procedure Supervisor**

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## **Disclaimer**

The Italian version of this document is the official and legally binding announcement document. The English version is not legally binding and is only meant to provide information.



# Research Topics

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40° cycle – Academic Years 2024/2025 – 2026/2027

[phd-sdc.it](http://phd-sdc.it)



**PhD SDC**  
SUSTAINABLE DEVELOPMENT  
AND CLIMATE CHANGE

## List of Research Topics

### CU1 - Earth Systems and the Environment

- The impacts of climate change on river discharge regimes at the regional scale
- Advances in carbon accounting: circularity and responsibility in composite systems
- Modelling of current and future air pollution in Europe under climate change
- Integration of EO data into subsidence risk assessment to support sustainable groundwater management
- Climate Change in the Alps: High-Resolution Modeling and Socio-Economic Impacts in Alta Valtellina
- Statistical data science for modelling intensive farming, air quality and climate change in the EU
- Predicting renewable energy market behaviour based on weather/seasonal forecast and machine learning
- Characterization of aerosol emission and transport in Africa in terms of atmospheric circulation
- Constraining ammonia emissions in the Po valley using inverse modeling
- Coccolithophores and multiproxy models to reconstruct Pleistocene paleo-monsoons in the China Sea
- Statistical data science for upper air climate change understanding using reference measurements
- Use of AI for hydrological monitoring
- Plastic and microplastics in coastal areas: toward a Zero Pollution vision
- Data assimilation in weather models to assess the impact of the future FORUM satellite mission
- The effect of Climate Change in precipitation patterns at regional scale
- Improving the air quality by air cleaning and ventilation device: towards a sustainable environment
- Sediment management in Alpine reservoir: strategies for optimal sediment flushing manoeuvres
- Development of ocean and coupled data assimilation for ocean and climate applications
- Strengthening the space - science network for monitoring rapidly shifting landscapes
- Molecular simulation of nucleation and surface processes of atmospheric aerosol
- Assessing centennial ocean and climate records to understand climate variability

### CU2 - Socio-Economic Risk and Impacts

- Statistical data science: Deep Learning for Modelling Risk measures and ESG scores
- Innovative and sustainable measures for reducing water footprint in cities
- Risk of Natural Hazards: Network Resilience and System Fragmentation
- Sustainable mobility determinants in urban contexts: demand and supply analysis and policy design
- Use of Satellite Data for Territorial Sustainability Analysis
- Agent Based - Input Output models for risk and impact assessment of natural adverse events
- Economic dimension of the public policies and regulatory frameworks within the European Green Deal
- Business and human rights: A tool for assessing impacts
- Italy's Net-Zero Roadmap: Sectoral Decarbonisation Strategies Aligned with Paris Agreement & EU Goals





- The impact of climate change on short/long-term measures to improve the supply-demand
- Legal comparative perspectives on food waste for a responsible production and consumption of food
- Gender equality and climate resilience in developing countries
- Preventing climate change: analysing the role of Universities

### **CU3 - Technology and Territory**

- Next-generation photoelectrocatalysts for CO<sub>2</sub> fixation
- Innovative processes for managing the natural presence of asbestos in a new large infrastructure
- SUSTAINABLE BIOBASED POLYMERIC COATINGS FROM NON-EDIBLE OILS
- Development of innovative solutions for the circularity of self-adhesive papers
- Development of selective catalysts for a sustainable carbon chemistry
- Development of green methods for the continuous production of high-value-added molecules
- Photoelectrocatalytic artificial-leaf devices for sustainable synthesis of chemicals and fuels
- Advanced Smart Sustainable manufacturing-workers training systems
- Eco-Friendly and Sustainable Systems for Leather Tanning
- Vibration energy harvesting from high-voltage overhead lines to supply low-power monitoring sensors
- Sustainable Solutions for the Production of Electrical Cables with low environmental impact
- Energy refurbishment and health in social housing in the context of climate change
- Integrated Planning solutions for more resilient human settlements and cities
- Artificial intelligence for energy management systems in public transport electrification
- Highly integrated hybrid energy storage systems for marine electric propulsion systems
- Satellite Remote Sensing Techniques for Monitoring hydrological basins
- Electro-nanocatalytic approaches for high added value products

### **CU4 - Theories, Institutions and Cultures**

- Language as a means to promote Climate Change education and awareness in underserved populations
- Institutions and governance of climate change
- Market regulation and sustainable investment policies: a comparative law perspective
- Environmental Philosophy: Water, Labour, and Sustainability
- Climate change litigation and the recent constitutional reforms
- Sustainability in the Anthropocene: the ethics and politics of plants and ecosystem conservation
- Resilient Cities - Resilient Territories: Principles of Water Ethics in the Climate Change Era
- Models, reasons and decisions: explaining sustainable choice in complex scenarios



#### **CU5 - Agriculture and Forestry**

- The interplay between sustainable food production, climate change and food quality
- Optimizing Plant Reproduction: Developing Climate-Resilient Varieties for Future Agriculture
- Grass haylage production: harvesting and feeding practices to adapt to climate change
- Multidisciplinary and sustainable approaches for food quality and authenticity
- A knowledge-based decision support system for sustainable use of water resources in agriculture
- Optimizing plant nutrient and health strategies for a climate-resilient rice cropping system
- Impact of agro-silvo-pastoral management and climate changes on mountain semi-natural grasslands
- Development of new technologies for ecophysiological analysis of biostimulant action
- The interplay between climate change, pest diseases and crop production
- Sustainable Design of Green Areas in Industrial-Artisanal Hubs
- Characterization of the mode of action of sustainable products against grapevine pathogens
- Assessments of biogeochemical cycles in Mediterranean agroforestry systems under climate change

#### **CU6 - Health and Ecosystems**

- combating infections and inflammation
- Micro/nanoplastic effects on the brain: a stimulus to a more sustainable approach
- Bioactive natural compounds from sustainable vertical-agriculture for inflammatory targeting
- CLIMATE CHANGE IMPACTS IN POLAR AND ALPINE PERMAFROST AREAS
- Biomolecules and biomaterials for ecosystems protection and human health (BREATH)
- Microplastics and climate change: impacts on deep sea organisms
- Exploring Active mobility. Scenarios of expanded accessibility in the foothill territories



*Curriculum: CU1 - Earth Systems and the Environment*

## **The impacts of climate change on river discharge regimes at the regional scale**

**Reference Person:** Annis Antonio (antonio.annis@unipd.it)

**Host University/Institute:** Università degli Studi di Padova / Dipartimento di Ingegneria Civile Edile e Ambientale - ICEA

**Research Keywords:** Climate change  
hydrological modelling  
flood hazard and damage

**Reference ERCs:** PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution  
PE10\_21 Earth system modelling and interactions  
PE10\_3 Climatology and climate change

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

This proposed research is aimed to investigate the impact of current and future changes of precipitation regimes and land use on runoff and flow propagation processes at large scale. This broad topic requires investigations on the state of the art of statistical hydrology for extreme events but also how it can be coupled with the current physically based (or physics-informed machine learning) methods for rainfall-runoff and flow propagation models and how these frameworks can be enhanced by the synergic adoption of in situ measurements and remotely sensed data for large scale (e.g. regional or at multi-basin scale) assessments. The research topic will also adopt a probabilistic framework to investigate on how uncertainties related to statistical hydrology (e.g. synthetic rainfall events changing through time), as respect to other uncertainties related to measurements of the input variables (e.g. uncertainties in rainfall/flow measurements), model parameters and model structure (e.g. simplification of the physical processes) can impact on prediction of variables of interests such as water levels, water extensions, erosion/deposition processes and potential risks and damages on population and assets.

### **Research team and environment**

The candidate will work with a research team from the Department of Civil, Environmental And Architectural Engineering (ICEA) and the Department of Land, Environment, Agriculture And Forestry (TESAF) of University of Padua, in which full professors with strong competence



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in the topic such as proff. Marco Marani , Marco Borga and other researchers, such as Antonio Annis (the reference person), Maria Francesca Caruso, Pietro Devò will support the candidate.

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**Suggested skills for this research topic**

The candidate should have a basic background on hydrology, statistics, environmental fluid dynamics, climate change, remote sensing as well a basic knowledge of any programming environment for data analysis and environmental modelling. The candidate should also have soft skills such as flexibility and adaptability in the workplace, ability to address work challenges, interacting with others, working in teams, working in open, multicultural and flexible environments, mastering the tools for communication, dissemination and public speaking.

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**Source of fundings**

DM629/2024 - M4C1 - Inv. 4.1 - Pubblica Amministrazione

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

to be defined

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Advances in carbon accounting: circularity and responsibility in composite systems**

**Reference Person:** Bastianoni Simone (bastianoni@unisi.it)

**Host University/Institute:** Università di Siena / Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente

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**Research Keywords:** GHG accounting  
Life Cycle Thinking  
Circularity

**Reference ERCs:** SH7\_5 Sustainability sciences, environment and resources  
SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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### **Description of the research topic**

How to assign the responsibility of GHG emission plays an important role in the research fields of mitigation of, and adaptation to climate change. The main efforts that have been done so far are focused on the macrosystem (especially country) level, investigating, for instance, how to discriminate between producer and consumer countries, including phenomena like decentralization, delocalization, or decoupling.

The proposal adapts the responsibility approach to the micro- or the meso- system, using a Life Cycle Thinking approach to GHG estimation and responsibility allocation. The accounting can be extended to include the indirect emissions (or process emissions), in order to calculate the effects of the production and consumption of goods and services in terms of the so-called Carbon Footprint (namely, accounting the GHG emission throughout the life cycle of the products or flows analyzed) in a system in which a set of subjects (production units, companies) are involved in a composite process made of phases that can be connected with each other. The main aim of the research is to find ways to highlight, measure and increase the cooperation, and the circularity of the whole system and mitigate the impact on the environment. The approach, first refined theoretically, will be applied to different systems. Examples of great interest are, circle closure in industrial districts and energy, water and waste management strategies.

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### **Research team and environment**

Sustainability is a strategic task of the University of Siena. The PhD candidate will work in the Ecodynamics Group (Department of Physical Sciences, Earth and Environment), a multidisciplinary research team that has been dealing with sustainability and climate change for three decades. The group has extensive experience in compiling GHG inventories at territorial level, certification tools, Life Cycle Assessment and Carbon Footprint, applied in multiple contexts and to various systems (territorial, productive, etc.). Other projects of the group are based on sustainability assessment of systems and processes, GHG emission responsibility assessment

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### **Suggested skills for this research topic**

The PhD candidate is expected to have a background in environmental science, sustainability foundations, assessment and indicators.

The candidate must have proficient English and familiarity with the most common tools for the estimation of environmental impacts. Knowledge of GHG accounting method, Life Cycle Assessment and other environmental accounting methods is seen as a significant merit.

The candidate should be motivated and open-minded, available to develop and share his/her experience in a transdisciplinary environment. He/she must be available to stay in Siena and also travel for both education and research purposes.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

ESTRA spa

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Modelling of current and future air pollution in Europe under climate change**

**Reference Person:** Bigi Alessandro (alessandro.bigi@unimore.it)

**Host University/Institute:** Università degli studi di Modena e Reggio Emilia / Dipartimento di Ingegneria 'Enzo Ferrari'

**Research Keywords:** Atmospheric modelling

Climate change

Air pollution

**Reference ERCs:** PE10\_1 Atmospheric chemistry, atmospheric composition, air pollution

PE10\_3 Climatology and climate change

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **Description of the research topic**

Air pollution and climate change are closely linked and represent two major environmental challenges. Climate change has been unequivocally attributed to anthropogenic emissions by the IPCC and climate forcing compounds are often co-emitted along with air pollutants.

The main objective of the project is to investigate the impact of climate change on air quality using the MINNI Integrated Assessment Model. MINNI will be applied to study PM<sub>2.5</sub>, NO<sub>2</sub> and O<sub>3</sub>, at the European scale (10 x 10 km<sup>2</sup> horizontal resolution), at the Italian scale (4 x 4 km<sup>2</sup>) and also at the city scale, for specific case studies, e.g. Naples (1 x 1 km<sup>2</sup>). The runs will initially focus on the recent past to estimate (and address) the bias between model results and, either ECMWF reanalysis and observations from both the air quality regulatory networks and the ACTRIS-RI network, with the latter helping to improve the model parametrization. Model runs will then focus on projections to 2050, in line with CMIP6 scenarios, including the species required by MINNI and with meteorological fields provided by either EURO-CORDEX or MED-CORDEX. Finally hazards that may be exacerbated by climate change will be also examined (e.g. wildfires and pollen emissions).

The overall aim of the project is to support policies that address both climate change and air pollution. The project will be developed in close collaboration with the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA).



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### **Research team and environment**

Research activities will be hosted at the LARMA Lab of the Dept. of Eng. "Enzo Ferrari" (<http://tiny.cc/larm>) and at the Atmospheric Pollution Lab of ENEA (<http://tiny.cc/fom7yz>).

LARMA works on atmospheric modelling and monitoring, collaborating with partners of the ACTRIS-RI and ICOS-RI. LARMA is also in charge of the Geophysical Observatory of Modena and of the local AERONET sun photometer.

The Atmospheric Pollution lab focuses on meteorological and air quality simulations on European, national, local domains, and on novel methods for air quality monitoring. MINNI is one of the 11 models of the Copernicus Atmosphere Monitoring Service for the air quality forecast at European level.

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### **Suggested skills for this research topic**

The candidate is expected to have a solid background in physics, math, earth/environmental sciences or related disciplines, as well as experience in the analysis of observational data and/or numerical simulations. A training in atmospheric chemistry/physics, data analysis, atmospheric modelling, coding (e.g. in R, Fortran, matlab, python) are considered an asset.

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### **Source of fundings**

Fondi dell'ente di appartenenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Integration of EO data into subsidence risk assessment to support sustainable groundwater management**

**Reference Person:** Boni Roberta (roberta.boni@iusspavia.it)

**Host University/Institute:** Istituto universitario di studi superiori di Pavia / Classe di Scienze, Tecnologie e società

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**Research Keywords:** Land subsidence risk assessment  
Sustainable groundwater management  
Earth Observation

**Reference ERCs:** PE10\_20 Geohazards  
PE10\_14 Earth observations from space/remote sensing  
PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

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### **Description of the research topic**

Italy is one of the countries in the world that has experienced significant damage due to land subsidence (LS), with several areas identified as hotspots through the use of Earth Observation (EO) data, specifically Interferometric Synthetic Aperture Radar (InSAR). LS is more severe in regions where the natural compaction of recent deposits is exacerbated by excessive groundwater extraction. Emilia-Romagna (ER) region has been particularly affected, with up to 7 cm/year subsidence rates impacting a significant portion of the population since the 1950s.

While numerous InSAR studies have examined LS monitoring, very few have converted the observations derived from EO into risk assessment. The various environmental, social, and economic effects of LS are frequently disregarded, as are the potential ways in which climate change, population expansion, and urban development could intensify this phenomenon in the coming years.

The PhD project will innovate with new EO-based methodologies aiming to enhance our understanding of groundwater exploitation impacts on urban landscapes and to provide valuable insights for better sustainable urban planning and natural resource management.

The main expected results of the PhD project:



-a new and innovative methodological workflow based on EO data and novel analysis techniques for LS risk assessment.

-improved urban resilience and security for groundwater resources, towards sustainable development.

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### **Research team and environment**

The research team comprises Dr. R. Bonì, a senior researcher in Physical Geography, Geomorphology, and Applied Geology; Prof. A. Taramelli, a professor of Remote Sensing and Surface Coastal Processes; and Dr. M. Righini, a postdoctoral fellow in Geomorphology. They collaborate internationally with the Geohazards InSAR Laboratory and Modelling Group at IGME in Madrid and nationally with CNR-ISAC in Rome. The PhD candidate will spend six months at each lab, enriching their research on geohazards and earth observation within this interdisciplinary team.

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### **Suggested skills for this research topic**

- Environmental remote sensing
- Geospatial analysis of Earth observation and non-Earth observation data
- Risk assessment
- Geostatistical data analysis and interpretation

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### **Source of fundings**

Fondi esterni

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None



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*Curriculum: CU1 - Earth Systems and the Environment*

## **Climate Change in the Alps: High-Resolution Modeling and Socio-Economic Impacts in Alta Valtellina**

**Reference Person:** Dottori Francesco (francesco.dottori@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze, Tecnologie e Società

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**Research Keywords:** Mountain Climate Change  
Convection-Permitting Models  
Socio-Economic Impacts

**Reference ERCs:** PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution  
PE10\_3 Climatology and climate change  
SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

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### **Description of the research topic**

Mountain regions are exposed and vulnerable to Climate Change (CC) due to their unique climatic and geographic characteristics. Increased temperatures, altered precipitation patterns, and more frequent extreme weather events can affect mountain environments, leading to profound ecological and socio-economic consequences.

This PhD research aims to determine the impact of CC on critical climate variables within the mountain context of Alta Valtellina (Sondrio Province, Alps in Italy). By utilizing high-resolution climate models, specifically Convection-Permitting Models, this study will provide detailed and accurate insights into the CC affecting this region. CPMs are km-scale atmospheric model that explicitly represent deep convection going beyond the traditional convective parameterization scheme, providing a more realistic representation of local process. Additionally, the research will explore the socio-economic impacts of these climatic changes, focusing to understand how shifts in climate variables affect local communities, economies, and infrastructure.

This research will be conducted in collaboration with the Agenzia Regionale per la Protezione dell'Ambiente Lombardia (U.O.C. fi Servizio Idro, Nivo, Meteo e Clima della Direzione Tecnica Monitoraggi e Prevenzione del Rischio Naturale) and "Levissima" Mineral Water brand. These



partnerships will provide valuable data, resources, and expertise regarding the region, ensuring that the study is grounded in the local reality.

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### **Research team and environment**

IUSS mission is to provide advanced education to undergraduate and graduate students, as well as fundamental and applied research. At IUSS, PhD candidates will find a multidisciplinary environment offering real opportunities for developing academic and professional tools. The candidate will join the research centre on Climate change impAct studies for RISk MANagement (CARISMA). For this scholarship there will be opportunity to do a period of internship at the Agenzia Regionale per la Protezione dell'Ambiente Lombardia (ARPA Lombardia) – Centro Nivometeorologico di Bormio.

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### **Suggested skills for this research topic**

The ideal candidate will have experience with most of these topics: quantitative risk assessment, statistical analysis and large dataset. The candidate should be passionate on research topics, hardworking, self-motivated, have an open-mindedness to look for new ideas of doing things and creativity in analytical thinking to extract meaning from sets of data. The candidate should be able to collaborate with the rest of the research team and effectively communicate to colleagues with different backgrounds. Competence on programming languages is required, as well as familiarity with spatial data format (i.e., NetCDF4, grib), tools and package for spatial analysis (i.e., Xarray, CDO, Gdal, NCO).

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### **Source of fundings**

DM629/2024 IUSS – M4C1 – Inv. 4.1 – Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None



*Curriculum: CU1 - Earth Systems and the Environment*

## **Statistical data science for modelling intensive farming, air quality and climate change in the EU**

**Reference Person:** Fassò Alessandro (alessandro.fasso@unibg.it)

**Host University/Institute:** Università degli studi di Bergamo / Dipartimento di Scienze Economiche

**Research Keywords:** Statistical models for large spatiotemporal data  
Machine learning, deep neural networks  
Impact and Scenario Analysis, Policy Assessment

**Reference ERCs:** PE1\_15 Generic statistical methodology and modelling  
PE6\_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)  
PE10\_3 Climatology and climate change

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

### **Description of the research topic**

Livestock emissions, vehiculated by manure, have a strong impact both on air quality and climate change. The first is related to the so-called ammonia cycle. According to this, manure yields ammonia (NH<sub>3</sub>) in the atmosphere, which reacts with atmospheric nitric and sulphuric acids to form up to 50% of primary particulate, PM<sub>2.5</sub>. For the second impact, livestock-mediated greenhouse gas (GHG) emissions are considered a sizeable causative agent of climate change, with up to 3.75 Gt CO<sub>2</sub>-equivalent emitted yearly.

The PhD student will develop advanced hybrid modelling techniques merging geostatistics and deep neural networks to build a data-driven statistical model of the impact of livestock on particulate matters at the EU level. An essential intermediate output will be the publication of an open access (FAIR) dataset harmonising all data entering the model and including air quality (EEA), Meteorology (ECMWF, ERA5) livestock emissions (Copernicus), land cover and land use (Copernicus). Harmonisation will be faced by change of support and data fusion statistical techniques. The model will follow a multiscale approach, able to provide small-scale impact maps and used to test various climate change and mitigation scenarios at the local and European levels.

The challenges related to the large size of the European data set, will be faced using high dimensional statistical models, advanced computational statistics, numerical optimisation techniques and high performance computing.



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### **Research team and environment**

The research project will be developed in close connection with the research group on environmental statistics at the Department of Economics of the University of Bergamo. The group is composed of prof. A. Fassò, prof. F. Finazzi, prof. M. Cameletti, Dr. Rodolfo Metulini, and PhD students Jacopo Rodeschini, Alessandro Fusta Moro, Andrea Moricoli, and Haroon Shaukat.

The PhD student will also collaborate with the Agrimonia network ([www.agrimonia.net](http://www.agrimonia.net)), including environmental statisticians from universities in Bergamo, Milano Bicocca, Torino, and Glasgow University.

At the department, the PhD student will be provided with a desktop position, computing facilities, library etc.

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### **Suggested skills for this research topic**

The ideal candidate for this project is a student with a master's degree in statistics, computer science, environmental engineering, environmental sciences or physics.

In the first 12-18 months, the training (in Bergamo, Pavia and abroad) will focus on the following:

- Atmospheric sciences for climate change and air quality dynamics
- Databases and coding
- Numerical optimisation
- Frequentist and Bayesian statistical theory
- Computational statistics
- Advanced geostatistical models for large spatiotemporal data
- Machine learning for spatiotemporal data
- Advanced computational statistics and high-performance computing.

This training will be based on classes and learning by doing.

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### **Source of fundings**

Fondi dell'ente di afferenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None



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*Curriculum: CU1 - Earth Systems and the Environment*

## **Predicting renewable energy market behaviour based on weather/seasonal forecast and machine learning**

**Reference Person:** Fosser Giorgia (giorgia.fosser@iusspavia.it)

**Host University/Institute:** Scuola Universita Superiore IUSS Pavia / Classe di Scienze, Tecnologie e Società

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**Research Keywords:** Energy  
weather and seasonal forecast  
machine learning

**Reference ERCs:** PE10\_2 Meteorology, atmospheric physics and dynamics  
PE6\_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)  
PE10\_21 Earth system modelling and interactions

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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### **Description of the research topic**

Power and gas prices are strongly influenced by both consumption and the availability of renewable sources of energy, in turn directly linked to weather variables like wind, incoming solar radiation at the surface, precipitation, temperature and snow melting. Short-term weather forecast thus plays a key role in the European energy sector, also for the impacts on power trading efficacy. The reliability of the short-term weather forecast impacts the European energy market movements and price. Seasonal forecast with their time-window of 3 to 6 months can help answer questions such as: "Will there be sufficient water reserves in mountain basins to allow for efficient planning of hydroelectric production?" and thus be crucial for the energy sector. Therefore, being able to exploit the weather information at different temporal scales would be a valuable support to anticipate market behaviours and prices.

In this context, the project aims at investigating and understanding the sources of uncertainty in weather and seasonal forecast products (e.g. linked to weather regimes or ENSO) and thus on the renewable energy production in Europe. The purpose is to merge the atmospheric and climate physics with statistical analysis and machine learning to provide end-users with more reliable weather and seasonal forecasts. To this end, the successful candidate will spend 12 months at A2A in Milano.

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### **Research team and environment**

The research activity will be carried out in the CARISMA group at IUSS Pavia, in collaboration with A2A in Milano and supported by ISAC CNR in Bologna. The CARISMA team is composed by STEM and Social scientists studying climate change and its associated impacts and risk.

A2A is an Italian multiutility active in several fields: generation of electricity from different sources, distribution and sale of electricity and natural gas, district heating, waste collection and treatment, electric mobility, public lighting, water service.

CNR-ISAC aims at the understanding of the atmosphere, climate and Earth system sciences in a multidisciplinary approach.

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### **Suggested skills for this research topic**

The ideal candidate should have a strong background in data analysis and statistics (analysis of probability distribution functions, uncertainties, etc.) and be familiar with the management of large datasets. Good programming skills are required, while experience with machine learning and/or a background in meteorology or in climate dynamics will be an added value.

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### **Source of fundings**

Fondi esterni

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

A2A Life Company SpA

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Characterization of aerosol emission and transport in Africa in terms of atmospheric circulation**

**Reference Person:** Gaetani Marco (marco.gaetani@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze, Tecnologie e Società

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**Research Keywords:** Climate

Aerosol

Impact

**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 13: Climate Action

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### **Description of the research topic**

Southern Africa is particularly exposed to climate change, characterised in the region by a rapid increase in temperatures and in the frequency and intensity of droughts. Natural and anthropogenic atmospheric aerosols are a fundamental component of the regional and global climate system, due to their direct, semidirect and indirect effect on the radiative balance. Aerosols also contribute to social impacts related to the local climate, particularly through their effect on air quality in urban areas. In this context, while climate model simulations provide fairly reliable simulations of essential climate variables at the global level, the representation of local climate impacts is still affected by great uncertainties. In particular, there is still little usable information available on the evolution of atmospheric aerosols in future climate scenarios, on a global scale and in southern Africa. The understanding of the dynamics of the aerosols and its relationship with the atmospheric dynamics still represents an ongoing challenge for climate modelling. This project will investigate the role of atmospheric circulation in the aerosol dynamics, using innovative machine learning methodologies for the definition of atmospheric circulation features, in a region where the literature on the topic is very limited.

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### **Research team and environment**

The research activity will be carried out in the CARISMA group at IUSS Pavia. The CARISMA team is composed by STEM and Social scientists studying climate change and its associated impacts and risk. The project will be co-supervised by Dr. Benjamin Pohl of the team



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Biogeosciences of the Université de Bourgogne, in Dijon, France. The candidate will spend 12 months in Dijon to implement the machine-learning-based classification of the atmospheric circulation in southern Africa.

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**Suggested skills for this research topic**

The ideal candidate should have a strong background in data analysis and statistics (analysis of probability distribution functions, uncertainties, etc.) and be familiar with the management of large datasets. He/she should have basic knowledge of atmospheric physics, climate dynamics and change. Programming skills and knowledge of machine learning techniques are a plus.

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**Source of fundings**

FFO IUSS

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

Université de Bourgogne

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Constraining ammonia emissions in the Po valley using inverse modeling**

**Reference Person:** Ghermandi Grazia (grazia.ghermandi@unimore.it)

**Host University/Institute:** Università degli studi di Modena e Reggio Emilia / Dipartimento di ingegneria "Enzo Ferrari"

**Research Keywords:** NH<sub>3</sub> emissions  
Inverse modelling  
Chemical transport model simulations

**Reference ERCs:** PE10\_1 Atmospheric chemistry, atmospheric composition, air pollution

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **Description of the research topic**

Ammonia (NH<sub>3</sub>), a critical precursor of particulate matter, has far-reaching effects on biodiversity, ecosystems, soil pH, climate, and human health. Increasing demands on agricultural production, including fertilization and livestock production, have led to rising atmospheric concentrations of NH<sub>3</sub>. However, there are significant uncertainties in current NH<sub>3</sub> emission inventories, particularly with respect to their temporal distribution, making accurate assessment and regulation challenging. To address these issues, the present research proposal aims to improve our understanding of the spatial and temporal distribution of NH<sub>3</sub> emissions by applying inverse modeling techniques. In collaboration with the regional environmental agency Arpae - Emilia Romagna, this project aims to refine our understanding of NH<sub>3</sub> emissions in the Po Valley, a heavily industrialized and intensively farmed area of northern Italy, with the potential to later extend the study to a wider region. Using a combination of chemical transport model simulations, ground-based observations and satellite remote sensing data, the candidate will explore inversion methods to generate optimized fluxes of NH<sub>3</sub>, providing essential data to support sustainable agricultural practices and informed policy making.

### **Research team and environment**

Research activities will be conducted at the LARMA Lab ([www.larma.unimore.it](http://www.larma.unimore.it)), Department of Engineering "Enzo Ferrari" of the University of Modena and Reggio Emilia (Italy), and at the SIMC department of the regional environmental agency Arpae - Emilia Romagna. The LARMA team comprises experts in urban and regional dispersion modeling, remote sensing, and gas



and aerosol monitoring. The Arpae team includes specialists in air quality management, chemical transport model simulations and geospatial analysis of air pollutants.

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**Suggested skills for this research topic**

- Master's degree or equivalent in meteorology, physics, geophysics, mathematics, chemistry, computer science or related disciplines
- Analytical skills and ability to work both independently and as part of a team
- Experience of working with Linux systems and preferably experience of working with high performance computing systems (Linux)
- Preferably experience in analyzing large datasets (model output data and satellite images)
- Preferably a background in atmospheric chemistry/aerosol dynamics with knowledge of inverse modeling
- preferably experience in atmospheric modeling and programming (e.g. R, Python, Fortran, etc.)

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**Source of fundings**

Fondi dell'ente di afferenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Coccolithophores and multiproxy models to reconstruct Pleistocene paleo-monsoons in the China Sea**

**Reference Person:** Lupi Claudia (claudia.lupi@unipv.it)

**Host University/Institute:** Università di Pavia / Dipartimento Scienze della Terra e dell'Ambiente

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**Research Keywords:** East Asian monsoon

Coccolithophore

paleoclimate model

**Reference ERCs:** PE10\_6 Palaeoclimatology, palaeoecology

PE10\_2 Meteorology, atmospheric physics and dynamics

PE10\_3 Climatology and climate change

**Reference SDGs:** GOAL 13: Climate Action, GOAL 14: Life Below Water

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### **Description of the research topic**

The East Asian monsoon (EAM) is one important branch of the larger-scale Asian monsoon and a dynamic component of the modern climate. Associated seasonal changes in prevailing wind patterns and precipitation affect not only landmasses but also oceans, where they result in strong seasonality in currents' intensity and direction, sea surface temperature and salinity. With expected increases in population in the densely-populated and growing economies supported by the EAM rains, understanding how this system will change under global warming is both a priority and a major challenge in climate science: EAM future projections remain plagued by a large uncertainty.

In this project, proxy data will be used to reconstruct teleconnections between the EAM, and primary productivity and carbonate production/export/preservation in the South China Sea (SCS). In particular, the project will exploit a high-resolution multiproxy dataset from Pleistocene sediments cored during the expedition IODP 367/368 in the SCS. Data relating to the abundance of coccolithophores, foraminifera, clay minerals will be processed from a statistical and spectral point of view to obtain environmental parameters useful for the reconstruction of Pleistocene critical intervals. The paleo data will be augmented with climate model experiments and the insight gained will help guide analyses of the EAM future changes in the CMIP6 archive, leading to uncertainty reduction on the basis of physically plausible scenarios.

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### **Research team and environment**



The successful candidate will be employed for three years at the University of Pavia and University of Trento (Italy) under the supervision of Claudia Lupi (University of Pavia) and Simona Bordoni (University of Trento) and will carry on exciting research at the intersection between paleo reconstructions and climate physics. The PhD candidate will have access to facilities for the study of deep marine sediments, while at the same time being engaged in the use and analyses of numerical models of the Earth's climate. Moreover, he/she is expected to perform part of the research work in national and international leading institutions for paleoceanographic reconstructions.

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### **Suggested skills for this research topic**

Successful candidates are expected to have a background in meteorology, climate and/or atmospheric physics, oceanography and ocean/atmosphere interactions. Previous research experience with (paleo)climate modelling will be considered a plus. We are looking for a candidate who knows how to work both in a team and independently, and who is willing to challenge themselves in transdisciplinary research.

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Statistical data science for upper air climate change understanding using reference measurements**

**Reference Person:** Madonna Fabio (fabio.madonna@imaa.cnr.it)

**Host University/Institute:** Consiglio Nazionale delle Ricerche / Istituto di Metodologie per l'Analisi Ambientale (CNR-IMAA)

**Research Keywords:** Climate change statistical modelling

In situ and satellite observations

Machine learning - Hybrid models

**Reference ERCs:** PE10\_3 Climatology and climate change

PE1\_15 Generic statistical methodology and modelling

PE10\_14 Earth observations from space/remote sensing

**Reference SDGs:** GOAL 4: Good Quality Education, GOAL 13: Climate Action

### **Description of the research topic**

Temperature changes (T) and humidity (U) of the upper troposphere/lower stratosphere (UTLS) are primarily due to increasing concentrations of well-mixed greenhouse gases and the depletion of stratospheric ozone. A rigorous assessment of the evolution of T and U in the UTLS, based on "reference" measurements, is key for addressing global climate change.

The GCOS Reference Upper-Air Network, GRUAN (<https://www.gruan.org/>), provides traceable upper-air measurements with quantified uncertainties to create climate data records of Essential Climate Variables including T, U, and wind from ground level to the lower stratosphere.

Within this project, the PhD student shall gain a good knowledge of atmospheric physics and statistics for studying Earth's climate, including training on balloon-borne measurement uncertainty.

The PhD student will also develop a data fusion spatiotemporal statistical model merging the GRUAN radiosonde with other data sources measuring T and U in the UTLS to understand the spatiotemporal trend mentioned above. Specifically, data will include satellite observation, Earth system reanalysis, radio occultation GNSS, and climate models (CMIP5/6). Moreover, the PhD student will develop statistical models for multivariate dynamic random fields defined on a spheric sector (UTLS) cross time, in medium to high resolution able to consider measurement uncertainty based on non-Gaussian distributed errors.



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### **Research team and environment**

The research project will be developed in close connection between the Climate and Upper-air measurement Team of the CNR-IMAA (PI: Fabio Madonna), which is a leading institute for balloon-borne and ground-based reference observations for weather and climate, and the research group on environmental statistics at the Department of economics of the University of Bergamo (UNIBG, Tutor: Alessandro Fasso'). The PhD student will be provided with a desktop position, computing facilities, library access, etc. both at CNR-IMA and UNIBG, where they will also develop a practice on performing balloon-borne measurements.

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### **Suggested skills for this research topic**

In the first 18 months, the training (in Bergamo, Potenza, Pavia and abroad) will focus on the following:

- Atmospheric and climate physics
- Balloon-borne and remote sensing observations
- Frequentist and Bayesian statistical theory
- Time series analysis
- Advanced geostatistical models for large spatiotemporal data
- Machine learning for spatiotemporal data
- Advanced computational statistics and high-performance computing.

Training will be based on classes and learning by doing.

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### **Source of fundings**

Fondi dell'ente di afferenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Use of AI for hydrological monitoring**

**Reference Person:** Manfreda Salvatore (salvatore.manfreda@unina.it)

**Host University/Institute:** Università degli Studi di Napoli Federico II / Dipartimento di Ingegneria Civile, Edile e Ambientale

**Research Keywords:** Environmental Monitoring  
Image processing  
Artificial Intelligence

**Reference ERCs:** PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution

**Reference SDGs:** GOAL 6: Clean Water and Sanitation

### **Description of the research topic**

In the coming years, water management will face critical challenges due to the combined impact of global warming, population growth, and pollution. Consequently, there is an urgent need to develop new strategies for river monitoring to support water budget and quality assessment. This research aims to develop a new generation of monitoring systems that leverage Earth Observations (EO), unmanned aerial systems (UAS), cameras, and Artificial Intelligence (AI) to provide both qualitative and quantitative characterizations of the space-time dynamics of river systems.

EO technologies offer increasing potential in terms of space-time resolution and the number of sensors, providing an extraordinary amount of EO-based information. This research seeks to integrate these observations to enhance our ability to describe river systems, considering the overall dynamics occurring at the river basin scale, such as soil moisture state, land use changes, and vegetation state. By combining river observations with machine learning algorithms, we can better interpret the river basin's response along the river, leading to a new, smart monitoring approach.

### **Research team and environment**

HydroLAB coordinated by Prof. Salvatore Manfreda is operating in the department DICEA of the University of Naples Federico II which is a leading institute in hydraulic construction and hydrological studies particularly devoted in the optimization of water management systems.



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HydroLAB is developing new innovative technologies for environmental monitoring using remote sensing and camera systems. The environment is a stimulating and challenging one with a strong and significant international dimension.

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**Suggested skills for this research topic**

AI, Machine Learning, image processing, programming, remote sensing and data processing

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

DSTECH S.r.l

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Plastic and microplastics in coastal areas: toward a Zero Pollution vision**

**Reference Person:** Nardi Alessandro (a.nardi@univpm.it)

**Host University/Institute:** Università Politecnica delle Marche / Dipartimento di Scienze della Vita e dell'Ambiente

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**Research Keywords:** plastics  
microplastics  
energy-to-waste

**Reference ERCs:** PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
LS8\_13 Marine biology and ecology  
LS9\_12 Ecotoxicology, biohazards and biosafety

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 11: Sustainable Cities and Communities, GOAL 14: Life Below Water

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### **Description of the research topic**

Plastic pollution pose a major threat to marine biodiversity in the Mediterranean sea, highlighted as among the most polluted and vulnerable basins. The consistent anthropogenic footprint, the population density in coastal areas and the limited technologies to contain and counteract plastic immision represent drivers favouring the release, persistence and impacts of plastics on marine biodiversity, with possible consequences for economic sectors as fishery, aquaculture and tourism. The project should aim to unravel plastic impacts in marine environments, but also to study possible mitigation actions and technological innovations: indeed, despite the increasing knowledge, the uptake, elimination and biological effects of various real-world weathered microplastics are still unexplored. At the same time, the fate of plastics stranded along Italian shores has been often overlooked, with limited knowledge on the possible re-use or recycle of these materials: the involvement of IRIS srl will allow to explore the possibility to valorize plastic litter collected along Italian shores, transforming it in to clean energy. In this context, GreenPlasma yields of energy per kilogram of plastics of different polymers, age and origin will be explored and possible asjustments of the pyrogassification process developed in order to maximize the possibility to transform plastic threats into green and circular economy opportunities towards EU Zero Pollution Vision.



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### **Research team and environment**

The project will be carried out at the Ecotoxicology and Environmental Chemistry Lab (ECOTOX), DiSVA, UNIVPM and with IRIS srl. The ECOTOX Lab team is mainly involved in the use of organisms as bioindicators of pollution, analysis of contaminants in aquatic species and foodwebs, presence and ecotoxicological effects of emerging contaminants as microplastics, pharmaceuticals and biotoxins. IRIS srl is an innovative SME with committed in the development of innovative waste-to-energy solutions as the GreenPlasma, a technology that uses a pyrogassification reaction to transform plastics into a hydrogen-rich syngas which will be then converted into clean electric energy.

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### **Suggested skills for this research topic**

Successful candidates are expected to have a background in marine biology and ecology with an interest in ecotoxicology of plastics and plastic-related contaminants, solutions to counteract plastic pollution and sustainable development goals. Preferred skills reflect the ability to sample marine abiotic matrices and to process biological samples, knowledge on the main techniques to investigate biological markers through spectrophotometric, gas-chromatographic, brightfield and fluorescence microscopy, modern molecular biology techniques.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

IRIS Srl

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Data assimilation in weather models to assess the impact of the future FORUM satellite mission**

**Reference Person:** Ortolani Alberto (ortolani@lamma.toscana.it)

**Host University/Institute:** Consiglio Nazionale delle Ricerche / Istituto per la BioEconomia

**Research Keywords:** Data Assimilation  
Atmospheric modelling  
Satellite observations

**Reference ERCs:** PE10\_2 Meteorology, atmospheric physics and dynamics  
PE10\_14 Earth observations from space/remote sensing  
PE6\_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)

**Reference SDGs:** GOAL 13: Climate Action

### **Description of the research topic**

Data assimilation (DA) combines models with observations, in the most accurate and computationally efficient way. It enables and improves operational forecasts, forcing a meteorological model towards the real atmospheric behavior. DA methods can be very different, according to the type of available data, model complexity, final objectives and constraints, such as operational timing and finite computing resources. Nowadays, the increasing amount of quasi real-time data magnifies the DA value in weather forecasts but also the computational challenge, while upgrading predictions at different spatial and time scales is of paramount importance to increase resilience in the context of climate change. The ESA Earth Explorer 9 FORUM mission (scheduled for 2027) will provide unprecedented spectral data in the whole Far-Infrared range, i.e. precise information on the Earth energy budget, cirrus contribution, water vapor and green-house gases. In the PNRR SRT-EMM research infrastructure, the assessment of FORUM data in weather forecast will be developed, both versus and in synergy with other main available observations (e.g. IASI-NG). Fast radiative transfer codes will be used to build the observation operator, as required to compare model variables with FORUM (synthetic) data in the DA process. Variational and Kalman-filter based DA techniques will be applied to multiscale atmospheric codes in order to assess the impact at different scales and in different future operational scenarios.

### **Research team and environment**

The team consists of researchers from CNR and LaMMA (consortium between CNR and the Tuscany regional administration), supported by professors of the Universities of Florence



and Bologna, already cooperating in the context of projects and academic courses and theses.

The PhD student will thus learn from CNR and academic experts as well as from the operational group of LaMMA (operational meteorological service of Tuscany). The overall accessible expertise will cover weather modeling, data assimilation, radiative transfer, operational forecasts, dynamical systems, machine learning, developed also thanks to European framework programs and European and Italian Space Agencies ones.

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### **Suggested skills for this research topic**

- Master's degree in one of the following disciplines: physics, engineering, mathematics, computer science, or related natural sciences
- Basic experience in developing and running numerical codes
- Basic knowledge of atmospheric physics and radiative transfer processes
- Knowledge of at least one programming languages among Fortran, C++, Python, Matlab
- Knowledge of the operating systems Linux and Windows or MacOS
- Ability to work within a team
- Attention to detail and organizational skills
- Excellent interpersonal and communication skills

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### **Source of fundings**

Fondi dell'ente di afferenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **The effect of Climate Change in precipitation patterns at regional scale**

**Reference Person:** Petaccia Gabriella (gabriella.petaccia@unipv.it)

**Host University/Institute:** Università degli Studi di Pavia / Dipartimento di Ingegneria Civile e Architettura (DICAR)

**Research Keywords:** climate change  
regional scale  
precipitation patterns

**Reference ERCs:** PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution  
PE10\_3 Climatology and climate change  
PE10\_2 Meteorology, atmospheric physics and dynamics

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

In recent years, climate change and its consequences are gathering increasing attention in the scientific community. The influence of climate change on temperature is vastly discussed, meanwhile, the effects on other hydrometeorological variables are still to be thoroughly studied. The impact of climate change on precipitation patterns and, in particular, on extreme rainfall is the reason for concern since change in the frequency and intensity of these extremes may lead to flood events, landslides or simple malfunctioning of urban drainage systems. Comprehending this phenomenon could lead to a better design of protection infrastructures and improve risk mitigation strategies.

The research aims:

- 1) to identify any statistically significant trend in rainfall patterns and extreme rainfall, examining their spatial and temporal patterns
- 2) to determine and detect which morphological and climatic variables are the main drivers of the variation in the frequency and intensity of extreme rainfall events
- 3) to assess how the change of precipitation patterns may change the hydrological risk from floods and drought on a regional scale



The research will be carried out in the whole Italian Territory, however some particular case studies will be selected. One of these will be the Valtellina area in the Lombardy region.

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### **Research team and environment**

The research team will comprise professors from both the IUSS and the University of Pavia. Prof. Gabriella Petaccia, associate professor in Hydrology at the Department of Civil Engineering and Architecture and expert in flood propagation, will supervise the research, and Mario Martina, full professor in Hydrology at the IUSS and expert in risk modelling, will co-supervise the research. The activities will be carried out at both universities. This will provide a great opportunity to share ideas among colleagues and Ph.D. students

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### **Suggested skills for this research topic**

The candidate will have to work with a team, so good skills in collaborating in a group are needed. English is required, Italian is welcome.

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Improving the air quality by air cleaning and ventilation device: towards a sustainable environment**

**Reference Person:** Ricci Alessio (alessio.ricci@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze,  
Tecnologie e Società

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**Research Keywords:** aerosol concentration  
computational fluid dynamics (CFD)  
experimental measurements

**Reference ERCs:** PE8\_7 Mechanical engineering  
PE3\_14 Fluid dynamics (physics)  
PE8\_4 Computational engineering

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 9: Industry,  
Innovation and Infrastructure, GOAL 11: Sustainable Cities and  
Communities

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### **Description of the research topic**

Air pollution is estimated to cause 4.2 million premature deaths worldwide in 2016, and in 2019 almost 99% of the world's population breathed air exceeding the guideline limits. Pollution from traffic emissions as well as industries represent a serious treatment for the outdoor-indoor air quality and health of people. In particular, the aerosol particle dispersion induced by external atmospheric wind is regarded as one of the main air pollutants. Aerosol particles can survive for a certain time and travel through indoor air currents, especially in buildings not equipped with an efficient mechanical ventilation system (MVS). To improve the air quality, more efficient and greener MVS can be installed, however, most of the times this is not doable in a large range of buildings. Air cleanings (AC) could be adopted instead, however, it is still not sufficiently clear how MVS and AC can improve the indoor air quality by reducing the aerosol particle concentration induced by atmospheric winds. The goal of this project is to evaluate ventilation strategies that allow preventing risk exposure of people while reducing energy consumption. Scenarios including different workspaces (as office and classrooms) will be analyzed by laboratory measurements and simulations of computational fluid dynamics to understand benefits/limitations of AC and MVS. Recommendations towards a sustainable development of buildings and work activities will be proposed.

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### **Research team and environment**



The PhD candidate will carry out the research study at IUSS of Pavia, in the CARISMA group, in close collaboration with an international company leader in the field of air cleaning, pollutant reduction, mitigation and risk management for the health and security work. The student will be co-supervised by Dr. Alessio Ricci from IUSS (Italy), prof. Bert Blocken from Heriot-Watt University (UK) and an expert from the above-mentioned international company. The candidate will benefit from the extensive experience of these teams in climatology, measuring/modeling of atmospheric winds and aerosol concentration, air quality assessment, risk management of natural and anthropogenic hazards.

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### **Suggested skills for this research topic**

The candidate should have knowledge of computational fluid dynamics (CFD), finite volume method, data analysis and statistics. Programming skills in Matlab/Python/C++ and knowledge of signal processing could also be beneficial. Team working attitude and excellent knowledge of spoken and written English are highly required.

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### **Source of fundings**

DM630/2024 IUSS - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

PlasmaMade B.V.

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Sediment management in Alpine reservoir: strategies for optimal sediment flushing manoeuvres**

**Reference Person:** Righetti Maurizio (maurizio.righetti@unibz.it)

**Host University/Institute:** Libera Università di Bolzano / Facoltà di Scienze Agrarie

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**Research Keywords:** sediment flushing and environmental considerations  
sustainable hydropower production  
reservoir sediment management

**Reference ERCs:** PE3\_14 Fluid dynamics (physics)  
PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 7: Affordable and Clean Energy, GOAL 11: Sustainable Cities and Communities

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### **Description of the research topic**

This research project aims to study and analyzing different possible approaches of sediment management choosing the best option depending on the specific case study and considering the economic aspects of the different strategies. The research project will have as possible case studies hydropower plants located in the province of Bolzano and there will be a direct contact with the local hydro power plant operators.

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### **Research team and environment**

The PhD candidate will be part of the Faculty of Science and Technology at the Free University of Bozen-Bolzano. The research team he will join consists of various experts in the fields of hydraulics, hydropower, ecosystems and hydraulic safety. The team consists of experienced researchers. There are many opportunities for contact with external public and private entities and with local hydroelectric companies, which manage the main hydropower plants in South Tyrol.

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### **Suggested skills for this research topic**

The main skills required of the candidate are the willingness to participate in the working and interdisciplinary team, creating a relaxed environment but pursuing clear research aims. Furthermore, it is necessary that the candidate be willing to learn and to get to know and apply



new aspects from different disciplines,. From the point of view of technical skills, the candidate should have the basics of programming (Fortran and/or Matlab) or the use of at least 2D hydraulic modelling software (Basement, Flow-2D, etc.). He/she should show willingness to perform field sampling that will mainly concern flow rate measurements, substrate sampling and as support to habitat modelling.

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**Source of fundings**

Fondi dell'ente di afferenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Development of ocean and coupled data assimilation for ocean and climate applications**

**Reference Person:** Storto Andrea (andrea.storto@cnr.it)

**Host University/Institute:** Consiglio Nazionale delle Ricerche / ISMAR (Istituto di Scienze Marine)

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**Research Keywords:** Earth system prediction  
data assimilation  
neural networks

**Reference ERCs:** PE10\_8 Oceanography (physical, chemical, biological, geological)  
PE10\_14 Earth observations from space/remote sensing  
PE10\_21 Earth system modelling and interactions

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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### **Description of the research topic**

Data assimilation optimally combines geophysical observations with numerical models. Expanding the capabilities of current data assimilation systems to enable optimal ingestion of observation in the context of Earth System models (where several modeling components of the Earth system are coupled together) is of paramount importance for both climate reconstructions and short to long-range ocean and climate predictions.

Within this research topic, the PhD candidate will assess the potential of deep learning in data assimilation, with a particular emphasis to the ocean. S/he will investigate the possibility to integrate traditional data assimilation schemes with new algorithms inherited from deep learning to enhance the exploitation of the current observing networks, e.g. neural network-based observation and cross-component operators.

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### **Research team and environment**

The PhD research project will be jointly supervised with prof. Buizza from Scuola Superiore Sant'Anna - Pisa. Additionally, the Rome branch of CNR ISMAR provides computational facilities (HPC) and a vibrant environment with several colleagues expert in satellite oceanography and related disciplines, and several PhD students and postdocs.

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**Suggested skills for this research topic**

Linear algebra and statistics; machine learning; programming skills; background in Earth System physics (oceanography and atmospheric physics) is a plus.

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**Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Strengthening the space – science network for monitoring rapidly shifting landscapes**

**Reference Person:** Taramelli Andrea (andrea.taramelli@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze  
Tecnologie e società

**Research Keywords:** Land Use and Land Cover  
Earth Observation and Remote Sensing  
Southeast Asia

**Reference ERCs:** PE10\_14 Earth observations from space/remote sensing  
PE10\_4 Terrestrial ecology, land cover change

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate  
Action, GOAL 15: Life on Land

### **Description of the research topic**

The PhD project will contribute to the retrieval of EO based Essential Variables (EVs) with multisensory analytics able to exploit active and passive space-borne Remote Sensing (RS) in conjunction with extensive field measurements to develop Land Use – Land Cover thematic products associated to the concept of ‘Live Cover’. EO based scientific knowledge will bridge the geospatial analyses, ecology and geomorphology to the field measurements and will support novel applications in different sectors, enhancing the reliability of the existing EO – EVs product portfolio and ensuring the most effective use of data from multiple space-based missions. A synthesized understanding of the dynamics and interactions of the changes over the Southeast Asia can provide advanced insights into processes that may exacerbate impacts on the biophysical and socio-economic systems across multiple land use sectors from natural forests and wetlands to rural/agricultural regions, and to urban areas. Expected PhDs results are related to the provision of accurate spatial thematic products representing landscape fragmentation changes; the improvement in the knowledge on the use of passive optical sensors in synergies with active SAR data to overcome spatial, temporal and atmospheric limitations and new calibration and validation field spectral libraries.

### **Research team and environment**

The research team consists of principal investigator, senior researchers, post docs and PhD students from distinct cultural and knowledge backgrounds (e.g., geography, geology, geomorphology, natural sciences, ecology, engineering, social and communication sciences). The team operates in a stimulating and collaborative research environment, where equity, diversity, and inclusion are essential principles. Indeed, the research environment is



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a young and dynamic environment that offers opportunities for integration, professional development and personal rewards.

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**Suggested skills for this research topic**

Experience in environmental remote sensing analysis, in the use of earth observation data and experience in the use of programming languages would be an asset. A good knowledge of Italian or of another language would be an asset.

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**Source of fundings**

FFO IUSS

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

ESA-ESRIN (Cofin IRIDE) NASA JPL , the Ho Chi Minh City University of Natural Resources and Environment (HCMUNRE) and the Vietnam Academy of Science and Technology (VAST)

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Molecular simulation of nucleation and surface processes of atmospheric aerosol**

**Reference Person:** Tasinato Nicola (nicola.tasinato@sns.it)

**Host University/Institute:** Scuola Normale Superiore / Classe di scienze

**Research Keywords:** Computational chemistry  
Atmospheric reactivity, kinetics and spectroscopy  
Aerosol formation and chemistry

**Reference ERCs:** PE4\_18 Environment chemistry  
PE4\_12 Chemical reactions: mechanisms, dynamics, kinetics and catalytic reactions  
PE4\_13 Theoretical and computational chemistry

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 13: Climate Action

### **Description of the research topic**

One of the sources of uncertainty in understanding and predicting climate change is the radiative forcing (RF) of aerosols, due to their direct effects on the reflection and absorption of radiation and indirect effects on cloud properties. Overall, aerosols have been estimated to provide a global average negative RF, though local contributions and annual variations depend on many factors. While the thermo-kinetics of nucleating particles leading to aerosol is ruled by molecular interactions, nucleation is often included in Earth-system models by continuum bulk descriptors, thus limiting the ability of predicting their properties. Besides nucleation, the interaction between gas-phase chemistry and aerosol also involves heterogeneous reactions that in turn can affect the RF contribution of gas-phase species. In this context, this research aims at developing reliable computational models for (i) investigating the nucleation/growth of aerosol and their chemical-physical properties and (ii) understanding the mechanistic details of the heterogeneous reactions they can trigger. This work will involve the integration of statistical-sampling schemes and quantum-chemical evaluation of molecular properties and reactivity. Results are expected to improve our understanding of aerosol formation at a molecular-level, and lead to the revision of the thermochemical and kinetic parameters of aerosol-mediated chemical reactions included in the chemical modules of Earth-system models.

### **Research team and environment**

The research is carried out in the STARK group at Scuola Normale Superiore. STARK scientific activity aims at developing and applying theoretical-computational methodologies



for the structural and spectroscopic characterization and the study of the chemical reactivity and kinetics of molecular systems. The group manages the high-performance computing facilities of the Village Cluster, equipped 100+ servers, 3000+ CPUs and 300 TB of storage.

The team includes:

- Nicola Tasinato (Associate professor)
- Daniela Alvarado Jimenez (PhD)
- Ayda Badri (PhD)
- Pietro Maria Curzietti (PhD)
- Zoi Salta (Researcher)
- Aafia Sehar (PhD)
- Roberto Buizza (Full professor, Scuola Superiore Sant'Anna)

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### **Suggested skills for this research topic**

Basic knowledge in thermodynamics, spectroscopy, chemical kinetics, and quantum chemistry.

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### **Source of fundings**

DM629/2024 - M4C1 - Inv. 3.4 - Transizioni digitali e ambientali

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

to be defined

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Assessing centennial ocean and climate records to understand climate variability**

**Reference Person:** Yang Chunxue (chunxue.yang@cnr.it)

**Host University/Institute:** Consiglio Nazionale delle Ricerche / ISMAR (Istituto di Scienze Marine)

**Research Keywords:** ocean reanalyses  
centennial climate change  
climate variability

**Reference ERCs:** PE10\_3 Climatology and climate change  
PE10\_21 Earth system modelling and interactions  
PE10\_8 Oceanography (physical, chemical, biological, geological)

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **Description of the research topic**

Ocean and climate reconstructions combining numerical models and observations dating back to the early 1900s allow us to explore climate variability and changes back to the instrumented period. However, the uncertainty in early periods is large, due to the poor observational sampling and the uncertainty in the initial and boundary conditions.

In this project, the PhD candidate will assess in detail the robustness and uncertainty of the long-term ocean and climate signals from 'climate reanalyses' designed to cover these extended periods, and of ancillary datasets. In particular, s/he will evaluate the attribution of the signals to anthropogenic causes, natural climate variability, and/or other spurious factors, identify the main challenges in the development of long-term climate records, and assess alternative strategies to improve long-term climate datasets.

### **Research team and environment**

The PhD research project will be jointly supervised with prof. Buizza from Scuola Superiore Sant'Anna - Pisa. Additionally, the Rome branch of CNR ISMAR provides computational facilities (HPC) and a vibrant environment with several colleagues expert in satellite oceanography and related disciplines, and several PhD students and postdocs.

### **Suggested skills for this research topic**



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data analysis; background in climatology and/or related field; programming skills

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**Source of fundings**

Fondi dell'ente di appartenenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

Ente pubblico di Ricerca

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Statistical data science: Deep Learning for Modelling Risk measures and ESG scores**

**Reference Person:** Amendola Alessandra (alamendola@unisa.it)

**Host University/Institute:** Università degli studi di Salerno / Dipartimento di Scienze Economiche e Statistiche

**Research Keywords:** Financial risk measures and ESG scores

Multivariate time series

Deep learning

**Reference ERCs:** SH1\_6 Econometrics; operations research

PE1\_15 Generic statistical methodology and modelling

PE1\_19 Scientific computing and data processing

**Reference SDGs:** GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production

### **Description of the research topic**

The project aims to investigate the effect of ESG scores on stock returns and risk measures. The research will explore different deep-learning tools to model complex multivariate time-series data. Deep Neural Networks can infer high-order correlations in complex data with large volumes and dimensionality. Researchers have developed several models to improve the performance of DNN-based methods, including CCN, TCN, LSTM, GRU, DeepAR, and Transformers. Their complexity grows as larger models are developed, requiring large training sample sizes and computational resources. So, it is crucial to determine if the complexity brought in by DNN-based methods is a necessary price to pay for a gain in performance. We need a general comparison covering all families of methods to allow us to answer this question within the specific application of the research.

The novel strategy aims to model the relationship between ESG scores, returns and risk measures, addressing the following:

1. Multi-horizon forecasting , i.e. the prediction at multiple future time steps
2. Use various data sources, i.e. available information about the future, exogenous time series, and static metadata, without prior knowledge of how they interact.
3. Interpretability, i.e. identify (i) globally-important variables for the prediction



problem, (ii) persistent temporal patterns, (iii) significant events.

4. Implementation of the overall strategy in Python and R language to facilitate dissemination of the results.

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### **Research team and environment**

The Department of Economics and Statistics research team has a tradition of research in neural networks and deep learning, time series analysis, and financial econometrics models (parametric and nonparametric, univariate and multivariate) for risk analysis and portfolio management. The research team has published in international journals, including the International Journal of Forecasting, International Journal of Approximate Reasoning, Annals of Statistics, JASA, Econometrics and Statistics, Journal of Machine Learning Research, Journal of Nonparametric Statistics, Statistical Analysis and Data Mining, Soft Computing

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### **Suggested skills for this research topic**

The candidate is expected to have a good background in Statistics, including a good knowledge of data management, data analysis, inference, statistical modelling, and statistical learning. Good knowledge of programming, algorithms and data structures, including a high-level programming language like Python and/or R, is also necessary. Knowledge of machine learning, neural network modelling, and optimisation will be a plus. A background in Econometrics with good programming and computational skills will also be considered.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Noto Sondaggi Srl

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Innovative and sustainable measures for reducing water footprint in cities**

**Reference Person:** Aronica Giuseppe Tito (garonica@unime.it)

**Host University/Institute:** Università degli Studi di Messina / Dipartimento di Ingegneria

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**Research Keywords:** Water footprint  
Sustainable engineering  
Resilience and risk impact

**Reference ERCs:** PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
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

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### **Description of the research topic**

Freshwater scarcity is increasingly perceived as a global systemic risk. Europe is one of the most urbanized continents in the world. Besides the urbanization, climate change as well as demand for goods and services may influence water demand. In different cities, this impact will be different. Part of water is delivered by public water supply (public or private systems). Although the share of the household's water demand in total water abstraction can be relatively small, it is nevertheless often the focus of public interest, as it comprises the water volumes that are directly used by the population. Looking forward to the next few decades, it seems likely that there will be a significant expansion in urban water infrastructures. Universities can pave the path toward promoting water footprint reduction and sustainable management practices. Due to their missions and strategic societal role, universities have indeed a crucial role in inspiring decisive actions taken by individuals, private and public organizations, and businesses. For this purpose, the proposed research topic intends to focus for water footprint accounting of direct water use in urban area by studying innovative sustainable and multifaceted measures like rainwater harvesting, both at the household and the community level. The innovative approaches are intended to support urban water managers and, as such, it can include additional aspects usually disregarded in previous water footprint of cities.

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### **Research team and environment**

The research activity will take place at the Department of Engineering within the Research Group of Water Engineering and Hydrology coordinated by Prof. Giuseppe T. Aronica. The Group includes an Associate Professor, two post-doc researchers and five Ph.D students; the research activities cover research topics related to water resources management, sustainable urban drainage systems, water supply systems, hydrology and hydraulics. These activities are supported by many national and international research projects, consultancies for Public Agencies and Private Companies. The Research Group have strong collaborations with Italian and international Universities.

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### **Suggested skills for this research topic**

The ideal candidate should have a strong background in civil and environmental studies, specifically in the field of sustainable urban drainage and water supply systems, applied hydrology and hydraulics. Familiarity with programming languages such as MATLAB, R, C++ and commercial software as EPA-SWMM, EPANET, 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 a collaborative environment, with an inter-disciplinary approach. Finally, willingness to international mobility is required.

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### **Source of fundings**

Fondi dell'ente di afferenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Risk of Natural Hazards: Network Resilience and System Fragmentation**

**Reference Person:** Arosio Marcello (marcello.arosio@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze, Tecnologie e Società

**Research Keywords:** Graph and network theory

Systemic climate risk

Indirect climate impacts

**Reference ERCs:** PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics

PE6\_6 Algorithms and complexity, distributed, parallel and network algorithms, algorithmic game theory

SH1\_1 Macroeconomics; monetary economics; economic growth

**Reference SDGs:** GOAL 8: Decent Work and Economic Growth, GOAL 9: Industry, Innovation and Infrastructure, GOAL 13: Climate Action

### **Description of the research topic**

Assessing the risk of complex systems to natural hazards induced by climate and its change is an important and challenging problem. In today's intricate socio-technological world, characterized by strong urbanization and technological trends, the connections and interdependencies between exposed elements are crucial.

In this context of complex relationships, this PhD research aims to explore the potentiality of using graph theory in risk assessment of catastrophic hazards. It will progress on the activities at IUSS on the development of an innovative holistic approach (doi:10.5194/nhess-20-521-2020) that allows to analyze risk in complex systems based on a graph, the mathematical structure to model connections between elements. The approach suggests representing the system's exposed elements and their connections using a weighted and redundant graph (doi.org/10.3390/w13202830). This method evaluates network properties to emphasize the centrality of certain "critical" exposed elements.

The focus of the research will be to analyze how the percolation threshold and network fragmentation could be used to explain a system's resilience after disruption of extreme natural hazards (e.g., flood), distinguishing between the connected and fragmented phases and determining whether the system can maintain its structure or completely fail.



Furthermore, the graph will be used to propagate impact into the system, for not only direct but also indirect and cascading effects.

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### **Research team and environment**

IUSS mission is to provide advanced education to undergraduate, graduate students, fundamental and applied research. At IUSS, PhD candidates will find a multidisciplinary environment offering opportunities for developing academic and professional tools. The candidate will join the research centre on Climate change impAct studies for RiSk Management (CARISMA). The team is composed by STEM and Social scientists working in the prism of CC on data analysis/modelling of Earth and economic system processes; impact/risk assessment of extreme events. The ideal candidate will have experience with most of these topics: graph theory, statistical analysis, quantitative risk assessment and large dataset.

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### **Suggested skills for this research topic**

The ideal candidate will have experience with most of these topics: network analysis, quantitative risk assessment, statistical analysis and large dataset. The candidate should be passionate on research topics, hardworking, self-motivated, have an open-mindedness to look for new ideas of doing things and creativity in analytical thinking to extract meaning from sets of data. The candidate should be able to collaborate with the rest of the research team and effectively communicate to colleagues with different backgrounds. Competence on programming languages is required, as well as familiarity with tools and package for network and spatial analysis (e.g., iGraph, Gdal).

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None



*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Sustainable mobility determinants in urban contexts: demand and supply analysis and policy design**

**Reference Person:** Bergantino Angela Stefania  
(angelastefania.bergantino@uniba.it)

**Host University/Institute:** Università degli Studi di Bari Aldo Moro / Dipartimento di Economia, Management e Diritto dell'Impresa

**Research Keywords:** consumer preferences'  
Sustainable mobility  
Urban transport

**Reference ERCs:** SH7\_9 Energy, transportation and mobility  
SH1\_7 Behavioural economics; experimental economics; neuro-economics  
SH7\_7 Cities; urban, regional and rural studies

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 10: Reduced Inequality, GOAL 11: Sustainable Cities and Communities

### **Description of the research topic**

The change towards sustainable mobility poses numerous research challenges. The analysis of the actors involved – private and public operators (local authorities, Ministries, agencies), consumers, citizens – should focus on behavioral aspects and technology adoption propensity. The organization of supply and of the territories in which mobility takes place (urban, inner areas, peripheries, etc.) is relevant, together with governance, planning and financial issues. The research project aims to investigate how virtuous forms of mobility – active mobility, shared mobility, public transport services (traditional, on-demand, etc) – and innovative organizational forms and means of transport – private/collective unmanned vehicles and urban air mobility vehicles – can compensate for the environmental externalities associated with passenger and freight urban transport and favouring greater equity and inclusion focusing on two main aspects: (i) Analyse the factors that can support the transition to less impactful forms of urban transport and mobility; (ii) Define and assess elements to design public policies and incentives that enhance the transition. The candidate will be encouraged to adopt a multi-disciplinary approach and use a wide range of empirical techniques (discrete choice models, spatial econometrics, big data and machine learning techniques, agent-based, experimental methods).

### **Research team and environment**



The research team is led by Professor Angela S. Bergantino, a full professor of Applied Economics at the University of Bari. She has held and currently holds senior positions in the transport sector at the national and international levels. She is the spoke leader for the PNRR project "Territorial sustainability" (P9). The research team is composed of several researchers (specialized in transport economics, experimental economics, environmental economics, econometrics and tourism) and post-doc and PhD students in economics. The PhD candidate will use the laboratories and research infrastructures equipped with computers and statistical software specific to research activities.

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### **Suggested skills for this research topic**

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

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### **Source of fundings**

Fondi dell'ente di appartenenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Use of Satellite Data for Territorial Sustainability Analysis**

**Reference Person:** Bergantino Angela Stefania  
(angelastefania.bergantino@uniba.it)

**Host University/Institute:** Università degli Studi di Bari Aldo Moro / Dipartimento di  
Economia, Management e Diritto dell'Impresa

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**Research Keywords:** Urban sustainability  
  
Satellite data and machine learning  
  
Territorial analysis

**Reference ERCs:** SH1\_12 Environmental economics; resource and energy  
economics; agricultural economics  
  
SH7\_7 Cities; urban, regional and rural studies  
  
SH7\_10 GIS, spatial analysis; big data in geographical studies

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate  
Action

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### **Description of the research topic**

The proposed research project explores the use of advanced satellite data to analyze territorial sustainability, focusing in particular on the monitoring of infrastructures and their environmental and socio-economic impact. The main objective is to develop innovative and integrative methodologies that use Earth observation (EO) technologies to provide solutions and guidelines to land management problems. The project will therefore contribute to the valorisation of investments in the space sector with particular reference to the field of remote sensing applied to territorial development policies and to a more effective and sustainable management of natural resources and infrastructures. The ultimate objective of the project is to be able to develop a replicable model that can be adopted in other regions and contexts for similar studies of territorial sustainability. The candidate will be encouraged to adopt a multi-disciplinary approach and use a wide range of empirical techniques (discrete choice models, spatial econometrics, big data and machine learning techniques, agent-based, experimental methods).

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### **Research team and environment**

The research team is led by Professor Angela Stefania Bergantino, full professor of Applied Economics and Transport Economics at the University of Bari. The research team is also composed by prof. Andrea Morone, Stefano Galavotti, Gabriele Tedeschi, Mario Intini, Ada



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Spiru, Alessandro Buongiorno and Giulio Fusco (specialized in sharing mobility, transport economics, economics of public choices, experimental economics, environmental economics, econometric modelling, regulation, tourism) and several post-doc and PhD students in economics.

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**Suggested skills for this research topic**

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

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

Geophysical Applications Processing (GAP) srl

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Agent Based – Input Output models for risk and impact assessment of natural adverse events**

**Reference Person:** Caiani Alessandro (alessandro.caiani@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze, Tecnologie e Società

**Research Keywords:** Risk and Impact Assessment

Production Networks

Natural Disasters and Natural Hazards

**Reference ERCs:** SH1\_12 Environmental economics; resource and energy economics; agricultural economics

SH1\_1 Macroeconomics; monetary economics; economic growth

SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 13: Climate Action

### **Description of the research topic**

The candidate should contribute to the ongoing research at the CARISMA research centre dedicated to developing a hybrid Agent-Based Input-Output (AB-IO) model for the risk and impact assessment of adverse natural events associated with climate change. The selected candidate is expected to contribute to one or more of the following aspects:

- Refining the AB-IO model with particular reference to:
  - o The inclusion of investment and capital.
  - o The modeling of transport infrastructures and transportation costs and their impact on firms' and final consumers' purchasing choices.
  - o The inclusion of financial aspects.
- Reconstructing firm-to-firm production networks.
- Assessing the direct impacts of extreme events, with a focus on the impact on firms' operability and economic performance.
- Developing probabilistic regional scenarios for future climate and its impact on:
  - o The future occurrence of extreme weather events.
  - o The impacts on natural capital, ecosystems, and ecosystem services.



o Assessing the reliance of economic sectors on ecosystem services and the economic pressure exerted by different economic activities on natural ecosystems.

The research activity will be carried out at the CARISMA (Climate Change Impact Studies for Risk Management) research centre of IUSS.

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### **Research team and environment**

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.

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### **Suggested skills for this research topic**

Good quantitative and programming skills

Past experience/willingness to work in the fields of economic modelling/engineering modelling of risk and impacts/statistical and econometric models/network models.

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None





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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Economic dimension of the public policies and regulatory frameworks within the European Green Deal**

**Reference Person:** Frey Marco (marco.frey@santannapisa.it)

**Host University/Institute:** Scuola Superiore Sant'Anna - Pisa / Centro Interdisciplinare sulla sostenibilità e il clima

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**Research Keywords:** European Green Deal

Public policies

corporate strategies

**Reference ERCs:** SH2\_1 Political systems, governance

SH7\_6 Environmental and climate change, societal impact and policy

SH1\_10 Management; strategy; organisational behaviour

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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### **Description of the research topic**

We welcome projects addressing the economic dimension of the public policies and regulatory frameworks developed within the context of the European Green Deal, with particular attention on the engagement of the private sector. In particular, we encourage submissions concerning (i) the economic analysis and assessment of some key Green Deal policies and legislations, including those in the fields of energy, agri-food and biodiversity protection, (ii) the rationale, potential and shortcomings of the 'climate neutral' economic model promoted by the Green Deal, with a particular focus on the possibility to develop such model within the specific institutional and regulatory context of the European Union, (iii) the economic impact of the various transitions triggered by the Green Deal and the role played by public regulation in connection with corporate strategies. Submissions are expected to rely on genuine trans-disciplinarity and to combine strong theoretical foundations with an applied social sciences approach.

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### **Research team and environment**

The research will take place at the Interdisciplinary Center on sustainability and climate that is a transdisciplinary research area that operates in the fields of Social and Experimental sciences. The Centre fosters research, teaching, and the development of innovative solutions to issues related to sustainability and the pressing challenge of climate change. The



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co-supervisor of this research project is Prof. Chiti Full Professor of Administrative Law, his expertise are on the features and ways of functioning of the European Green Deal as a Regulatory Project aimed at ensuring the ecological transition of the European Union

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**Suggested skills for this research topic**

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

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

Ergo srl

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Business and human rights: A tool for assessing impacts**

**Reference Person:** Giuliani Elisa (elisagiuliani@gmail.com)

**Host University/Institute:** Università di Pisa / Dipartimento Economia e Management

**Research Keywords:** Business and human rights

**Reference ERCs:** SH1\_10 Management; strategy; organisational behaviour

SH1\_2 International trade; international management;  
international business; spatial economics

SH2\_4 Legal studies, constitutions, human rights, comparative  
law

**Reference SDGs:** GOAL 8: Decent Work and Economic Growth, GOAL 10: Reduced  
Inequality, GOAL 12: Responsible Consumption and Production

### **Description of the research topic**

Human rights violations by companies are at the core of the European Directive on Corporate Sustainability Due Diligence (CSDDD) which is an important piece of EU legislation that will require companies in the EU and third countries to conduct due diligence on environment and human rights in their operations, subsidiaries and value chains.

In light of these new regulatory scenarios, it appears useful to understand the exposure of multinational companies in the EU context to violations of human rights. One of the important issues is to quantify, in terms of number and severity, the phenomenon and measure the economic costs of such violations.

The objective of this research will be to quantify these impacts, considering a sample of large EU multinational companies and a time period of 20 years (2000-2020).

### **Research team and environment**

University of Pisa is a lively working environment. The candidate will be working in close connection with scholars from REMARC (<https://remarc.ec.unipi.it/>) and from the Horizon Europe project "Rebalance" (<https://rebalanceproject.org/>). They will be able to exploit connections and opportunities at UIL in Rome and at the European level with the European Trade Union Institute (ETUI); European Trade Union Confederation (ETUC); International Trade Union Confederation (ITUC), and the Trade Union Advisory Committee (TUAC) to the OECD.



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**Suggested skills for this research topic**

No specific skills

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

UIL Unione Italiana del Lavoro and/or related EU organizations

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Italy's Net-Zero Roadmap: Sectoral Decarbonisation Strategies Aligned with Paris Agreement & EU Goals**

**Reference Person:** Luzzati Tommaso (tommaso.luzzati@unipi.it)

**Host University/Institute:** Università di Pisa / Dipartimento di Economia e Management

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**Research Keywords:** Zero net emissions roadmap  
Recent EU trends assessment  
Sectoral decarbonization strategies

**Reference ERCs:** SH7\_5 Sustainability sciences, environment and resources  
SH3\_8 Social policies, welfare, work and employment  
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

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### **Description of the research topic**

The project aims to monitor and map Italy's progress toward achieving net zero emissions (NZE), specifically focusing on sectoral levels. Through an extensive literature review encompassing Italy and other European countries, the candidate will analyze and select indicators crucial for assessing recent trends and the effectiveness of policies aimed at NZE, with a particular emphasis on the "hard to abate" sectors.

The precise scope of the research focus will be determined collaboratively by the candidate and the tutoring team. A preliminary proposal outlining the proposed research direction must be developed within the written project, which will be submitted during the application process. Additionally, the proposal will be briefly presented during the oral interview stage for shortlisted candidates.

Useful references:

Rockström, J., Gaffney, O., Rogelj, J., Meinshausen, M., Nakicenovic, N., & Schellnhuber, H. J. (2017). A roadmap for rapid decarbonization. *Science*, 355(6331), 1269-1271.

Sun, T., Ocko, I. B., Sturcken, E., & Hamburg, S. P. (2021). Path to net zero is critical to climate outcome. *Scientific reports*, 11(1), 22173;



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Barbabella, A., Montanini, C., Ferruccio V. (2023). PROPOSTA DI ROADMAP PER LA NEUTRALITA' CLIMATICA DELL'ITALIA in vista della pubblicazione della proposta di Piano. Italy for Climate.

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### **Research team and environment**

The research will be conducted at REMARC - DEM - University of Pisa. The expertise of Prof. D'Alessandro and collaborators in IAM will complement my knowledge in SD, multicriteria assessment, and composite indicators. The student will benefit from the diverse competences at two interdisciplinary Research Centers on sustainability at the University of Pisa (Energia per lo Sviluppo Sostenibile, CIRESS; Studio degli Effetti del Cambiamento Climatico, CIRSEC). Part of the research will be carried out at the Sustainable Development Foundation, which focuses on climate neutrality, energy transition, circular and regenerative economy, green cities, sustainable mobility, and natural capital.

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### **Suggested skills for this research topic**

Knowledge and experience in Environmental studies; skills in analysis of data and ability in navigating databases, in particular in the field of climate change and emissions. Acquaintance with micro- and macroeconomics, particularly Industrial Organisation and Economic/Social Policies.

Knowledge of Italian is not required, but might be useful at the beginning of the internship.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

FONDAZIONE PER LO SVILUPPO SOSTENIBILE

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **The impact of climate change on short/long-term measures to improve the supply-demand**

**Reference Person:** Noto Leonardo Valerio (leonardo.noto@unipa.it)

**Host University/Institute:** Università di Palermo / Dipartimento di Ingegneria

**Research Keywords:** Strategic infrastructure planning

Climate changes

Cost-benefit analysis

**Reference ERCs:** PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage

PE10\_3 Climatology and climate change

SH1\_12 Environmental economics; resource and energy economics; agricultural economics

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 13: Climate Action

### **Description of the research topic**

Enforcement of the adaptation paradigm is already resulting in the introduction of several strategies to adapt to climate change, as demonstrated by recent European regulation. These strategies materialize as new limits on water losses in water infrastructure, more binding constraints on reuse, etc. As such, they mostly concern already existing infrastructure and will have in the long term a pervasive, lasting positive effect on the water supply - demand balance. On the other hand, there are also other investment types, consisting of large, strategic infrastructure, such as new desalination plants, reservoirs, inter-basin transfers. Given their non-negligible capital and environmental costs, these investments are often in the spotlight and hence need better databases and improved tools to be assessed. More in general, improved methodologies are needed to coordinate and optimize the different type of measures and investments to enhance the supply-demand balance at a river basin district scale considering the deep uncertainties associated to climate, technology, and socio-economic change.

Applying for this research project the candidate will get in touch with theory and practice of investment appraisal and will explore the quantitative methods for planning under deep uncertainty. They will be involved in hydrologic modelling of water availability and demand under climate change and may also develop new skills in modelling water resources systems to conduct simulation studies.



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### **Research team and environment**

The research activity will be held at the University of Palermo (Italy) and will be coordinated by Prof. Leonardo V. Noto, full professor of hydrology. His expertise ranges from hydrological modeling, ecohydrology, to climate change aspects. The team is also composed of researchers, post-doc, and Ph.D. students that have a great experience in the above topics. Particularly, Ph. Doctor Claudio Arena, researcher, has a long-standing experience for risk-based appraisal methodologies of investments to mitigate droughts and water resources system modelling. The candidate will thus find an enthusiastic team working on the various aspects of these challenging, multidisciplinary issues.

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### **Suggested skills for this research topic**

The candidate will need to have some knowledge about hydrological processes, water supply infrastructure and economics. Other required skills regard the knowledge of the mostly known programming languages, such as Python, Matlab, and the software QGIS.

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### **Source of fundings**

Fondi dell'ente di afferenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Legal comparative perspectives on food waste for a responsible production and consumption of food**

**Reference Person:** Ricci Carola (carola.ricci@unipv.it)

**Host University/Institute:** Università degli Studi di Pavia / Dipartimento di Scienze Politiche e Sociali

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**Research Keywords:** Food waste and loss prevention  
Responsible production and consumption of food  
Sustainability

**Reference ERCs:** SH2\_4 Legal studies, constitutions, human rights, comparative law  
SH2\_5 International relations, global and transnational governance  
SH3\_9 Poverty and poverty alleviation

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 12: Responsible Consumption and Production, GOAL 17: Partnerships to Achieve the Goal

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### **Description of the research topic**

Moving from the international legal framework, where a uniform definition of food loss and waste is lacking, the research project aims at identifying best practices of food waste prevention, including food donation, through a comparative analysis of the approaches adopted at the regional (EU) and national levels (including also non-EU States).

In fact, in view of the possible approval of amendments to the Waste Directive (COM proposal dated July 2023), which would impose binding reduction objectives for Member States, the research project foresees a comparison among the EU countries which have already introduced measures to reduce food loss and waste and non-EU States (i.e. developing countries that adopt prevention/reduction policies) aimed, on the one hand, at reducing the environmental impacts of food waste, and, on the other, at preventing the loss of nutritional value and access to food from a food security perspective. In this vein, a specific focus will be given to the impact on/of local/urban food policies.

The choice of the domestic legal systems and local/urban food policies to be analysed will be made on the basis of common agreement between the PhD candidate and the supervisor(s), based also on the interest and skills of the selected candidate.

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### **Research team and environment**

The PhD candidate will be introduced in a research team composed of scholars of international law and comparative law, who closely work with the reference person within the framework of two research projects on sustainability and responsible production and consumption of food funded with Next Generation EU funds, and namely within the 'ONFoods' project (<https://onfoods.it/>). He/she will profit from contacts with the interdisciplinary network of ONFoods researchers, from the University of Pavia and partner Universities, as well as from the supervisor's established contacts with foreign research institutes specialized in food law and sustainability.

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### **Suggested skills for this research topic**

The candidate must have a relevant degree from the Social Sciences (Law, Political Science, International Relations etc.) and a strong legal background in international, EU and/or comparative law. The knowledge of foreign languages other than English would be an asset to effectively conduct comparative research.

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### **Source of fundings**

FFO IUSS

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Gender equality and climate resilience in developing countries**

**Reference Person:** Rosso Anna Cecilia (annacecilia.rosso@uninsubria.it)

**Host University/Institute:** Università degli Studi dell'Insubria / Dipartimento di Economia

**Research Keywords:** Climate change resilience

Gender Equality

Programme evaluation

**Reference ERCs:** SH1\_3 Development economics; structural change; political economy of development

SH7\_6 Environmental and climate change, societal impact and policy

SH7\_3 Population dynamics: households, family and fertility

**Reference SDGs:** GOAL 1: No Poverty, GOAL 5: Gender Equality

### **Description of the research topic**

Billions of rural people rely on small-scale farming for an income, but climate change and the degradation of natural resources threaten the ecosystems that they depend on. Despite being at the front lines of the climate crisis, smallholder farmers receive just 0.8 per cent of global climate finance. While women produce up to 80% of the food in low- and middle-income countries, deep-rooted gender-based discrimination means they have limited access to resources to build resilience to climate change. A comprehensive approach that delivers climate finance to women farmers while changing gender disparities is needed. The project will be developed in collaboration with the International Organization IFAD (International Fund for Agricultural Development), under the initiative Gender Transformative Mechanisms (GTM) in the context of Climate Adaptation, considering – as case study – the gender team of IFAD. The GTM is an IFAD facility supporting women and men benefitting from IFAD with investments to promote gender transformative programming while building their resilience capacities. The Ph.D. candidate will generate robust empirical evidence on the effects of gender equality-climate resilience derived from the implementation of GTM interventions in pilot projects in Burkina Faso, India and Ethiopia. The candidate will be involved in quantitative and qualitative research on GTM impacts on its intended beneficiaries.

### **Research team and environment**

The PhD student will work under the supervision of prof. Anna C. Rosso and Elena Maggi, from the Department of Economics of University of Insubria, that has been promoted by the University and Research Ministry as Department of Excellence 2023-2027. This department



offers a Ph.D. in Methods and Models for Economic Decisions (MMED), where Anna C. Rosso and Elena Maggi are members of the board. The PhD student will have the chance to: first, collaborate with other PhD students; second to network with international scientists that the PhD board regularly invites to workshops and to give lectures. The candidate will work with the researchers of IFAD, with an internship of at least 6 months.

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### **Suggested skills for this research topic**

The candidate should hold at least a Master's degree in economics or related field (e.g. agricultural economics, development economics, natural resource economics, rural development economics), or a strong quantitative interdisciplinary program in which economics are included. Knowledge in natural resource economics, demonstrated capacity to integrate gender equality, rural women's empowerment in the context of agriculture and economics concepts are considered extra merit. Excellent written and oral communication skills in English are required. Working knowledge of French is preferable but not mandatory.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

IFAD- International Fund for Agricultural Development

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*Curriculum: CU2 - Socio-Economic Risk and Impacts*

## **Preventing climate change: analysing the role of Universities**

**Reference Person:** Salomone Roberta (roberta.salomone@unime.it)

**Host University/Institute:** Università degli Studi di Messina / Dipartimento di Economia

**Research Keywords:** Climate change  
Carbon footprint  
Life Cycle Assessment

**Reference ERCs:** SH7\_6 Environmental and climate change, societal impact and policy  
SH1\_10 Management; strategy; organisational behaviour  
SH1\_9 Industrial organisation; entrepreneurship; R&D and innovation

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **Description of the research topic**

Universities can pave the path toward promoting carbon emissions reduction and sustainable management practices. Due to their missions and strategic societal role, universities have indeed a crucial role in inspiring decisive actions taken by individuals, private and public organizations, and businesses. Furthermore, universities can be considered effective pilot cases well describing the complexities of the climate transition, because they represent multifaceted systems involving different populations with various needs/expectations and multiple interacting activities and operations. Globally, many universities have adopted measures to limit the effects of their actions on the environment, become more sustainable in their operations, as well as carbon neutral. For this purpose, a growing number of universities are reporting GHG emissions as a means to measure sustainability and develop climate action plans with emissions reduction goals.

Research proposals may investigate the ways universities are experiencing the measurement of the organizational carbon footprint, and how universities can enhance their positive impact on climate change. The proposal should also provide contributions to a better understanding of the potential of universities to prevent climate change in cities. The proposal should address the role of the university and the challenges facing it in a multi-scalar way.

### **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 Acrobat 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.

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### **Suggested skills for this research topic**

We are looking for candidates with: a background in Environmental Management and Assessment; good command of written and verbal English; proficiency in advanced computer skills included in Microsoft Office 365 Business; ability and willingness to work in collaborative, multi-disciplinary environment; documented experience of both quantitative and qualitative research work; availability to stably work in Messina and 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.

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### **Source of fundings**

Fondi dell'ente di appartenenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU3 - Technology and Territory*

## **Next-generation photoelectrocatalysts for CO<sub>2</sub> fixation**

**Reference Person:** Alessandri Ivano (ivano.alessandri@unibs.it)

**Host University/Institute:** Università degli Studi di Brescia / Dipartimento di Ingegneria dell'Informazione

**Research Keywords:** CO<sub>2</sub> capture  
CO<sub>2</sub> transformation  
Photoelectrocatalysis

**Reference ERCs:** PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
PE4\_4 Surface science and nanostructures  
PE5\_6 New materials: oxides, alloys, composite, organic-inorganic hybrid, nanoparticles

**Reference SDGs:** GOAL 7: Affordable and Clean Energy

### **Description of the research topic**

This research proposal aims to address these challenges by investigating next-generation photoelectrocatalysts for CO<sub>2</sub> conversion. Leveraging advanced materials synthesis techniques, such as nanotechnology and heterostructure engineering, the project will design and fabricate tailored photoelectrocatalysts with enhanced properties for efficient CO<sub>2</sub> reduction. Fundamental insights into the reaction mechanisms and surface interactions will be gained through comprehensive characterization techniques, including spectroscopy, microscopy, and electrochemical analysis.

Furthermore, the proposed research will explore innovative strategies for improving the charge transfer kinetics and surface reactivity of photoelectrocatalysts, thereby enhancing their overall performance. By systematically optimizing catalyst composition, structure, and morphology, this study aims to achieve breakthroughs in CO<sub>2</sub> conversion efficiency and selectivity, ultimately contributing to the development of sustainable energy and environmental solutions.

Through a multidisciplinary approach integrating materials science, electrochemistry, and chemical engineering, this PhD research seeks to advance the fundamental understanding of photoelectrocatalytic CO<sub>2</sub> conversion and pave the way for the design and implementation of next-generation photoelectrocatalysts with practical relevance for a carbon-neutral future



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### **Research team and environment**

The group of Chemistry and Sustainable Materials at the University of Brescia specializes in the design and fabrication of nanostructured materials for applications in catalysis and environmental remediation. These materials are capable of synergistically leveraging the combination of nanoscale light management and surface chemistry.

The group activities are characterized by a truly multidisciplinary approach integrating materials science, electrochemistry, applied physics and chemical engineering.

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### **Suggested skills for this research topic**

chemistry; catalysis; applied physics; chemical engineering; materials science

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

A2A Life Company SpA

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*Curriculum: CU3 - Technology and Territory*

## **Innovative processes for managing the natural presence of asbestos in a new large infrastructure**

**Reference Person:** Belluso Elena (elena.belluso@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Scienze della Terra

**Research Keywords:** Managing asbestos risk in digs for infrastructures

Infrastructure environmental impact minimization

Sustainable mobility in urban areas

**Reference ERCs:** PE10\_10 Mineralogy, petrology, igneous petrology, metamorphic petrology

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

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production

### **Description of the research topic**

The project will design innovative advanced processes to manage the natural occurrences of asbestos and fibrous minerals during the design and realization of a large road infrastructure that supports sustainable mobility in an urban context. This doctoral project will directly contribute to the reduction of the carbon footprint linked to the realization of the large road infrastructure "Gronda di Genova" through the development of advanced and innovative technological processes for the mitigation of the risk from asbestos and other natural mineral fibres and the related impact on the community, with a view to minimizing the environmental footprint of the work. The project has two phases: 1) the PhD candidate will develop high TRL methods and technologies for maximizing the reuse of excavation materials and bentonite fluidifiers (Na and Ca-bentonite) which will be used in the executive phase of the project. The project will assure sustainability of the proposed production processes, integrating the recycling and regeneration activities of materials in a zero-waste process. In phase 2, the candidate will aim at the development of new technologies for reducing the impact generated by the excavated rocks which are contaminated with asbestos and other mineral fibres, pursuing a high-risk, high-gain research objectives at a lower TRL. The candidate will take advantage of the strong commitment of the industrial partner (ASPI) in producing



technologies and methodologies in civil engineering, road safety and environmental sustainability.

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### **Research team and environment**

The PhD candidate will be supported by researchers from the Interdepartmental Centre for Studies on Asbestos and Other Toxic Particulate of the University of Turin - Italy; <https://www.centroscansetti.unito.it>. The research team has a highly multidisciplinary composition and maintains strong global connections with academic and industrial partners. The strong support from Autostrade per l'Italia SpA (ASPI), where the candidate will spend at least 6 months, contributes to the project's effectiveness and implementation. Several external partners are involved, including the Pittsburgh Mining Research Division of the National Institute for Occupational Safety and Health (US NIOSH), the Institute of Geosciences and Earth Resources (IGG) of the National Research Council of Italy (CNR).

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### **Suggested skills for this research topic**

Field work and laboratory skills; fundamentals of inorganic chemistry and petrological sciences; environmental engineering; elements of sampling methodology; excellent English is mandatory; Master's degree in Chemistry, Geology, Environmental Engineering or similar academic degrees. Experience in optical and electron microscopy is a plus.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Autostrade per l'Italia S.p.A.

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*Curriculum: CU3 - Technology and Territory*

## **SUSTAINABLE BIOBASED POLYMERIC COATINGS FROM NON-EDIBLE OILS**

**Reference Person:** Bongiovanni Roberta Maria (roberta.bongiovanni@polito.it)

**Host University/Institute:** Politecnico di Torino / Dipartimento di Scienza Applicata e Tecnologia

**Research Keywords:** PHOTOINDUCED POLYMERISATION

SUSTAINABLE COATINGS

NMR CHARACTERIZATION

**Reference ERCs:** PE5\_15 Polymer chemistry

PE4\_15 Photochemistry

PE11\_4 Engineering of polymers and plastics

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure

### **Description of the research topic**

The project concerns biobased polymeric coatings obtained from non-edible oils through photoinduced click reactions. Research aims are a) preparation of sustainable coatings from biomass through ecofriendly, solvent free reactions induced by light b) study of the coatings by NMR spectroscopy to determine their fine structure and correlate it with their properties. The expected outcomes of the project are: 1) obtaining sustainable coatings: given the concerns on waste recycling and availability of raw materials, the reactions developed will be applied on waste cooking oils 2) understanding polymer architecture by spectroscopic analyses and establishing structure-property relationships: polymer architecture manipulation will be used as a design principle for novel materials. To implement the research, polymers are prepared by thiol-ene chemistry, employing pristine unsaturated oils and multifunctional thiols. Also azide-alkyne reactions, which have not been explored in oleo-chemistry, are studied: novel oils derivatives with azide groups and homologues with triple bonds are synthesized on purpose by addition reactions on epoxidized oil. Properties of the thiol-ene and azide-alkyne networks (e.g., thermal and mechanical properties) are characterized. While polymers morphology and topology are investigated by solid-state NMR, to elucidate their chemical architecture.

### **Research team and environment**

The candidate will develop the project in the PolyMat team, focussed on sustainable thermoset polymers & composites, in the form of films, fibers and 3D printed objects. Innovation to the field is brought by the choice of chemistries allowing reduction of energy



consumption (photoinduced processes), applying the Green Chemistry guidelines (e.g., eliminating solvents, using water-based systems, replacing toxic/hazardous chemicals with safer ones), the reversibility of the curing to recycle the polymeric network, the choice of biobased and/or recycled precursors and . PolyMat is a multicultural group (6 international PhD), with long experience in facilitating integration of foreign students.

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**Suggested skills for this research topic**

M.Sc. in Chemistry, Materials Science, Materials Engineering are preferred. Skills concerning synthesis and characterisation of polymers are required.

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**Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU3 - Technology and Territory*

## **Development of innovative solutions for the circularity of self-adhesive papers**

**Reference Person:** Bonomo Matteo (matteo.bonomo@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Chimica

**Research Keywords:** Adhesive Coatings

**Reference ERCs:** PE5\_3 Surface modification

PE5\_15 Polymer chemistry

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production

### **Description of the research topic**

The project aims to develop innovative solutions to increase the circularity of release liners used in the self-adhesive paper sector. In particular, the development of alternative surface treatments with release properties, with the aim of replacing silicone and consequently improving the recyclability of paper liners (today these materials must be disposed of as undifferentiated waste, negatively impacting the sustainability of the product). In addition to optimizing paper surface treatments, a collateral objective will concern the development of sustainable solutions capable of reducing the Carbon Footprint (CFP) of release liners and/or developing new functions of the latter.

These aspects can be considered as key principles of the Circular Economy, which fully falls within the themes of the European strategy and the PNRR, as a further element of transition towards a green economy. Furthermore, they fit perfectly inside the KET (advanced materials).

### **Research team and environment**

The research team is characterized by a high multidisciplinary and internationalization level (especially at the Ph.D. and Post Doc level). The research team is composed by one Full Professor (Industrial Chemistry), one Associate Professor (Organic Chemistry), three assistant professor, six post-doc researchers and more than 15 Ph.D. students. The team has a plethora of different scientific interaction with both (inter)national research group and companies.

### **Suggested skills for this research topic**

The candidate should show a multidisciplinary background at the interface between polymer, organic and industrial chemistry; moreover, a very good knowledge of English is required



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considering the international nature of the company. A proactive and multifacet personality is welcomed to be part of the MOF research group.

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

AHLSTROM-MUNKSJÖ ITALIA SPA

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*Curriculum: CU3 - Technology and Territory*

## **Development of selective catalysts for a sustainable carbon chemistry**

**Reference Person:** Bordiga Silvia (Silvia.Bordiga@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Chimica

**Research Keywords:** catalysis  
C-H activation  
Metallorganic Frameworks

**Reference ERCs:** PE5\_6 New materials: oxides, alloys, composite, organic-inorganic hybrid, nanoparticles  
PE4\_10 Heterogeneous catalysis  
PE5\_9 Coordination chemistry

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

### **Description of the research topic**

Mankind is able to design chemical processes which convert raw materials into desired products at high rates and yields.. Nature, on the other hand, has developed very precise catalytic processes via the evolution of enzymes, which are however costly and fragile, and have reaction rates too slow for industrial use. The vision here is to develop new catalysts taking advantages from what discovered in the first three years of the CUBE projects creating novel man-made catalysts which convert simple chemicals into products at higher added value, at high yields and turn-over rates. The chemical conversion of carbon in all its oxidation states, spanning from the simplest to more complex molecules (C1-C6 entities, will be the focal point of this project that aim to the development of advanced new materials for selective catalysis. The PhD candidate will develop novel catalytic materials to tackle the most crucial and challenging reactions of all, involving the activation of C-H in simple hydrocarbon, using not only thermal but also photo ed electro-activation. Till now a considerable variety of molecular units mimicking the active sites discovered in the enzymes have been discovered, tested and compared with other species developed in other technological area (i.e. redox mediators in photovoltaic cells). These species have been then included in sophisticated tridimensional scaffold where the reactive moieties have been included into robust hybrid network based on Zr and Ce sites.



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**Research team and environment**

The team is an international network with expertise in Synthesis, Characterisation and testing.

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**Suggested skills for this research topic**

Organic synthesis, coordination chemistry, spectroscopies

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**Source of fundings**

DM629/2024 - M4C1 - Inv. 3.4 - Transizioni digitali e ambientali

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

Max Planck

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*Curriculum: CU3 - Technology and Territory*

## **Development of green methods for the continuous production of high-value-added molecules**

**Reference Person:** Cavazzini Alberto (cvz@unife.it)

**Host University/Institute:** Università degli Studi di Ferrara / Dipartimento di Scienze Chimiche, Farmaceutiche ed Agrarie

**Research Keywords:** continuous bioreactors and green purification

**Reference ERCs:** PE4\_5 Analytical chemistry

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 9: Industry, Innovation and Infrastructure

### **Description of the research topic**

The research project falls within the scope of improving environmental sustainability, green chemistry/circular processes, particularly with regard to chemical processes for the production of various chemicals. The aim is to train an expert in the green transition with a solid cultural background in the so-called "green skills", which specifically include the knowledge necessary to assist in the conversion of existing processes into new sustainable and technologically advanced processes that guarantee high quality standards with low environmental impact (use of green solvents, energy savings, automation, etc.). These skills also include the principles of the circular economy that the PhD student will acquire through collaboration with the research group of Prof. Massimiliano Mazzanti from the Department of Economics and Management of the University of Ferrara, coordinator of the inter-University center SEEDS ([www.sustainability-seeds.org](http://www.sustainability-seeds.org)). In particular, this doctorate intends to study the feasibility of a biotechnological process easily scalable to production scale, which, from the continuous production of bioactive molecules (proteins and peptides, especially), allows to obtain the target active ingredients at a purity level suitable for pharmaceutical purposes with always continuous separation systems (Multicolumn Countercurrent Solvent Gradient Purification, MCSGP).

### **Research team and environment**

The PhD candidate will be part of a dynamic research group consisting of young, internationally recognized researchers working in the fields of separation science and food chemistry. The team possesses a combination of theoretical knowledge and practical expertise in each step of analytical workflows, from sample preparation to data evaluation. The research group's activities cover a wide range of samples, including (bio)pharmaceuticals and petrochemicals as well as complex mixtures derived from food or plants. The group employs various chromatographic approaches, from targeted to untargeted methods, and utilizes advanced analytical techniques such as multidimensional GC or LC.



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**Suggested skills for this research topic**

Analytical chemistry expertise

basic knowledge of chromatographic processes

principles of biocatalysis

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**Source of fundings**

Fondi dell'ente di appartenenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU3 - Technology and Territory*

## **Photoelectrocatalytic artificial-leaf devices for sustainable synthesis of chemicals and fuels**

**Reference Person:** Centi Gabriele (centi@unime.it)

**Host University/Institute:** Università degli Studi di Messina / Dipartimento di Scienze Chimiche, Biologiche, Farmaceutiche ed Ambientali

**Research Keywords:** artificial leaf devices  
photoelectrocatalysis  
solar fuels and chemicals

**Reference ERCs:** PE4\_10 Heterogeneous catalysis  
PE8\_2 Chemical engineering, technical chemistry  
PE4\_15 Photochemistry

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities

### **Description of the research topic**

The research aims to develop artificial leaf-type devices for the sustainable and direct production of chemicals and fuels using sunlight, starting from small molecules (N<sub>2</sub>, CO<sub>2</sub> and H<sub>2</sub>O). These devices find applications from resilient uses, such as in net-zero communities or valleys, to advanced applications, such as in space. This objective requires a holistic system approach, which integrates fundamental applied knowledge in chemistry, engineering, physics, industrial technologies and other aspects. The study is crucial to develop key technologies to accelerate the transition to the replacement of fossil fuels and close the carbon cycle. Artificial leaf-type devices are the frontier of research in this area aimed at producing solar fuels that overcome the many limitations of current PtX-type technologies to produce e-fuels. The Doctorate integrates with a very active research group that leads these activities on a world scale. The PhD will operate in a highly stimulating international environment, working in collaboration with many other researchers and companies. In parallel, the PhD will improve his/her knowledge and competencies for innovative strategies for the renewable energy value chain, valorising leadership & communication skills as well as enforcing the capabilities to develop and manage international research projects.

### **Research team and environment**

The Doctorate will operate at the CASPE Centre (Laboratory of Catalysis for Sustainable Production and Energy; <http://ww2new.unime.it/catalysis/>) - Dept ChiBiofarAm/UniME. The



centre has about 600 m<sup>2</sup> of laboratories, fully equipped with equipment for the preparation, characterisation and testing of catalysts, and where operate about 8 permanent scientists and 20-30 non-permanent researchers, including many international PhDs. The centre has many established international collaborations. The research activities focus on catalysis, including photo-, electro and plasma catalysis and related processes. The main research areas are solar-driven chemistry and energy, and circular economy.

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### **Suggested skills for this research topic**

The research integrates fundamental studies on materials and mechanistic aspects with the technological and engineering development of the devices. Specific techno-scientific capabilities are integrated with educational aspects to promote human capabilities for proper management and strategic direction of energy and use of solar resources. These activities require combining fundamental and technological knowledge to additional skills in terms of system analysis, multidisciplinary integration, team working, dissemination and communication, planning a sustainable energy system, and managing the complex interconnections.

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### **Source of fundings**

DM629/2024 – M4C1 – Inv. 4.1 – Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU3 - Technology and Territory*

## **Advanced Smart Sustainable manufacturing-workers training systems**

**Reference Person:** Dassisti Michele (michele.dassisti@poliba.it)

**Host University/Institute:** Politecnico di Bari / DMMM

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**Research Keywords:** sustainable manufacturing  
training  
artificial intelligence

**Reference ERCs:** PE8\_9 Production technology, process engineering  
PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
PE8\_10 Manufacturing engineering and industrial design

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure

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### **Description of the research topic**

The research project aims to develop safer, more efficient and sustainable work environments in the manufacturing sector through the implementation of adaptive training and retraining programs based on the study of the attentional and cognitive load of workers. The main objective is to identify and mitigate gaps in current training practices, proposing an innovative approach to training based on adaptivity. Adaptive training means integrating advanced technologies and a personalized approach based on real-time monitoring of workers' cognitive and motivational loads in order to deliver adaptive training and/or retraining programs to improve workers' skills.

The goal is to create a highly personalized, intuitive, and accessible learning environment, taking into account the specific cognitive and learning needs of workers. The platform model will extend its customized methodology based on artificial intelligence and machine learning to the needs of workers, addressing the unique challenges that may arise in this situation.

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### **Research team and environment**

1 Full professor; 2 Associate professors; 2 Adjuncted Researcher;

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**Suggested skills for this research topic**

ustainable manufacturing; product life-cycle management; eco-sustainability; Industrial and Manufacturing Engineering;

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**Source of fundings**

Fondi dell'ente di appartenenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU3 - Technology and Territory*

## **Eco-Friendly and Sustainable Systems for Leather Tanning**

**Reference Person:** Gaeta Carmine (cgaeta@unisa.it)

**Host University/Institute:** Università degli Studi di Salerno / Dipartimento di Chimica e Biologia "A. Zambelli"

**Research Keywords:** Leather Tanning  
Sustainable Processes  
Bio-Based and Eco-Friendly Tanning Processes

**Reference ERCs:** PE5\_17 Organic chemistry  
PE5\_16 Supramolecular chemistry

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production

### **Description of the research topic**

The project aims to develop innovative biobased and eco-friendly derivatives for leather tanning. Specifically, our goal is to create derivatives with antimicrobial properties as additives for tanning, and to develop environmentally friendly systems with tanning capabilities.

The tanning industry plays a crucial role in Italy. Tanning involves a series of chemical processes that make leather non-putrescible and stable. Basic chromium sulfate,  $\text{Cr}(\text{OH})\text{SO}_4$ , is the most widely used tanning agent. ISTAT data indicate that for the production of Chromium (III) salts necessary for leather tanning processes, Italy imports tens of thousands of tons of hexavalent chromium salt (Cr VI). This fact highlights a significant environmental issue: the high environmental risk associated with the transport and storage of the raw material. From the above, it is clear how important it is to study alternative tanning processes to the use of Chromium (III).

In this PhD project, we propose new research aimed at developing new classes of tannins and other tanning additives that are metal-free and/or derived from biomass, with the goal of reducing and/or eliminating the use of Cr(III) salts in tanning processes.

Particular attention will be focused on the use of environmentally friendly polyphenols and other organic molecules derived by biomass.

The project will be financially supported and conducted in collaboration with FGL International SPA from Santa Croce sull'Arno (PISA).



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### **Research team and environment**

Composition of the research team: n° 2 associate professors, n° 2 postdoc students, n° 3 PhD student. We have the opportunity to conduct the research entirely in-house by using the facilities provided by University of Salerno, or in collaboration with industrial research laboratories for application studies. On this topic, our group has active collaborations with foreign universities, research centers and chemical companies.

FGL International Stanta Croce sull'Arno (PISA).

National Research & Development Institute for Textiles and Leather, ICPI Research Division, Bucharest, Romania, prof. Elena Badea.

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### **Suggested skills for this research topic**

A degree in Chemistry or Biology. Proficiency in organic synthesis chemistry laboratory techniques and familiarity with NMR and IR characterization methods.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

FGL International S.p.A., Sede Legale in Santa Croce Sull'Arno (PISA) - CF 01614420501 e P.IVA 01614420501

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*Curriculum: CU3 - Technology and Territory*

## **Vibration energy harvesting from high-voltage overhead lines to supply low-power monitoring sensors**

**Reference Person:** Gatti Gianluca (gianluca.gatti@unical.it)

**Host University/Institute:** Università della Calabria / Dipartimento di Ingegneria Meccanica, Energetica e Gestionale (DIMEG)

**Research Keywords:** Energy harvesting  
Vibrations and dynamics  
Structural health monitoring

**Reference ERCs:** PE8\_7 Mechanical engineering  
PE8\_1 Aerospace engineering

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities

### **Description of the research topic**

Vibration energy harvesting (VEH) from otherwise dissipated kinetic energy in the environment has attracted intense research effort recently, as a sustainable way to reduce the use (and disposal) of batteries or the need of electric wires. High-voltage overhead lines are susceptible to wind-induced oscillations and, in the case of contact lines, vibrations from passing vehicles (e.g. trains). Wind can generate oscillations in suspended cables due to flutter, with centimeters of amplitudes and a frequency range of 3-150 Hz. Flutter can cause damaging due to fatigue and failure of conductor strands.

Traditionally, the so-called Stockbridge damper is used to dissipate the energy of wind-induced oscillations in the main cable to an acceptable level. The damper is typically shaped as a dumbbell device with two masses at the extremes of a short flexible rod, clamped to the main cable.

This project aims at converting the currently unused vibration energy into usable low-power electrical energy to supply local sensors for structural health monitoring of the power line and structure. This requires a deep investigation of the system dynamics and its interactions with the damping device when subject to oscillations. A key objective is to design a VEH device that can be embedded within the damper itself. This will impact positively on maintenance services and costs, allowing for targeted interventions based on sensor data. It will also underpin reliability and sustainable mobility.



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### **Research team and environment**

The research activity will be carried out at the Dept. of Mechanical, Energy and Management Eng. of the University of Calabria in collaboration with the Dept. of Mechanical and Aerospace Eng. of the Polytechnic of Turin (prof. S. Marchesiello). The overall research group consists of a Full professor, an Associate professor, a Post-doc Researcher, a PHD student, and several Master students. The team has recognized expertise in vibration energy harvesting, nonlinear dynamics, mechatronics, with both theoretical and experimental skills. The candidate will spend a minimum of 6 months at Bertolotti S.p.A., taking advantage of the company know-how in the prototyping of overhead dampers.

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### **Suggested skills for this research topic**

Good background in mechanical engineering, specifically dynamics and vibrations, is required. Programming skills (MATLAB) are recommended. Candidates with good knowledge in nonlinear dynamics, electronics, measurements, and data analysis are encouraged. Working enthusiasm, creativity and attitude to problem solving are welcome.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Officina Fratelli Bertolotti S.p.A.

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*Curriculum: CU3 - Technology and Territory*

## **Sustainable Solutions for the Production of Electrical Cables with low environmental impact**

**Reference Person:** Gorrasi Giuliana (ggorrasi@unisa.it)

**Host University/Institute:** Università di Salerno / Ingegneria Industriale

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**Research Keywords:** Electrical cables  
Transport of energy  
Insulating materials

**Reference ERCs:** PE8\_2 Chemical engineering, technical chemistry  
PE8\_6 Energy processes engineering  
PE8\_10 Manufacturing engineering and industrial design

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure

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### **Description of the research topic**

The objective of the research is to investigate the mechanisms of grafting, hydrolysis and subsequent condensation of alkoxy-silanes in complex polyolefin systems, which may or may not contain flame-retardant mineral fillers such as aluminum hydroxide, magnesium hydroxide, calcium carbonate or mixtures of the same, in quantities typically of 50% or greater.

In-depth knowledge of the entire production process, both from the point of view of the chemical reactions described above and involved in the production of the compound, and in close connection with the transformation technology of the polymeric material, represents an essential condition for the optimization of the final product and the environmental impact of its production, including the prospect of identifying chemicals - such as the cross-linking catalyst, but not only - that present more sustainable HSE profiles.

For the same general considerations as above, of particular interest is also the identification of the most suitable analytical methodologies for determining the molecular structure of the system and the interactions between the organic and inorganic components, to guarantee improved control of the product, avoiding unnecessary waste due to non-compliant materials.

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### **Research team and environment**



The research team is composed of two full professors (prof. Giuliana Gorrasi and prof. Roberto Pantani) of chemistry and chemical engineering with expertise in the field of polymeric materials, either thermoplastics or thermosettings, for targeted applications with structural and functional properties

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**Suggested skills for this research topic**

The candidate for this PhD project must have a good knowledge in polymer science and polymer processing with particular attention to polyolefins

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

Versalis S.p.A.

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*Curriculum: CU3 - Technology and Territory*

## **Energy refurbishment and health in social housing in the context of climate change**

**Reference Person:** Manzan Marco (manzan@units.it)

**Host University/Institute:** Università degli Studi di Trieste / Dipartimento di Ingegneria e Architettura

**Research Keywords:** Health and Comfort Conditions  
Building energy efficiency  
Heat Waves and Urban Heat Island

**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  
PE8\_6 Energy processes engineering

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 7: Affordable and Clean Energy, GOAL 11: Sustainable Cities and Communities

### **Description of the research topic**

The recent approval of the revision of EPBD directive, represents a challenge in Europe. Its application requires expertise for the companies involved in building refurbishing because they will be forced to adopt new technologies to comply with new regulations. The objective of the research is to study methods for building refurbishing, with particular focus on social housing, taking into account the energy transition and with attention to people's well-being and health. The research will use simulation and experimental measurements to identify dangerous situations related to high summer temperatures and to explore possible mitigation actions. The numerical part will exploit dynamic calculation systems capable of simulating the behavior of the building and plant systems and the integration of renewable sources. Heat waves and urban heat islands effects will be considered as well. The research will consider future climate by exploiting projections obtained from GCM-RCM simulations obtainable from the CORDEX platform. The methodologies will be applied to real cases during the period spent by the PhD student in a company and during a period of study abroad. The results will consider both the effect of refurbishing on energy consumption and high temperatures that can occur in internal environments without mechanical cooling systems. Alternative approaches, such as the use of fans will be considered for mitigating the heat risk on people in particular fragile people.



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### **Research team and environment**

The experimental facilities allow the researcher to perform various measurements related to the performance of the building envelope and HVAC systems. Measurements will be carried out on site in the university laboratory or in real buildings during renovation activities. The student will be placed in an environment with other students and postdoctoral researchers, as well as structured research staff. The student will use computers and servers with specialized numeric codes to carry out the research.

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### **Suggested skills for this research topic**

The candidate must have knowledge of phenomena related to thermodynamic and heat transfer in particular manner problems related to energy efficiency in buildings and buildings plants for Heat Ventilation and Air Conditioning (HVAC). Previous experience in building simulations is appreciated especially if obtained in using dynamic simulation codes such as EnergyPlus, Trnsys and ESPr is highly appreciated. The candidate should have or demonstrate interest in computational skills with ability in learning programming languages and writing scripts in particular using the Python language. Knowledge of Italian Language or willingness to learn it is highly recommended

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

AZIENDA TERRITORIALE PER L'EDILIZIA RESIDENZIALE DI TRIESTE

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*Curriculum: CU3 - Technology and Territory*

## **Integrated Planning solutions for more resilient human settlements and cities**

**Reference Person:** Pezzagno Michele (michele.pezzagno@unibs.it)

**Host University/Institute:** Università degli Studi di Brescia / Dipartimento di Ingegneria Civile Ambiente Territorio Architettura e Matematica

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**Research Keywords:** Planning Just cities with Nature Based Solutions

Planning with nature

Water sensitive cities

**Reference ERCs:** SH7\_7 Cities; urban, regional and rural studies

SH7\_8 Land use and planning

SH7\_10 GIS, spatial analysis; big data in geographical studies

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

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### **Description of the research topic**

The impact of climate extremes on human settlements is expected to grow. Global trends indicate a continuous rise in urban population and the associated infrastructure system. This urban growth is occurring alongside an increase in the frequency of heatwaves, heavy storms, and floods. Consequently, it is crucial for urban development and architectural communities to recognize that while climate impacts will be felt globally, cities and urban regions are significantly more vulnerable to these extremes than rural areas. Designing resilient human settlements in response to climate change requires an integrated approach. Key elements to be accounted for include climate extremes, economic growth, human mobility, and livability. To raise public awareness of climate crisis and achieve effective design and planning, a transparent, data-driven, and geospatial design approach will be explored. This approach will enable local communities to better manage their vulnerabilities to climate risk and enhance their long-term resilience.

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### **Research team and environment**

The research team is multidisciplinary, oriented towards interdisciplinary exchange, and requires skills in collaboration, a systemic vision, and the development of complex geospatial models.



In the research groups there are experts from various fields, each bringing their unique knowledge and perspectives. This diversity enriches the research by integrating different approaches and methodologies. The team is designed to promote interdisciplinary dialogue. Regular meetings, collaborative projects, and open communication channels are established to facilitate the exchange of ideas and ensure that insights from different disciplines are effectively integrated.

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### **Suggested skills for this research topic**

Development of Complex Geospatial Models: A significant focus of the team is the creation of advanced geospatial models. This involves utilizing sophisticated software and analytical techniques to map, analyze, and interpret spatial data. These models are crucial for understanding and addressing complex geographical and environmental challenges.

To effectively participate in the research group, a good knowledge of both English and Italian is necessary.

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU3 - Technology and Territory*

## **Artificial intelligence for energy management systems in public transport electrification**

**Reference Person:** Porru Mario (mario.porru@unica.it)

**Host University/Institute:** Università degli Studi di Cagliari / Dipartimento di Ingegneria Elettrica ed Elettronica

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**Research Keywords:** Electric propulsion systems  
Energy management systems  
Artificial Intelligence

**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 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

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### **Description of the research topic**

Recent international energy transition policies set increasingly challenging targets for reducing pollutant emissions for the transportation sector. However, electric private cars are not a sustainable solution because of their high consumption per person and km, and the inherent poor public space utilization and congestion issues. Consequently, improving local public transport is the best solution in the urban context especially when clean vehicles are considered. Particularly, multi-source electric propulsion system architectures with multiple energy sources are very promising for public transport vehicles. They rely on a combination of technologies among batteries, supercapacitors, hydrogen fuel-cells, diesel engines and catenary/wireless power supply which require managing the power flows among the energy sources properly. In this context, the research activity will regard the development of advanced energy management and control strategies for multi-source electric propulsion systems for public transport vehicles, with particular reference to artificial intelligence techniques. More in detail, these will be based on infomobility data collectable during the repetitive scheduled duties that characterize public transportation fleets, thus enabling a suitable data forecast and the employment of real-time optimisation-based energy management and control systems.

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### **Research team and environment**

The research team consists of professors and researchers that have 20-year experience in design and control of power electronic converters, electrical machines and drives. The team has been working also on energy management and control systems of energy storage systems for more than 10 years, for both vehicular and power system applications. The research group does experimental research activity at the Department of Electrical and Electronic Engineering, whose laboratories are equipped with several devices, instruments, and prototypes preparatory to the proposed research activity (electric drive test bench, multi-level converters, hybrid energy storage systems, real-time simulators, etc.).

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### **Suggested skills for this research topic**

The research activity will mainly regard electrical engineering topics, more specifically, the modelling of electrical systems and components (power electronic converters, electrical machines, energy storage systems, etc.) and the design of energy management and control systems. A good knowledge of MATLAB/Simulink is required, and knowledge of some programming languages (e.g. Python, C) are also very advisable. Experience with real-time simulation platforms (e.g. Typhoon HIL, OPAL-RT) and artificial intelligence techniques represents a plus. All these skills can be refined appropriately during the PhD thanks to the attendance of specific training courses.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

A.T.P. - Azienda Trasporti Pubblici Nuoro

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*Curriculum: CU3 - Technology and Territory*

## **Highly integrated hybrid energy storage systems for marine electric propulsion systems**

**Reference Person:** Porru Mario (mario.porru@unica.it)

**Host University/Institute:** Università degli Studi di Cagliari / Dipartimento di Ingegneria Elettrica ed Elettronica

**Research Keywords:** Electric propulsion systems  
Energy storage systems  
Energy management systems

**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 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **Description of the research topic**

Recent international energy transition policies have established increasingly challenging emission reduction targets for the transport sector, including ships and boats. In particular, the International Maritime Organisation (IMO) has set ambitious emission reductions, such as 40% in 2030 and 70% in 2050 for international shipping, to be achieved through improvements in energy efficiency and the adoption of near-zero greenhouse gas emission technologies and energy sources. In this context, multi-source electric propulsion architectures for vessels based on a combination of technologies such as batteries, supercapacitors, hydrogen fuel cells and diesel engines are very promising. The research activity focuses on the study, development and prototyping of innovative and highly integrated configurations of hybrid energy storage systems for marine electric propulsion systems. As these systems require proper management of the power flows between the energy sources, i.e. multi-mode, the research activity also deals with the development and implementation of advanced energy management and control strategies by combining conventional and novel approaches, with particular reference to artificial intelligence techniques.

### **Research team and environment**

The research team consists of professors and researchers that have 20-year experience in design and control of power electronic converters, electrical machines and drives. The team



has been working also on energy management and control systems of energy storage systems for more than 10 years, for both vehicular and power system applications. The research group does experimental research activity at the Department of Electrical and Electronic Engineering, whose laboratories are equipped with several devices, instruments, and prototypes preparatory to the proposed research activity (electric drive test bench, multi-level converters, hybrid energy storage systems, real-time simulators, etc.).

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### **Suggested skills for this research topic**

The research activity will mainly regard electrical engineering topics, more specifically modelling of electrical systems and components (e.g. energy storage systems and power electronic converters), and the design of energy management and control systems. A good knowledge of MATLAB/Simulink is required, and knowledge of some programming languages (e.g. Python, C, VHDL) is also very advisable. Experience with real-time simulation platforms (e.g. Typhoon HIL, OPAL-RT) and artificial intelligence techniques represents a plus. All these skills can be refined appropriately during the PhD thanks to the attendance of specific training courses.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

NEPSY srl

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*Curriculum: CU3 - Technology and Territory*

## **Satellite Remote Sensing Techniques for Monitoring hydrological basins**

**Reference Person:** Ruello Giuseppe (ruello@unina.it)

**Host University/Institute:** Università di Napoli Federico II / Dipartimento di Ingegneria Elettrica e delle Tecnologie dell'Informazione

**Research Keywords:** Satellite Remote Sensing  
Monitoring of Climate Change impacts  
Data fusion for hydrological applications

**Reference ERCs:** PE10\_14 Earth observations from space/remote sensing  
PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 9: Industry, Innovation and Infrastructure

### **Description of the research topic**

The proposed topic aims at evaluating the effectiveness of satellite remote sensing techniques in monitoring hydrological basins. This includes assessing water resources, detecting changes in water bodies, predicting floods or droughts, and understanding climate change impacts on hydrological systems. The topic is multidisciplinary, covering remote sensing, hydrology, environmental science, and data analysis.

The candidate will analyze the efficacy of various remote sensing techniques, including multispectral, hyperspectral, and synthetic aperture radar, with an emphasis on data fusion techniques. Key satellite missions (like Landsat, Sentinel, and MODIS), and sensors (e.g. optical, radar, and thermal) will be analyzed and relevant imagery and remote sensing data will be sourced from NASA, ESA, and other providers.

Selected techniques will be applied to specific hydrological basins to monitor changes over time. Time series satellite data will assess the impact of climate change on hydrological basins, evaluating correlations between hydrological parameters and environmental factors like land use, vegetation cover, and human activities.

Expected outcomes include improved understanding of the capabilities and limitations of satellite remote sensing techniques for hydrological monitoring and the development of robust methodologies to support decision-making processes for hydrological basin management based on remote sensing insights.



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### **Research team and environment**

The research team is composed of researchers from the University of Naples Federico II (UNINA) in close collaboration with the company Tecnion srl. The UNINA group boasts consolidated and recognized expertise in the field of radar remote sensing, with a particular focus on applied electromagnetism and the analysis and processing of remotely sensed data from active (SAR) and passive (multispectral) systems. The research group has led or collaborated on research projects funded by national and international bodies (MiSE, MIUR, US ONR, ASI, European Union). This experience has created a productive environment with national and international contacts with the scientific community and industry.

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### **Suggested skills for this research topic**

The candidate should possess a robust background in Civil or Information Engineering. Essential attributes include strong motivational skills, the ability to work independently, manage time effectively, and stay driven in a research-intensive environment. Proficiency in satellite remote sensing, coupled with skills in data analysis and processing, is highly valued. A sound understanding of hydrology and the influence of climate on hydrological systems is highly valued too. Proficiency in programming languages like Python or MATLAB for advanced data modeling and analysis is an important requisite. Familiarity with GIS software and spatial data visualization tools would be advantageous.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Teknion srl

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*Curriculum: CU3 - Technology and Territory*

## **Electro-nanocatalytic approaches for high added value products**

**Reference Person:** Sarno Maria (msarno@unisa.it)

**Host University/Institute:** Università degli Studi di Salerno / Dipartimento di Fisica E.R. Caianiello

**Research Keywords:** Electro nano-catalysis  
Biomass and CO2 valorization

Chemicals and syngas production

**Reference ERCs:** PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage

PE11\_9 Nanomaterials engineering, e.g. nanoparticles, nanoporous materials, 1D & 2D nanomaterials

PE5\_12 Chemistry of condensed matter

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 9: Industry, Innovation and Infrastructure, GOAL 13: Climate Action

### **Description of the research topic**

Electrochemical processes are now a real opportunity for obtaining various chemical products at low temperatures and "easily", even starting from waste and biomass, water and CO2. In this context, it is extremely important to design nano-catalysts, through morphologies, couplings and "ad hoc" compositions to improve the processes performance. Electricity supplied from renewable energy sources allows for sustainable productions, and can be a real smart approach.

Biodiesel production can be achieved through esterification and/or trans-esterification of fatty acids, in the presence of inorganic or enzymatic catalysts. Enzymes immobilization allows overcoming the main drawbacks, which are free enzymes, poor stability, and costs.

Enzymatic immobilization on nanoparticles based on a suitable design and optimization can significantly enhance catalytic performance. One of the possible ways to reduce CO2 emission is to capture and eventually valorise it. In this scenario, the main challenge is to develop new solutions with low environmental impacts. On the other hand, CO2, through a chemical way and use of non-fossil energy, can be transformed into chemicals, pharmaceuticals, or biofuels, e.g., syngas for mediated productions.



In this scenario of electrochemical nano-assisted catalysis, the exploration of carbon nanomaterials as catalysts support, due to their conductivity, large specific surface area, high porosity, and relative chemical inertness results of particular interest.

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### **Research team and environment**

The PhD student will work inside the Interdepartmental Research Center NANO\_MATES (Research Centre for NANOMaterials and nanoTEchnology at Salerno University) c/o Department of Physics of the Salerno University. NANO\_MATES was born with the idea of generating a research network within the Salerno Campus to enhance the skills acquired in the field of nanosciences and nanotechnologies with a particular focus on sustainability. In particular, the research team mainly composed of Chemical Engineers, is constituted of 2 Full Professors, 3 Associate Professors, 4 PhD student, 3 senior researchers and several PhD/Post Docs responsible of different National and International collaborative projects.

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### **Suggested skills for this research topic**

Chemical Engineering

Environment Engineering

Nanotechnology

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Rilub SPA

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Language as a means to promote Climate Change education and awareness in underserved populations**

**Reference Person:** Bambini Valentina (valentina.bambini@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze Umane e della Vita

**Research Keywords:** communication  
language  
mental health

**Reference ERCs:** SH4\_11 Pragmatics, sociolinguistics, linguistic anthropology, discourse analysis  
SH4\_8 Language learning and processing (first and second languages)

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 10: Reduced Inequality

### **Description of the research topic**

Language has been showed to be a key element for communicating climate change and shaping sustainable societies, yet large inequalities remain in terms of climate change education and awareness. Vulnerable groups include people with medical conditions such as poor mental health, who might experience linguistic and societal barriers and whose health can be worsened by climate change impact. The project will aim at identified linguistic strategies for feasible and effective intervention programs to promote climate change education and awareness in underserved populations, with specific reference to people with mental illnesses. Particular attention will be paid to pragmatic phenomena and metaphorical and multimodal communication, to increase knowledge about the health impacts of climate change, to prepare and cope with climate hazards, and promote intentions to practice recommended behaviors.

### **Research team and environment**

The Laboratory of Neurolinguistics and Experimental Pragmatics at IUSS (<https://www.neplab.it/>) is devoted to the study of the neurocognitive correlates of language processing in typical and atypical conditions and across the lifespan, with a focus on pragmatics and metaphor. The team includes the PI Valentina Bambini, researchers and postdoctoral fellows, as well as PhD students, in an interdisciplinary and lively research environment. The Lab is fully equipped for behavioral and EEG experiments and has numerous connections with clinical facilities.



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**Suggested skills for this research topic**

As-native knowledge of Italian is required. Experience in linguistics and pragmatics, psycho/neurolinguistics, and training in with mental rehabilitation are a plus.

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**Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Institutions and governance of climate change**

**Reference Person:** Beretta Ilaria (ilaria.beretta@unicatt.it)

**Host University/Institute:** Alta Scuola per l'Ambiente (ASA) / Dipartimento di Sociologia

**Research Keywords:** Institutions  
Interdisciplinarity  
European Green Deal

**Reference ERCs:** SH7\_6 Environmental and climate change, societal impact and policy  
SH2\_1 Political systems, governance

**Reference SDGs:** GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

### **Description of the 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**

Università Cattolica (UCSC) is one the largest non-state universities in Europe; it 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. UCSC pursues multidisciplinary and interdisciplinary approaches to scientific research; 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 l'Ambiente, a postgraduate school that UCSC created 13



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years ago in Brescia to gather competencies on the environment existing in different faculties and departments.

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**Suggested skills for this research topic**

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

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**Source of fundings**

DM629/2024 – M4C1 – Inv. 4.1 – Pubblica Amministrazione

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

to be defined

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Market regulation and sustainable investment policies: a comparative law perspective**

**Reference Person:** Monti Alberto (alberto.monti@iusspavia.it)

**Host University/Institute:** Scuola Università Superiore IUSS Pavia / Classe di Scienze, Tecnologie e Società

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**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\_1 Political systems, governance

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

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### **Description of the 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 sustainability-related 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.

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### **Research team and environment**

IUSS mission is to provide advanced education to undergraduate and graduate students, as well as fundamental and applied research. 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. The selected candidate will join the Legal Science Research Group (LSRG) at IUSS 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.

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### **Suggested skills for this research topic**

Requirements: strong legal background (law degree); knowledge of the comparative law methodology; intellectual curiosity; ability to work in team.

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Environmental Philosophy: Water, Labour, and Sustainability**

**Reference Person:** Omodeo Pietro Daniel (pietrodaniel.omodeo@unive.it)

**Host University/Institute:** Università Ca' Foscari Venezia / Dipartimento di Filosofia e Beni Culturali

**Research Keywords:** Historical Epistemology of the Environment  
Historical hydrosociology  
Social Metabolism

**Reference ERCs:** SH6\_15 History of science, medicine and technologies  
SH7\_6 Environmental and climate change, societal impact and policy  
SH5\_8 Cultural studies, cultural identities and memories, cultural heritage

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

### **Description of the research topic**

The research addresses the environment between philosophical conceptualisation and environmental aesthetics. Its background problematises concepts such as 'world' and 'environment' and 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 Anthropocene.

This PhD project of 2024 investigates the cultural experience of water through labour. It addresses the epistemology of traditional fishing activities, including practical and tacit knowledge. Located at the crossdisciplinary confluence of historical epistemology, environmental humanities, and the environmental sciences, this PhD reassesses forms of knowledge and practices that have permitted lasting societal interactions with the environment. These are currently under threat owing to multiple crises, especially climate change. By mapping significant cases, this PhD aims to establish a broad cognitive basis for the comprehension of water ecologies and their natural-cultural history. Such comprehension can reorient the management of resources towards a more sustainable paradigms, in line with the SDGs and the UNESCO water programs (IHP and WWAP). The research of this PhD is inserted in the framework of the UNESCO Chair on Water Heritage and Sustainable Development in Venice.



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### **Research team and environment**

The research will be embedded in a lively research and teaching environment, especially in connection with ongoing research agendas in political epistemology, environmental philosophy, and historical hydrosociology, of which the UNESCO chair Water Heritage and Sustainable Development is exemplar.

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### **Suggested skills for this research topic**

Background formation in areas related to the environmental humanities. Fluent knowledge of English.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

VeGAL Agenzia di sviluppo del Veneto Orientale

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Climate change litigation and the recent constitutional reforms**

**Reference Person:** Panzeri Lino (lino.panzeri@uninsubria.it)

**Host University/Institute:** Università degli Studi dell'Insubria / Diritto, Economia e Culture

**Research Keywords:** Environmental protection  
Climate change  
Italian constitutional reforms

**Reference ERCs:** SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

The issue of environmental protection poses multiple challenges to the law and has prompted reflection on the appropriateness of its constitutionalization. This debate has also concerned Italy, where, despite the lack of specific references in the Constitution that came into force in 1948, environmental protection has nevertheless received a constitutional foundation over time thanks to the valuable contribution of the Constitutional Court case law.

In light of this development the Constitutional law No. 1/2022 should be read. This reform raised multiple questions, relating not only to the appropriateness of affecting the Fundamental Principles of the Constitution and its qualification as a "budget" or "program" revision, but also with reference to its potential.

The PhD project, from a constitutionalist perspective, can be of interest from two points of view: on the one hand, to reconstruct, also from a comparative point of view, the constitutional amendments made in recent years, their nature and consequent prospects; on the other hand, to elaborate the case law of the European Court of Human Rights and the Courts of other European Countries, in an attempt to identify points of contact, mutual interactions and prospects for dialogue.

### **Research team and environment**

Research Team of the Department of Law, Economics and Cultures, University of Insubria (Research Team with an interdisciplinary approach)

### **Suggested skills for this research topic**



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The research requires knowledge of constitutional law and comparative law; a willingness to explore the topic in an interdisciplinary manner is also required. The research will be run in Italian and in English.

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**Source of fundings**

DM629/2024 - M4C1 - Inv. 4.1 - Pubblica Amministrazione

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

to be defined

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Sustainability in the Anthropocene: the ethics and politics of plants and ecosystem conservation**

**Reference Person:** Pellegrino Gianfranco (gpellegrino@luiss.it)

**Host University/Institute:** Libera Università degli Studi Sociali Guido Carli / Dipartimento di Scienze Politiche

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**Research Keywords:** Plant Ethics  
Environmental Ethics  
Biodiversity

**Reference ERCs:** SH2\_7 Political and legal philosophy  
SH5\_10 Ethics and its applications; social philosophy  
SH3\_2 Inequalities, discrimination, prejudice

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

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### **Description of the research topic**

This research focuses on the ethical and political justification of sustainable patterns of ecosystem and plant conservation in the Anthropocene. The researcher will answer the following research questions: 1. Which model of sustainability is the fittest (i.e., the most theoretically plausible and politically feasible) in the Anthropocene? 2. Is the value of plants and ecosystems instrumental to human well-being, or does it have an intrinsic value? 3. How can this model of sustainability support the value and the political opportunity of reforestation and landscape restoration, also in the light of climate change mitigation and adaptation? 4. How can this model of sustainability deal with trade-offs between the environmental impact of renewable energies and the conservation of plants, ecosystems and landscape? 5. Which conservation and restoration policies can be justified in the light of the above? 6. Which are the consequences of these conservation and restoration policies in terms of intergenerational justice?

The research will span sustainability and Anthropocene studies; plant ethics; environmental and ecological citizenship and justice; climate justice (with a focus on mitigation policies); intergenerational justice.

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### **Research team and environment**



The supervisor will be the reference person above. The PhD candidate will work with many other scholars at Luiss, whose research activities are closely related to the research topic – in particular with Christian Iaione, whose work deals with urban studies, sustainability, climate change and the commons, with Raffaele Bifulco and Jorge Vinuales, working on environmental law.

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### **Suggested skills for this research topic**

The ideal candidate for this research will have a background in one or more of these fields: political theory, qualitative political science, philosophy, anthropology, and sociology. Previous publications on the topics will be considered a preferential title. Previous education in the fields of ecology, environmental ethics, environmental political theory, environmental sociology or anthropology, and public policy analysis will be considered a preferential title, too. He/she should be able to adopt an interdisciplinary perspective and move from theoretical premises to policies.

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### **Source of fundings**

DM630/2024 – M4C2 – Inv. 3.3. – Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

LUISS Business School

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Resilient Cities – Resilient Territories: Principles of Water Ethics in the Climate Change Era**

**Reference Person:** Pirni Alberto (alberto.pirni@santannapisa.it)

**Host University/Institute:** Scuola Superiore Sant'Anna – Pisa / Istituto DIRPOLIS – Centro Interdisciplinare Sostenibilità e Clima

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**Research Keywords:** Ethics of Climate Change  
Water (usage and consumption)  
Resilient Cities and adaptation policies

**Reference ERCs:** SH5\_10 Ethics and its applications; social philosophy  
SH7\_6 Environmental and climate change, societal impact and policy  
SH1\_12 Environmental economics; resource and energy economics; agricultural economics

**Reference SDGs:** GOAL 6: Clean Water and Sanitation

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### **Description of the research topic**

The research aims at addressing the ethical, social, and educational profiles regarding the management of water as fundamental and scarce resource. The so-called “water ethics” – an emerging branch of research within the paradigm of environmental and climate ethics –, together with the intergenerational justice approach will constitute the leading methodological focus of the expected proposals for addressing innovative ethical models related to the redistribution of climate-change-related costs and burdens. Comparative policy analysis and intersectional approaches will be also the key factors for addressing specific case studies, in cooperation with (all levels) institutional actors and international organizations operating on the same crucial sectors.

Moreover, the research focus would encourage an “action-research” approach, devoted at privileging the comparative analysis between homologous case-studies (at national and European level), with specific reference to the following topics: adaptation to Climate change and management of water resources on regional (as well as sub- and sovra-) scale with specific reference to reproducibility and replicability in different contexts of those policies within a comprehensive intergenerational approach. The expected guiding value for the analysis and the correlative policy selection and proposals will be the trans-temporal guarantee of equal access to water as scarce resource.

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### **Research team and environment**



The research will be mainly carried out at the Sant'Anna School of Advanced Studies (Pisa – Italy). The research will be developed within the Institute of Law, Politics and Development, in cooperation with the Interdisciplinary Center in “Sustainability and Climate”.

Due to the specificity of the project, the research path will include a secondment at the “AcquaNovara.VCO”, a leading public enterprise in the water-services sector, based in Piedmont, Italy, that can serve as reference case-study, since it has been implementing from many years a wide and multifaceted climate-change-sensitive strategy.

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### **Suggested skills for this research topic**

Openness towards interdisciplinary approaches, together with a solid competence in the social sciences area will be appreciated.

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### **Source of fundings**

DM629/2024 IUSS – M4C1 – Inv. 4.1 – Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Models, reasons and decisions: explaining sustainable choice in complex scenarios**

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|-----------------------------------|--|
| <b>Reference Person:</b>          | Sereni Andrea (andrea.sereni@iusspavia.it)   |
| <b>Host University/Institute:</b> | Scuola Universita Superiore IUSS Pavia / Classe di Scienze Umane e della Vita  |
| <b>Research Keywords:</b>         | Evidence, reasoning and decision-making<br>Models, understanding and scientific explanations<br>Aeronautical knowledge, safety and sustainability        |
| <b>Reference ERCs:</b>            | SH4_13 Philosophy of science, epistemology, logic<br>SH4_7 Reasoning, decision-making; intelligence<br>SH4_12 Philosophy of mind, philosophy of language |
| <b>Reference SDGs:</b>            | GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action                                    |

### **Description of the research topic**

Many high-stake decisions (individual choices and public deliberations on policies, regulations, and technological designs) stem from a combination of predictive models, deliberative processes, and interaction with automated systems. It is crucial to understand how such complex decisions can be quantitatively modeled; how agents' attitudes, biases and heuristics affect them; when they are rationally justified by evidence, background knowledge and cultivated intuitions; to what extent opaque mathematical models or devices can be trusted in spite of a partial understanding of their inner workings; how scientific, personal and sub-personal factors combined can increase or mitigate risk and margins for error.

We seek applications of traditional tools from analytic (including formal) epistemology, accounts of scientific explanation, theories of reasoning and decision-making, logico-mathematical thinking, and novel approaches to technology and AI in areas where individual choices, policies and design can affect (or be affected by) considerations on sustainable development and trust in experts and scientific models.

Aviation will be considered a preferential field of application, due to pervasive reliance on both automation, mental math and rules of thumb; advanced predictive models; the role of human factors in trained personnel; safety management systems; the influence of scientific aeronautical knowledge on piloting skills; and repercussions on both safety and the environment.



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### **Research team and environment**

The team focuses on epistemology and theories of knowledge; philosophy of mathematics and logic; risk, uncertainty and decision-making; philosophy of mind, affectivity and technology. It includes Full professors (Andrea Sereni), Associate professors (Alfredo Tomasetta), Researchers (Silvia De Toffoli, Giulia Piredda, Luca Zanetti) and post-docs (Rachel Boddy, Alessio Tacca, Guido Tana). It promotes recurrent philosophical events (seminars, workshops, masterclasses) in its areas of expertise and supports international networks. Its members participate in, or coordinate, competitive research projects, and are involved in multidisciplinary MA (Philosophical Knowledge) and PhD (HuME) programs.

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### **Suggested skills for this research topic**

Candidates should possess familiarity with, and/or training in, one or more of the fields relevant to the project, preferentially in (analytic) epistemology, philosophy of science, and theories of reasoning and decision-making. Background knowledge in (philosophies of) logic and mathematics may prove useful. Multidisciplinarity and willingness to apply traditional philosophical methods and problems to under-explored domains related to sustainability are recommended. Depending on the field of application (e.g. – as suggested in the project, but not necessarily limited to it – aviation), study or personal expertise, or familiarity with the proposed field, will be considered beneficial.

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU5 - Agriculture and Forestry*

## **The interplay between sustainable food production, climate change and food quality**

**Reference Person:** Lucini Luigi (paolo.ajmone@unicatt.it)

**Host University/Institute:** Università Cattolica del Sacro Cuore / DISTAS - department for sustainable food process

**Research Keywords:** functional foods

food security

food quality

**Reference ERCs:** LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

LS2\_9 Metabolomics

LS4\_8 Impact of stress (including environmental stress) on physiology

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

The framework shift imposed by climate change determines a shift in the food sector towards sustainable production systems, where primary production, ingredients choice and food consumption patterns are expected to change. As a consequence, the demand for climate-friendly production systems has shown possible impacts in terms of food quality. The project will focus on the relationship between climate change and food quality in terms of functional components (e.g. vitamins, polyphenols, carotenoids and other antioxidants) and quality aspects (shelf life, sensory properties, texture). To this aim, untargeted metabolomics approaches based on high resolution mass spectrometry will be used, given the limited knowledge available on this topic to date. different food production systems and different ingredients will be tested (having natural products and sustainability as a priority).

### **Research team and environment**

climate change

### **Suggested skills for this research topic**

The candidate should ideally have confidence with untargeted metabolomics approaches to profile functional components in food. Basic analytical chemistry and data processing skills are advisable to better address the



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**Source of fundings**

DM629/2024 - M4C1 - Inv. 4.1 - Pubblica Amministrazione

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

to be defined

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*Curriculum: CU5 – Agriculture and Forestry*

## **Optimizing Plant Reproduction: Developing Climate-Resilient Varieties for Future Agriculture**

**Reference Person:** Albertini Emidio (emidio.albertini@unipg.it)

**Host University/Institute:** Università degli Studi di Perugia / Dipartimento di Scienze Agrarie, Alimentari e Ambientali

**Research Keywords:** Plant Reproduction  
climate change

**Reference ERCs:** LS2\_1 Genetics  
LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology  
LS2\_2 Gene editing

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **Description of the research topic**

Apomixis is an alternative method of reproduction that some plants use to produce viable seeds, resulting in genetic clones of the female parent. While this process holds significant promise for breeders and farmers, it is notably absent in most major food crops. Transforming a sexually reproducing plant into one that utilizes apomixis could stabilize the genotype of a variety tailored to specific environmental conditions or market demands. This would allow for the continuous, cost-effective production of clonally reproduced seeds, independent of pollination or pollinators.

The potential of apomixis is immense, especially in addressing the challenges posed by a growing global population, climate change, and societal demands for health and biodiversity preservation. By harnessing apomixis, we could develop plant varieties that not only meet these challenges but also offer increased primary and by-product yields, reduced waste, and enhanced suitability for energy production within a circular economy framework. This approach could revolutionize agriculture by providing more reliable, efficient, and sustainable solutions, ensuring food security and environmental resilience for the future.

### **Research team and environment**

UNIPG, one of Europe's oldest universities, has a renowned Section of Agricultural Genetics with a rich history in studying forage and grass species, focusing on polyploidy, reproductive systems, and seed development. Prof. Albertini's research centers on the molecular basis of plant reproduction and apomixis. He is also involved in projects exploring epigenetic changes



from DNA methylation/de-methylation caused by environmental stresses. His team includes 4 associate professors, 2 researchers, and 8 PostDocs and PhD students, all working on these vital epigenetic projects.

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**Suggested skills for this research topic**

The candidate should have knowledge on: biology of Plant Reproduction, genetics, bioinformatics, plant breeding, environmental sciences

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**Source of fundings**

Fondi dell'ente di afferenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU5 – Agriculture and Forestry*

## **Grass haylage production: harvesting and feeding practices to adapt to climate change**

**Reference Person:** Atzori Alberto Stanislao (asatzori@uniss.it)

**Host University/Institute:** Università degli Studi di Sassari / Dipartimento di Agraria

**Research Keywords:** Bale-silage harvesting.  
Forage digestibility and quality  
Sustainable and low-lignified haylages

**Reference ERCs:** LS9\_10 Veterinary and applied animal sciences  
LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology  
LS9\_4 Microbial biotechnology and bioengineering

**Reference SDGs:** GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

Drought and climate change are causing a reduction of the grazing season in Mediterranean areas. Otherwise, the increasing of animal performances, the precision agriculture, the adaptation to climate change and the mitigation of methane emission from livestock chains, as well known, will beneficiate from increases in crop good practices and digestibility of forages. The production of haylages and fermented forages from grass and legumes copes with both objective and their use is increasing in Mediterranean areas. However the production of fermented forages has some constraints at agronomic level and increases risk of food safety in milk and dairy chains. The aim of this study will focus i) the optimization of crop productivity of forages under climate adaptation frameworks (genetic, crop cultivation practices, water efficiency) ii) optimizing the haylage production process at field level under mediterranean conditions. Effect on the temperature range and climate patterns will be focused to optimize the perfect window of forage cut and harvesting. Optimum haylage conservation techniques and Fermentation patterns will be defined and monitored with use of inoculum of probiotics. In vitro trials using dairy sheep as animal model will include the estimation of nutritive values and digestibility of haylages in comparison with conventional dry hays at the experimental farm of the University of Sassari. The project will define sustainable feed production under climate change scenarios.

### **Research team and environment**



The research team is coordinated by Prof. Alberto Stanislao Atzori (Animal Science) and Prof. Pier Paolo Roggero (Agronomy) and has large experience in animal nutrition and crop cultivation, management and environmental impact of ruminant production systems. Improvement of production techniques, forage production, dairy nutrition, evaluation of farming good practices to adapt to climate change, applied mathematical modeling are focused. The team collaborates with a microbiology unit. The research team also involves the use of an experimental farm with technological equipments and a feed and microbiological lab.

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**Suggested skills for this research topic**

Aptitude for field and lab work, skills for data analytics, motivation to work in team

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**Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU5 – Agriculture and Forestry*

## **Multidisciplinary and sustainable approaches for food quality and authenticity**

**Reference Person:** Beccaria Marco (marco.beccaria@unife.it)

**Host University/Institute:** Università degli Studi di Ferrara / Dipartimento di Scienze Chimiche, Farmaceutiche ed Agrarie

**Research Keywords:** Health-promoting food

Food authenticity

Food safety

**Reference ERCs:** LS9\_5 Food biotechnology and bioengineering

PE4\_5 Analytical chemistry

LS2\_9 Metabolomics

**Reference SDGs:** GOAL 8: Decent Work and Economic Growth, GOAL 12: Responsible Consumption and Production, GOAL 17: Partnerships to Achieve the Goal

### **Description of the research topic**

Using an interdisciplinary approach that combines advanced technologies in analytical chemistry, food science, and data science, the project aims to conduct comprehensive analyses of key chemical and morphological markers specific to various categories of high-value Italian foods. This work will establish chemical profiles of high-quality Italian foods, identifying and quantifying key compounds responsible for flavor, aroma and nutritional value, as well as food components with beneficial effects on human health. The adoption of sophisticated modeling approaches and machine learning algorithms will enable the development of predictive models for assessing food quality and authenticity, improving the ability to discern variations in product composition. In addition, the study aims to develop portable and rapid detection methods for assessing food quality on-site, facilitating real-time monitoring along the production and distribution chain. This approach will promote more effective and timely control of food quality, contributing to greater environmental sustainability through optimized resource management.

### **Research team and environment**

The research will be carried out in different institutes, both academies and industries. Each institute will have a scientific leader who will mentor the candidate in accordance with the project themes. The research team's knowledge ranges from sampling and sample preparation techniques, analytical analysis and data processing to industrial knowledge of



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raw materials(collection, storage, etc.). The PhD candidate will be trained in all these aspects of the research.

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**Suggested skills for this research topic**

The candidate should be a dynamic person (traveling is required) and have good communication skills. Fluent in Italian and English (at least B2 level). Good knowledge of analytical chemistry applied to food science is required. Good knowledge and practical experience with at least one among sample preparation techniques, gas chromatography, liquid chromatography, and/or mass spectrometry techniques is an important requirement. Familiarity with data handling, analysis, and interpretation and intermediate programming skills (e.g., Python, R, or Matlab) are also preferred.

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**Source of fundings**

Fondi dell'ente di afferenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

UNIVERSITA' DEGLI STUDI DI FERRARA

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*Curriculum: CU5 - Agriculture and Forestry*

## **A knowledge-based decision support system for sustainable use of water resources in agriculture**

**Reference Person:** Bonaccorso Brunella (bbonaccorso@unime.it)

**Host University/Institute:** Università degli Studi di Messina / Dipartimento di Ingegneria

**Research Keywords:** Water resources  
Irrigated agriculture  
Drought events

**Reference ERCs:** PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution  
LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology  
PE6\_12 Scientific computing, simulation and modelling tools

**Reference SDGs:** GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

Many agricultural areas within the Mediterranean region are experiencing a broad range of threats related to the reduction of water resources availability mainly driven by water overexploitation and pollution and land degradation. Furthermore, climate change is expected to exacerbate the existing water scarcity conditions, especially in arid and semi-arid regions. Irrigated agriculture can prevent yield losses due to drought periods; on the other hand, it is required to become more efficient, given the competing and equally relevant civil and industrial uses. To this end, effective implementation of innovative solutions to limit water waste while improving sustainable agricultural production at the irrigation district level is of primary importance.

The Land Reclamation Consortia (LRC) in Italy are public entities in charge of water resources management and development and flood prevention in agriculture. They can be responsible for water resources monitoring by collecting data on rainfall, water levels and agricultural water use for a more accurate and sustainable management of water resources. LRC can also promote precision irrigation practices among farmers by the use of advanced technologies.

In this respect, this research project aims at developing innovative solutions (e.g., Decision Support Tools) for farmers targeting a better use of water resources for irrigation and maintenance/increase of agricultural production, to be implemented at the LRC scale.

### **Research team and environment**



The research activity will be carried out at the Department of Engineering, University of Messina within the Group of Water Engineering and Hydrology covering research topics related to water resources management, stochastic hydrology applied to the analysis of extreme hydrometeorological events, drought and flood risk management, hydrological and hydraulic river basin modeling, among others. The Research Group collaborates with several other research groups in Italy and abroad.

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### **Suggested skills for this research topic**

The Ph.D. Candidate should have a background in agricultural/environmental engineering, earth and environmental sciences, or related disciplines. A solid background in mathematics, statistics and data analysis is recommended. In addition, programming skills (e.g., MATLAB, R project, Python), GIS knowledge, and experience in re-analysis, climate model and remote sensing data retrieval and elaboration will be positively evaluated. A willingness for international mobility is also recommended, as well as an attitude to work in a collaborative environment, with an interdisciplinary approach.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Irritec S.p.A | P.IVA 00171620834

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*Curriculum: CU5 - Agriculture and Forestry*

## **Optimizing plant nutrient and health strategies for a climate-resilient rice cropping system**

**Reference Person:** Celi Luisella Roberta (luisella.celi@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Scienze Agrarie, Forestali e Alimentari

**Research Keywords:** phosphorus biogeochemistry in plant-soil systems  
biobased solutions  
rice nutrition and health

**Reference ERCs:** PE10\_9 Biogeochemistry, biogeochemical cycles, environmental chemistry

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 13: Climate Action

### **Description of the research topic**

Rice cropping systems represent the most widely investigated wetland in view of the peculiarity which characterizes nutrient cycling and impacts climate. Rice is traditionally cultivated under flooding conditions causing an increased phosphorus (P) supply in solution, counteracted by the oxidizing environment around the rice roots, which lead to the coprecipitation of iron (Fe) and P, forming the Fe plaque. Recently we observed that also fertilizer-P can be entrapped on Fe-plaque. However, the extent by which the P trapped by Fe plaque surfaces represents a source and/or a sink to rice plant uptake remains largely unknown, as well as the effects on rice health and performance. Furthermore, rice agroecosystems are also widely required to reduce water consumption and find new saving water technologies to face the dramatic effects of climate change. This can change the interplays between reducing conditions and rhizospheric oxygenation that control P availability.

The aim of this PhD thesis aims i) to investigate the role of these plaque as source or sink of P for rice plants also under different water management techniques and the effects on plant health, iii) to develop and test biobased products that may control the function of Fe plaques as sources or sinks of nutrients and pathogens. This project launches the creation of an European R&D hub of BAIC AGRO Italy srl within the Butterfly Area of UNITO to start a virtuous process for the attraction of foreign investments.

### **Research team and environment**



The Soil Biogeochemistry research team is composed by 7 Researchers and two post-doc with a deep knowledge on soil biogeochemistry and nutrient cycling in both agricultural and natural ecosystems, with focus on carbon, phosphorus and nitrogen processes and particular attention to improving the bioavailability of nutrients in environments characterized by specific dynamics, such as rice paddies. The work will be in collaboration with the team of Plant pathology with prof. Massimo Pugliese, to assess combined abiotic and biotic stress.

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**Suggested skills for this research topic**

Chemometry, statistics, spectroscopy

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

BAIC AGRO ITALIA SRL

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*Curriculum: CU5 – Agriculture and Forestry*

## **Impact of agro-silvo-pastoral management and climate changes on mountain semi-natural grasslands**

**Reference Person:** Freppaz Michele (Giampiero.lombardi@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Scienze Agrarie, Forestali e Alimentari

**Research Keywords:** Anthropogenic-climate changes impact on grasslands

Agri-management/climate affects vegetation

Agri-management/climate affects land use

**Reference ERCs:** LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

LS8\_1 Ecosystem and community ecology, macroecology

LS8\_2 Biodiversity

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **Description of the research topic**

The research aims to study how climate changes, together with changes in agronomic, pastoral, and forest management, which are closely linked to the socioeconomic variations of the last 70 years, can negatively affect biodiversity and the resistance/resilience of semi-natural grasslands in the mountains. Understanding these impacts on rural areas and finding indicators capable of predicting them is essential for identifying sustainable management practices for agroecosystems, in line with biodiversity conservation and ecosystem service principles. Not only the conservation of current status should be targeted, but also the restoration of permanent grasslands should be achieved in a sustainable way wherever possible. Innovative practices should be identified and applied to preserve and restore different target ecosystem functions, which depend on the starting condition of the land and socioeconomic framework (e.g. main targets could be the recovery of sward productivity when farms are present, biodiversity improvement in a natural park, land protection when grasslands on a steep slope surmount a village...). The PhD student will analyze the conservation status of different grassland habitats, assess how rapidly grasslands deteriorates due to abandonment/change of agricultural practices and climate, study land use evolution with regard to fragmentation and ecological connectivity, and experiment agronomic practices for conservation/restoration.

### **Research team and environment**



The research team includes researchers specialized in agro- and silvo-pastoral management, botany, soil science, plant-soil-animal relations, GIS and remote-sensed analyses.

The study will be carried out in the mountains of Italian north-western Alps, mainly Susa valley where the co-funding company operates. However, also case-studies from other areas will be considered.

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### **Suggested skills for this research topic**

The candidate should have a master degree in the areas of agronomic, forestry, biological or natural sciences. He/she should be able to combine knowledge of agronomic and grazing management, botany, soil science, and remote-sensing. Since an important part of the activities will be outdoor, the candidate must be able to navigate comfortably in mountain terrain.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

TELT sas

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*Curriculum: CU5 - Agriculture and Forestry*

## **Development of new technologies for ecophysiological analysis of biostimulant action**

**Reference Person:** Lovisolo Claudio (claudio.lovisolo@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Scienze Agrarie, Forestali e Alimentari

**Research Keywords:** biostimulant  
organic agriculture  
ecophysiology

**Reference ERCs:** LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology  
LS8\_14 Ecophysiology, from organisms to ecosystems

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

The doctoral project will continue the technological development undertaken by the Start Up Plant Flow srl, for the creation of high-throughput gas exchange analysis systems for the ecophysiological studies of plants upon climate change. Technological development will be accompanied by the application of the technology, thus creating new screening methods and protocols that support the design and optimization of new sustainable technologies for agriculture, such as biostimulants and new varieties resistant to abiotic stress. This research initiative will allow Plant Flow srl to further strengthen its analysis services aimed at the Agritech industry, offering increasingly robust support to increase the resilience of the agricultural sector in the face of climate change and accelerate its transition towards a green economy.

Plant Flow Srl carries out two main activities:

The development of cutting-edge technologies for ecophysiological analyses, characterized by high automation and the ability to measure many plants and parameters simultaneously and continuously (high-throughput).

A B2B analysis service for Agritech companies, carrying out screening and experiments to evaluate the effects of new organic products on crop yields.



As a result, Plant Flow Srl operates in the Agritech sector and supports the research and development of various industries, including biostimulants, seed companies and breeders, thus contributing to the creation of new green solutions.

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### **Research team and environment**

Claudio Lovisolo's group at DISAFA UNITO (<https://www.plantstresslab.unito.it/who-we-are/claudio-lovisolo>)

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### **Suggested skills for this research topic**

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

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Plant Flow srl

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*Curriculum: CU5 - Agriculture and Forestry*

## **The interplay between climate change, pest diseases and crop production**

**Reference Person:** Lucini Luigi (luigi.lucini@unicatt.it)

**Host University/Institute:** Università Cattolica del Sacro Cuore / Dipartimento di Scienze e Tecnologie Alimentari per una filiera agro-alimentare Sostenibile

**Research Keywords:** plant biochemistry  
plant pathology  
climate change

**Reference ERCs:** LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology  
LS9\_9 Plant pathology and pest resistance

**Reference SDGs:** GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

### **Description of the research topic**

The research will aim at investigating at multiple level the interconnected multilayered response in crops related to pest diseases in the framework of climate change. In more detail, ear fungal diseases will be considered as a model, and molecular approaches (MS-based metabolomics, gene expression patterns) will be combined with phenotyping and physiological assays. Competences from plant science, biochemistry and plant pathology will ensure a trans-disciplinary view, and data fusion will allow depicting the interaction between climate change triggered stresses and pest diseases in crops.

### **Research team and environment**

The reference prof Luigi Lucini (Università cattolica del sacro Cuore, plant biochemistry and metabolomics) will benefit the contribution from Cristina Nali (university of Pisa, plant pathologist), Claudio Lovisolo (University of Turin, plant physiology) and prof Roberto Ferrise (University of Florence, agronomist). Thus, a multidisciplinary team will support the topic development, providing also facility for phenotyping and metabolomics.

### **Suggested skills for this research topic**

The candidate is supposed to have knowledge on plant science and agronomy, possibly including plant pathology and plant biochemistry basic knowledge.

### **Source of fundings**



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DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU5 - Agriculture and Forestry*

## **Sustainable Design of Green Areas in Industrial-Artisanal Hubs**

**Reference Person:** Nali Cristina (cristina.nali@unipi.it)

**Host University/Institute:** Università di Pisa / Dipartimento di Scienze Agrarie, Alimentari e Agro-ambientali

**Research Keywords:** Integration of climate-adaptive species  
Multifunctional green area design  
Environmental and social impact evaluation

**Reference ERCs:** LS8\_1 Ecosystem and community ecology, macroecology  
LS8\_14 Ecophysiology, from organisms to ecosystems  
LS9\_9 Plant pathology and pest resistance

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 13: Climate Action, GOAL 15: Life on Land

### **Description of the research topic**

The project emphasizes the conservation and protection of natural areas, while also integrating tree species that are preferably native, low-maintenance, and suitable for climate change for new plantings. Additionally, it focuses on designing solutions that ensure optimal conditions for tree growth near industrial buildings. The project seeks to enhance environmental quality, provide recreational and aesthetic benefits, and promote sustainability.

The project employs a structured methodology that includes research and analysis, species selection and design, implementation and optimization, and monitoring and evaluation. In brief, analyses and interviews with stakeholders will be conducted to understand the current usage and needs of green spaces, site inspections to evaluate the conditions of existing natural areas and the surroundings of industrial buildings, analysis of local climate data to identify tree species that are suitable for future planting and resilient to climate change, and review of successful conservation and green area projects to identify best practices and innovative approaches. The species selection and area design will be carried out by selecting species resilient to climate change, focusing on attributes such as drought tolerance and heat resistance. The area design will ensure the maximum provision of ecosystem services, including the conservation of existing biodiversity and ecological, recreational, and aesthetic benefits.



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### **Research team and environment**

The Urban green areas and landscape planning and management group of the Department of Agriculture, Food and Environment of the University of Pisa led by Prof. Damiano Remorini, also includes Full and Associate Professors, PhD students, and some technicians. Major research interests include advancing vegetation spectroscopy and the concept of hyperspectral phenotyping of plant stress, and physio-chemical responses of plants to biotic/abiotic stresses. The group is equipped of greenhouses and ozone-exposure facilities, as well as field and lab equipment for morpho-physiological and biochemical analyses (e.g., photosynthesis systems, Chl a fluorometer, HPLC, GC-MS, microbiology tools).

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### **Suggested skills for this research topic**

The selected candidate will have to develop a unique skill set including the capability of analyzing both standard (e.g., ecophysiological results) and high-dimensional data (e.g. hyperspectral and multivariate data sets) to improve the monitoring of plants under biotic and abiotic stress. The prospective candidate should be highly motivated to perform research at an advanced level. Experience in standard Urban green areas and landscape planning and management is essential. The preferred candidate should have a Degree in Agricultural Science or related field. Good Italian and English communication skills are essential.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Techbau SpA

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*Curriculum: CU5 - Agriculture and Forestry*

## **Characterization of the mode of action of sustainable products against grapevine pathogens**

**Reference Person:** Perazzolli Michele (michele.perazzolli@unitn.it)

**Host University/Institute:** Università degli Studi di Trento / Centro Agricoltura, alimenti, ambiente

**Research Keywords:** sustainable agriculture

biological control

biofertilization

**Reference ERCs:** LS9\_9 Plant pathology and pest resistance

LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

**Reference SDGs:** GOAL 12: Responsible Consumption and Production

### **Description of the research topic**

The aim of the project is the characterization of the mechanism of action of products of natural origin for the control of grapevine pathogens and to promote plant growth. The objective is the screening of the products supplied by the company to characterize their efficacy against grapevine pathogens and to promote crop growth. The most effective products will subsequently be characterized to understand the mechanism of action and the side effects non-pathogenic microorganisms.

### **Research team and environment**

Research activities will be carried out at University of Trento at Center Agriculture Food Environment in collaboration with the co-financing company.

### **Suggested skills for this research topic**

plant pathology, plant physiology, molecular biology, micorbiology

### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

### **Internship (of a minimum of 6 months) at**

CBC (Europe) S.r.l. Divisione Biogard



*Curriculum: CU5 – Agriculture and Forestry*

## **Assessments of biogeochemical cycles in Mediterranean agroforestry systems under climate change**

**Reference Person:** Spano Donatella (spano@uniss.it)

**Host University/Institute:** Università degli Studi di Sassari / Dipartimento di Agraria

**Research Keywords:** Agroforestry  
Nature Based Solution  
Climate Change

**Reference ERCs:** LS8\_5 Biological aspects of environmental change, including climate change  
LS8\_14 Ecophysiology, from organisms to ecosystems  
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

### **Description of the research topic**

The resilience of Mediterranean agricultural and forestry systems against climate change and land degradation requires a sound understanding and implementation of Nature-Based Solutions (NBSs). Agroforestry and Silvopastoral systems may play a key role in ecological balance and preservation of natural resources, supporting biodiversity, providing ecosystem services, and acting as a natural carbon sink, besides sustaining important multi-purpose functions for the rural population. Monitoring (e.g., eddy covariance, ET and sap flow measurements, soil water content, agrometeorological stations) and assessment tools are important to evaluate the effectiveness and resilience of these solutions, including field experiments (to better characterize agroforestry and land models, represent interlinkages between trees and crops, physiological processes, resilience to climate change, productivity, and other ES as functions of environmental drivers, vegetation structure, management, and climate change) and remote sensing. Such assessment will support best practices for promoting and fostering ecosystem services, land fertility and productivity, water availability, biodiversity levels, and resilience to climate change, from both ecological and economic standpoints.

### **Research team and environment**

The PhD student will be based at the University of Sassari, the Laboratory of Agrometeorology and Ecophysiology. The laboratory consists of a team of experts, including specialists in



agriculture and forest systems, ecophysiologists, agrometeorologists, and experts in climate change impact and risk assessment. Our team is comprised of experienced senior scientists and young researchers, postdocs, and PhD students, along with researchers from UNISS and the Euro-Mediterranean Center on Climate Change Foundation (CMCC). All resources for field experiments and calculations will be provided. The student will collaborate with external teams involved in ongoing projects at UNISS and CMCC.

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### **Suggested skills for this research topic**

The candidate should demonstrate skills in agriculture and forest science, environmental engineering, informatics, machine learning, AI, plant and ecosystem monitoring techniques, and modeling. They should also be capable of managing databases and files from different sources and have an interest in artificial intelligence methods.

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### **Source of fundings**

Fondi dell'ente di appartenenza

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU6 - Health and Ecosystems*

## **combating infections and inflammation**

**Reference Person:** Angelucci, Ardini (2 referenti) Francesco, Matteo  
(Francesco.angelucci@univaq.it)

**Host University/Institute:** Università degli studi dell'Aquila / Dip. di medicina clinica, Sanità pubblica, Scienze della vita e dell'Ambiente

**Research Keywords:** poverty-related diseases  
tropical and neglected diseases  
inflammation associated to infectious diseases

**Reference ERCs:** LS1\_8 Structural biology  
LS1\_13 Early translational research and drug design

**Reference SDGs:** GOAL 1: No Poverty, GOAL 3: Good Health and Well-being, GOAL 6: Clean Water and Sanitation

### **Description of the research topic**

Thioredoxin reductases (TrxRs) are key targets for treating infectious and inflammatory diseases. Selective inhibition of TrxRs is challenging due to a focus on irreversible mechanisms. Research on the TrxR from *Schistosoma mansoni*, a human parasite causing schistosomiasis, revealed a new "doorstop pocket" in the enzyme. This led to the development of novel TrxR inhibitors that outperform praziquantel, the standard schistosomiasis treatment, effective against both mature and juvenile stages of the parasite. Inhibition via small molecules at the doorstop pocket is promising, as this pocket exists in all TrxRs, including human TrxR1. Preliminary studies show that inhibitors designed for *Schistosoma*'s TrxR can also inhibit the human version. Human TrxR1 and thioredoxin, its substrate, regulate the inflammasome, suggesting potential as new anti-inflammatory drug targets. Our project refines these compounds for schistosomiasis while assessing their efficacy in human inflammation models through rational design. Targeting the doorstop pocket may offer new therapeutic strategies in diseases where TrxR inhibition is beneficial.

### **Research team and environment**

At present there are 1 assistant professor, one technician, 2 Ph.D student and 3 master students, which assure a young and active scientific environment in the lab.

The group of Prof. Angelucci and Prof. Ardini is well-equipped with all the technologies and instrumentations for structural and functional studies of protein and is already involved in a structural genomics project on *Schistosoma mansoni*. We have monthly scheduled synchrotron time to collect X-ray high resolution data on protein crystals; we are also





participating in a national consortium of universities to get access to cryo-electron microscopy (Cryo-EM) facilities present in Europe.

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**Suggested skills for this research topic**

- heterologous expression of protein and their purification
- biocrystallography, cryo-EM
- enzymology
- protein-ligand binding

no other languages than English are requested

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**Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

Dompé spa

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*Curriculum: CU6 - Health and Ecosystems*

## **Micro/nanoplastic effects on the brain: a stimulus to a more sustainable approach**

**Reference Person:** Boido Marina (marina.boido@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Neuroscienze

**Research Keywords:** Pollution  
Central nervous system

**Reference ERCs:** LS5\_11 Neurological and neurodegenerative disorders  
LS4\_8 Impact of stress (including environmental stress) on physiology  
LS5\_15 Neuroimmunology, neuroinflammation

**Reference SDGs:** GOAL 3: Good Health and Well-being

### **Description of the research topic**

A growing body of evidence suggest that micro/nanoplastic exposure can bring a variety of toxic effects on human health, including oxidative stress, metabolic disorder, immune response, as well as reproductive and developmental toxicity. Emerging evidence are now shedding light also on the neurotoxic effect of these materials: indeed, ingested micro/nanoplastics seem able to spread from the gut to the brain and/or break the blood brain barrier. Once into the brain parenchyma, they accumulate and induce neuroinflammation and neuronal dysfunction/damage. This could in turn affect several cognitive functions (as learning and memory) and even trigger neurological disorders.

This project will aim at in depth studying the effects of micro/nanoplastic exposure on the developing and ageing nervous system, by exploiting several experimental models and human cells (iPSCs). We intend to unravel the impact of these tiny materials on both different cell types (neurons, astrocytes and microglia), and different cellular subcompartments (as nucleus, mitochondria, etc...), by exploiting advanced approaches and microscopy techniques.

The project will focus in particular on the SDG 3 (Good health and well-being), but will also contribute to raise attention on the need to eliminate the use of plastic packaging in favor of renewable and more sustainable materials.

### **Research team and environment**

The research activity will be carried out at the Neuroscience Institute Cavalieri Ottolenghi (NICO <https://www.nico.ottolenghi.unito.it/eng>; Dept. Neuroscience, Univ. Turin), under the



supervision of the reference person. The main goal of NICO is to study the biological mechanisms of nervous system function, to develop innovative therapeutic approaches for neurodegenerative/psychiatric diseases. NICO 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.

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### **Suggested skills for this research topic**

The candidate should have a degree in Medicine & Surgery, Biology, Medical Biotechnology or Neuroscience.

The ideal candidate should be skilled in the fields of cellular and molecular biology. Technical competences should include cell cultures, ICC/IHC, biomolecular analysis and microscopy.

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

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### **Source of fundings**

DM629/2024 IUSS - M4C1 - Inv. 4.1 - Ricerca PNRR

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU6 - Health and Ecosystems*

## **Bioactive natural compounds from sustainable vertical-agriculture for inflammatory targeting**

**Reference Person:** Collino Massimo (massimo.collino@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Neuroscienze

**Research Keywords:** FOOD SUPPLEMENT

INFLAMMATION

DIET

**Reference ERCs:** LS7\_7 Pharmacology and toxicology

LS4\_7 Nutrition and exercise physiology

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 12: Responsible Consumption and Production

### **Description of the research topic**

The health potential of nutraceuticals and food supplements is triggering interest but the challenges to achieving sustainability are daunting as they need to balance nutritional requirements, costs, and environmental impact. Therefore, it appears urgent to develop innovative and sustainable strategies for producing and validate dietary components able to ensure affordable, eco-friendly and healthy food supplements. The project focuses on the production of bioactive natural compounds by innovative sustainable Italian vertical agriculture and the preclinical investigation of their beneficial effects, mainly against the development of neurogenic inflammation, which is known to play a crucial role in the onset of numerous neurodegenerative diseases (including Parkinson's and Alzheimer's diseases), migraines and cerebrovascular diseases.

The main objectives are:

- (i) contribute to the design of formulations based on bioactive natural compounds produced through innovative vertical farming techniques with low environmental impact
- (ii) provide rigorous preclinical in-vitro and in-vivo findings on their potential beneficial effects in counteracting the inflammatory response, mainly neuroinflammation, leading to the development of chronic diseases
- (iii) identify the main molecular targets underlying the documented effects and the specific biomarkers of the state of bio-vulnerability and resistance to neuroinflammation processes

### **Research team and environment**



The research activity will take place mainly at the Department of Neuroscience (Univ. Turin, IT) within the Research Unit of Neuro-Immunopharmacology coordinated by Prof. M. Collino. Our main expertise is the study of the effects of pharmacological and/or nutritional approaches to target key mediators involved in the dysregulated central and peripheral inflammation, evoked by insults (e.g. ischemia, sepsis) and lifestyle (e.g. diet, stress). These activities are supported by national and European grants, and consultancies for private companies. The proposed research includes also internship in a company specialising in the production of botanicals for nutritional and pharmaceutical use

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### **Suggested skills for this research topic**

The candidate should have a degree in Medicine & Surgery, Pharmacy/Industrial Pharmacy, Biology, Medical Biotechnology or Neuroscience. The ideal candidate should be skilled in the fields of cellular and molecular biology and preclinical pharmacology. Technical competences should include in vivo and/or in vitro procedures, immunocytochemistry, biomolecular analysis and microscopy. Additionally, team working, problem-solving ability, computer skills and basic statistical knowledge will be appreciated.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Cultipharm SRL

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*Curriculum: CU6 - Health and Ecosystems*

## **CLIMATE CHANGE IMPACTS IN POLAR AND ALPINE PERMAFROST AREAS**

**Reference Person:** Guglielmin Mauro (mauro.guglielmin@uninsubria.it)

**Host University/Institute:** Università degli Studi dell'Insubria / Scienze Teoriche ed Applicate

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**Research Keywords:** Climate Change

Permafrost

Ecosystems

**Reference ERCs:** PE10\_3 Climatology and climate change

PE10\_18 Cryosphere, dynamics of snow and ice cover, sea ice, permafrosts and ice sheets

PE10\_13 Physical geography, geomorphology

**Reference SDGs:** GOAL 13: Climate Action, GOAL 15: Life on Land

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### **Description of the research topic**

The research will be focused on the analyses of the impacts of the climate change on permafrost environments and the related ecosystems in polar areas and alpine mountains. In these areas permafrost is thawing almost everywhere, changing deeply the landscape and triggering surface instability that interacts with the evolution of the ecosystems and with the CO<sub>2</sub> and CH<sub>4</sub> fluxes. The Research will be focused on these complex and dynamic relationships in Alaska where Insubria opened in 2022 his international Branch and, for comparison in the Italian Alps where Insubria had traditional study sites in Upper Valtellina. This comparison will be important because both the areas are suffering the more intense warming in the planet

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### **Research team and environment**

This PhD is within the frame of Climate Change Research Center (CCRC) of Insubria Un. where the work will be in a multidisciplinary team including the CRyosphere Lab (resp. M. Guglielmin) with a Researcher (S. Ponti, expert in remote sensing), one Post Doc (Alessandro Longhi, expert in soils) and other 4 PhD. This group interacts with the Botany and Climate Change Lab (Resp. Nicoletta Cannone). The team is working in cooperation of many national and international Institution (i.e British Antarctic Survey, Trieste University).

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**Suggested skills for this research topic**

The candidate should have basic knowledge on the climate change, on the climate change impacts on the Cryosphere and on the ecosystems of periglacial 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 polar environment.

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**Source of fundings**

Fondi dell'ente di appartenenza

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

None

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*Curriculum: CU6 - Health and Ecosystems*

## **Biomolecules and biomaterials for ecosystems protection and human health (BREATH)**

**Reference Person:** Pucciarelli Sandra (sandra.pucciarelli@unicam.it)

**Host University/Institute:** Università di Camerino / Scuola di Bioscienze e Medicina Veterinaria

**Research Keywords:** Bioactive compounds.  
environmental decontamination  
biodiversity protection

**Reference ERCs:** LS9\_4 Microbial biotechnology and bioengineering  
LS8\_12 Microbial ecology and evolution  
PE5\_7 Biomaterials synthesis

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 6: Clean Water and Sanitation, GOAL 13: Climate Action

### **Description of the research topic**

Marine organisms living in extreme environments can produce novel bioactive compounds potentially useful for pharmaceutical, cosmeceutical, and biotechnological applications (doi: 10.3390/md18120657, doi: 10.3390/antibiotics7040090).

The goal of this PhD project is to characterize useful and sustainable biomolecules produced by Antarctic bacterial strains newly isolated in the laboratory of the Reference person. The genomes from these strains will be sequenced and analyzed to discover metabolic pathways involved in the synthesis of molecules of interest.

Therefore, the PhD candidate will work on: 1- characterization of the metabolic pathways involved in biomolecules and biomaterial synthesis in order to discover new potentiality; 2- biomolecules characterization by Scanning Electron Microscopy (SEM), Fourier transform infrared (FTIR) and UV-Vis spectroscopy; 3- protocols optimization for the biosynthesis and definition of potential uses; 4- possible application of these bacteria in bioremediation, in particular for hydrocarbons and heavy metals (the methods are reported in patent PCT/EP2020/082865).

This PhD project implies applications of bioinformatics, biochemistry, microbiology, and biotechnology. The outputs of the research can bring to the development of new and more





cost-effective bioproducts. These production of biomolecules of interest avoiding natural resources exploitation gives a contribution to ecosystems and public health preservation.

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### **Research team and environment**

Sandra Pucciarelli is a Senior researcher (with habilitation) in the field of molecular biology and biotechnology. She heads a research group working on the synthesis of biomaterials using bacteria. Thanks to the experiences of the IrIdES srl members, she also acts in the field of environmental/analytical chemistry, and remediation. She also relies on international collaborations: Prof Pietro Liò (University of Cambridge) that can support in bioinformatics, and prof. Ilidio Correia (Universidade da Beira Interior) that can provide his expertise in bioengineering. The research group is operating at the School of Bioscience and Veterinary Medicine of the University of Camerino.

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### **Suggested skills for this research topic**

The PhD candidate must possess basics knowledge in the field of microbiology, molecular biology, biotechnology, and biochemistry. She/he must be motivated in working in a multidisciplinary environment. The candidate must be able to carefully plan the experiments after making a deep study of the problematics to formulate scientific hypothesis. The candidate must be able to analyse the obtained data, using statistical support to verify the robustness of the obtained results and form logical conclusions leading to new hypotheses. The candidate must be able to work in a team and to be perseverant. Finally, she/he must train the communication skills.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

IrIdES srl

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*Curriculum: CU6 - Health and Ecosystems*

## **Microplastics and climate change: impacts on deep sea organisms**

**Reference Person:** Savoca Serena (ssavoca@unime.it)

**Host University/Institute:** Università degli Studi di Messina / Dipartimento di Scienze  
Chimiche, Biologiche, Farmaceutiche ed Ambientali

**Research Keywords:** Microplastics  
Climate changes  
Deep-sea environment

**Reference ERCs:** LS8\_5 Biological aspects of environmental change, including  
climate change

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 13: Climate Action,  
GOAL 14: Life Below Water

### **Description of the research topic**

Plastic pollution represents a serious threat to marine ecosystems, together with global warming. Numerous studies on plastic pollution have focused on coastal and surface waters, while available information is limited for the mesopelagic and deeper layers that occupy a large area of the global ocean. To better understand the influences of microplastics on marine ecosystems, many studies have evaluated their abundance, distribution, and composition using marine bioindicators and the detection of plastic-associated contaminants in their tissues. Among these additives, phthalate esters (PAEs) are one of the most used classes of plasticizers, which can easily be released into the aquatic medium. PAEs have been proposed as a possible tracer of the exposure of marine organisms to microplastics in the natural environment.

This PhD project aims to improve awareness of microplastic-biota relationships, focusing on the study of potential adverse effects of microplastic and climate change on meso-bathypelagic organisms. This will be performed evaluating and correlating microplastic contents (abundance and polymer type) and environmental parameters monitoring vs a) morphometry b) total length- weight relationships c) isometric and allometric growth d) observed sex ratio e) gonado-somatic index f) hepatosomatic index g) stomach contents analysis h) Levin's index. Additionally, PAEs contents will be investigated in organisms' tissues to assess potential bioaccumulation processes.

### **Research team and environment**



Lab StREAM is a multidisciplinary researchers team. The scientific activity mainly focus on marine organisms biology and distribution studies. Special attention is addressed to extreme or stressed marine areas, characterized by particular anthropogenic or natural conditions: Strait of Messina, brackish lagoons, Eolian Islands, mediterranean coasts, Antarctic areas, hydrothermal vents, deep environments. Researches performed by Lab StREAM concern benthic and nektonic organisms, focusing on trophic web functioning, biodiversity and monitoring of marine protected areas. A special attention is addressed to the effects of different classes of pollutants (marine litter) on marine organisms.

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**Suggested skills for this research topic**

Basic knowledge on marine biology, ecology and zoology

Marine pollution

Biological lab experience

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**Source of fundings**

DM629/2024 - M4C1 - Inv. 4.1 - Pubblica Amministrazione

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**Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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**Internship (of a minimum of 6 months) at**

to be defined

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*Curriculum: CU6 - Health and Ecosystems*

## **Exploring Active mobility. Scenarios of expanded accessibility in the foothill territories**

**Reference Person:** Velo Luca (lucavelo@iuav.it)

**Host University/Institute:** Università Iuav di Venezia / Dipartimento di Culture del Progetto

**Research Keywords:** Active mobility  
Territorial regeneration  
Mobility scenarios

**Reference ERCs:** SH7\_7 Cities; urban, regional and rural studies  
SH7\_6 Environmental and climate change, societal impact and policy  
SH7\_9 Energy, transportation and mobility

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 10: Reduced Inequality, GOAL 11: Sustainable Cities and Communities

### **Description of the research topic**

Active mobility means all mobility forms, including direct involvement of the human body (walking, cycling, using public transport). Active mobility can improve climate and health benefits and strengthen investments in public transport, providing a compelling environmental and economic alternative to the current subsidies supporting motorized transport. At the same time, it is a collective challenge. Traditionally car-dependent territories, such as foothill areas of the Veneto Region, exploring forms of active mobility can be a way to improve strategies of territorial regeneration and landscapes integration to foster more site-specific strategies, effective policies and design solutions. Promoting active mobility involves challenges and opportunities associated with implementing soft infrastructures related to public spaces, and minor mobility networks (municipal roads, dirt roads, cart tracks, embankments) reconsidering the spatial structure and the social practices. This condition allows for the main object of the PhD program, which focuses on considering the territory and its anthropic system (built - infrastructural) consisting not only of "areas" but also of "layers" (spaces - data) and dynamics (social - economical) playing different and synergistic roles in the functioning of a vast inhabited territory, basic elements for rethinking scenarios to develop more sustainable and healthy spaces and standards.

### **Research team and environment**

The PhD candidate will take advantage of the laboratories and tools of the research clusters based at University Iuav in Venice. The multidisciplinary task force includes urban designers,



planners, economists, ecologists conducting international research on the interaction between the environment, the economy, and society in the climate crisis. The candidate will benefit from luav infrastructures. luav provides PhD programs in Urbanism, Planning and New technologies; the environment provides interactions in various disciplines, with the opportunity to attend seminars and courses. The group has intense research contacts with local and foreign institutions.

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### **Suggested skills for this research topic**

Candidates should preferably have an academic background in civil engineering, architecture, human geography, politics or design sciences, ability to handle GIS and analyze datasets and to perform both quantitative and qualitative research in social sciences. Fluency both in English and Italian is recommended.

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### **Source of fundings**

DM630/2024 - M4C2 - Inv. 3.3. - Dottorati Innovativi

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### **Period of research abroad**

For this scholarship it is mandatory a period of research abroad of 6 months.

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### **Internship (of a minimum of 6 months) at**

Fondazione Palazzo Festari Intesa Programmatica d'Area Alto Vicentino

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# **PhD SDC**

**SUSTAINABLE DEVELOPMENT  
AND CLIMATE CHANGE**

## **CONTATTI**



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