



# Research Topics

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39° cycle – Academic Years 2023/2024 – 2025/2026

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



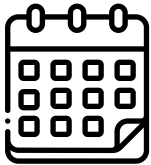
**PhD SDC**  
SUSTAINABLE DEVELOPMENT  
AND CLIMATE CHANGE

# HOW TO APPLY



**PhD SDC**  
SUSTAINABLE DEVELOPMENT  
AND CLIMATE CHANGE

## An overview of procedures



### Deadline for Application

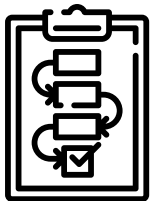
1.00 PM CEST on **17 July 2023**



### Admission Requirements

**Master's degree** or equivalent qualification

The qualification must be obtained by the start of the doctoral course (20 December 2023).



### Online Application Procedure

- Register on <https://pica.cineca.it/iuss/dottorato-39/>. You will be prompted to insert your details (such as your name, address, email, date and country of birth, etc.). Once registered, you will receive an email asking you to activate your account.
- Log in if you are already registered and enter "Sustainable Development and Climate Change" in the Search field.  
Select "Bando di concorso per l'ammissione al corso di dottorato nazionale in Sustainable Development and Climate Change".



### Required Accompanying Documents

- Valid ID document (with photo)
- Curriculum Vitae
- Research Proposal
- Letter of Purpose
- University Degree

For details please refer to [Art. 3.2](#) of the official Call for Applications.

**Call for applications**

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

**39<sup>th</sup> cycle – 2023/2024 academic year**

**DEADLINE FOR SUBMISSION 13:00 (Italian Time) 17 July 2023**

**Changes or additions to the call will be published on the “Call for applications”  
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 **39<sup>th</sup> – XXXIX cycle of the National Doctoral Course in Sustainable Development and Climate Change** (hereafter PhD-SDC) for the **2023/2024 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 document [“Research Topics”](#). 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. Gran Sasso Science Institute
2. Libera Università di BOLZANO
3. Luiss Libera Università internazionale degli studi sociali Guido Carli
4. Politecnico di BARI
5. Politecnico di MILANO
6. Politecnico di TORINO
7. Scuola Normale Superiore di PISA
8. Scuola Superiore di Studi Universitari e Perfezionamento Sant'Anna
9. Univesità Cattolica del Sacro Cuore
10. Università degli Studi "G. d'Annunzio" CHIETI-PESCARA
11. Università degli Studi "Mediterranea" di REGGIO CALABRIA
12. Università degli Studi dell'AQUILA
13. Università degli Studi di BARI ALDO MORO
14. Università degli Studi di BRESCIA
15. Università degli Studi di CAGLIARI
16. Università degli Studi di CAMERINO
17. Università degli Studi di CATANIA
18. Università degli Studi di FERRARA
19. Università degli Studi di FIRENZE
20. Università degli Studi di MESSINA
21. Università degli Studi di MILANO
22. Università degli Studi di MODENA e REGGIO EMILIA
23. Università degli Studi di NAPOLI "L'Orientale"
24. Università degli Studi di Napoli Federico II
25. Università degli Studi di PADOVA

26. Università degli Studi di PALERMO
27. Università degli Studi di PAVIA
28. Università degli Studi di ROMA "La Sapienza"
29. Università degli Studi di ROMA "Tor Vergata"
30. Università degli Studi di SALERNO
31. Università degli Studi di SASSARI
32. Università degli Studi di SIENA
33. Università degli Studi di TERAMO
34. Università degli Studi di TORINO
35. Università degli Studi di TRENTO
36. Università degli Studi di TRIESTE
37. Università degli Studi di Urbino Carlo Bo
38. Università degli Studi INSUBRIA Varese-Como
39. Università di PISA
40. Università IUAV di VENEZIA
41. Università Politecnica delle MARCHE
42. Università Telematica UNITELMA SAPIENZA
43. Università "Carlo Cattaneo" - LIUC
44. Università degli Studi di Bergamo
45. Università degli Studi di Parma
46. Università degli Studi ROMA TRE
47. Università degli Studi di Udine

### 1.3 Scholarships

The attached "[Research Topics](#)" document describes the **111** scholarships available. 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 [IUSS website](#) 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 Wednesday 20 December 2023.

## **Art. 3 - APPLICATIONS**

### **3.1 Application Procedure**

Applications must be submitted exclusively online by **17 July, 2023 at 13:00 Italian time**. There are no application fees.

Please refer to the application procedure described below.

- Go to the following link: <https://pica.cineca.it/iuss/dottorato-39/>;
- 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 required University name and major)
- Other titles

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 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) | <b>Proof of university degree awards needed for the admission, including</b> | <p>Language: Italian, English, French or Spanish. For academic documents in all other languages applicants</p>   |

|    |  |  |
|----|--|--|
|    | <p><b>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>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> </ol> <p><b>EU and non-EU member state universities:</b> where available, certificates, transcripts of records master's degree or diploma supplement, if available.</p>   |
| 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> </ul>   |

|           |                          |   |
|-----------|--------------------------|---|
|           |                          | Expected results and impacts.   |
| <b>g)</b> | <b>Letter of Purpose</b> | <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>  |
|                   | <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> </ul> <p>Any other relevant qualifications listed on the CV that provide evidence of academic and professional experience.</p> |
| <b>Assessment Results</b>        | The results of the qualification assessment will be published on the IUSS website – on the “Call for Applications” page, by 4 August 2023.   |
| <b>Interview Schedule</b>        | The interviews will be conducted starting from 4 September 2023. Candidates will be given reasonable notice of the date and timing of the interview.   |
| <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 **25 September 2023**.

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 before the deadline indicated;
3. Once scholarships are assigned, they are no longer obtainable;
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 **5 October 2023**, subject to any subsequent update regarding deadlines for Decrees n. 117/2023 and 118/2023.

## 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 Wednesday **20 December 2023**.

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 20 December 2023, 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

## 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](#). 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 Decree no. 118/2023) 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).

The School has selected the research projects to be included in the doctoral courses of the 39th 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 19 Ministerial Decree no. 118/2023 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. 118 “PNRR Research” scholarships: a period of study and research abroad for a minimum of 6 up;
- for PNRR Decree n. 118 “Public Administration” and “Cultural Heritage” scholarships: a period of study and research abroad for a minimum of 6 up, 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. 118 “Digital and Environmental Transitions” scholarships: a period of study and research abroad for a minimum of 6, 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.

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” ([Regulation for Doctoral Courses](#)) 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.

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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. 65 – 2022 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**

Giovanna Spinelli, Head of Education Unit – Palazzo del Broletto, Piazza della Vittoria n. 15 – 27100 Pavia – tel +39 0382375811, fax +39 0382375899, e-mail: [info@iusspavia.it](mailto:info@iusspavia.it).

### **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.



## **List of topics**

### **CU1: Earth System and Environment**

- Short- and long-lived climate forcing compounds in urban areas
- Integrated and environmentally sustainable water resources management in the Mediterranean area
- Assessing the impacts of climate change and extreme events on water resources
- Microplastic pollution: exchanges between ocean and atmosphere
- Simulating Climate-Chemistry Scenarios to Assess Changes in Air Quality in Italy
- Impacts of climate change related stressors and anthropogenic pollution on marine biodiversity.
- Remote sensing and machine learning techniques for river monitoring
- Integrated Ecohydrological Modeling for in Data-Scarce Environments
- Enhanced weathering as a climate solution: modeling and field aspects
- Fate of nanoplastics in the environment and in wastewater treatment plants
- From hazard to eco innovation : the new role of harmful minerals in the view of resource efficiency
- Risk assessment of ports exposure to extreme winds
- sustainable sediment management in hydropower reservoirs in a climate change scenario
- Foraminifera in the Sedimentary Record as Proxies of Climate Change and Anthropogenic Pollutants
- Development and application of computational strategies for tropospheric condensed phase chemistry
- Genomics consequences and adaptive chances for natural populations in fast changing environments
- Statistical data science for modelling intensive farming, air quality and climate change in the EU
- Every drop counts. Towards new sustainable territorial water footprints

### **CU2: Socio-economic risk and impacts**

- Italian Inner Areas as Engine for Green Transition and Recovery
- Risk based design and management of urban solutions decisions
- Sustainable mobility determinants in urban contexts: demand and supply analysis and policy design
- Robust design of financial risk hedging tools for climate change adaptation
- Statistical data science methods for climate change risk perception based on textual data
- Regenerative-resilient Circular Supply Chains through network relationships: impact models for SMEs
- Statistical data science: Measurement issues of Social Sustainability
- Environmental policies and consumption choices for low carbon and circular transitions
- Transformative role of energy communities and business actors for the clean energy transition
- Statistical data science: Deep Learning for Modelling Risk measures and ESG scores
- A multicriteria framework for Raworth's doughnuts with a focus on the working time-waste NEXUS



- Sustainability and complexity of the reverse logistics process in the circular economy
- Socio-economic analysis of climate-related risks and adaptation and mitigation actions
- Skills in the green transition: the relation between university education, research, and innovation
- Impact of climate change on water resources management and water uses in Italy
- The role of co-operative firms in the digital and green transition
- Different economic impacts of climate change in rural and urban areas: the role of migration
- Reuse, reduce, recycle: challenges and opportunities in the fashion industry
- Green technologies, digitalization and regional diversification: the role of global linkages
- Climate Extremes and Workplace Safety
- Statistical data science: evaluation of inequalities in Social Sustainability
- Using Machine Learning for climate-related environmental and socio-economic vulnerability
- Sustainable mobility: models, methods and case studies.
- The role of Public Administration in the transition towards a sustainable and circular bioeconomy
- Governance issues in climate action

### CU3: Technology and Territory

- Sustainable Solvents and Technologies: Unlocking Greener Synthetic Strategies
- Bio-conjugation of Enzymes to develop robust catalysts for C-H activation catalysts
- Photoelectrocatalytic artificial-leaf devices for sustainable and resilient energy management
- Manufacturing sustainability of production chains through Digital Twin
- Monitoring and modelling of a ZEB (Zero Energy Building)
- Artificial Intelligence for Precision Livestock Farming: Supporting Sustainable Production
- Combining organocatalysis and ring strain: new opportunities for sustainable organic synthesis
- Synthesis of bio-based products and study of their applications
- Fabrication of novel bio-based hybrid materials for water and soil purification
- Green infrastructure and nature-based solutions to support spatial planning at multiple scales
- Real Time Risk Analysis to Decision Support System for Critical Infrastructures' resilience
- Paradigm capsized: planning with tangible, manageable and measurable NbS
- Rethinking, Engineering and Optimizing the value chain of Italian food processing residues
- How to tackle urban climate fragility: making possible with regenerative design
- Declining the circular economy for fastening systems in construction
- Innovation in passive technologies to deliver summer comfort under XXI century climate conditions
- Sustainable Energy Communities



- Sustainable and Circular Digital Manufacturing
- Novel energy conversion and electric propulsion systems for electric vessels
- Eco-design of materials and technologies for sustainable energy production and storage
- E-mobility and Smart-Grids
- Eco friendly nanosponges for CO2 capture and utilization
- Removable photocured inks and coatings for fully recyclable packaging
- Energy transition, Air Quality and Low Carbon technologies and policies

#### CU4: Theories, Institutions and Cultures

- Diachronic Webfare and Transgenerationality. In memory of engineer Franco Tatò
- The Documerial Capital for Future Generations
- Environmental and climate migrations? A critique of definitions. A political ecology of migrations
- Psycho/neurolinguistic approaches to the use of language in climate change communication
- Institutions and governance of climate change
- The Dieselgate Returns - Liability of Corporations for environmentally unsustainable behaviors
- Citizens, Sustainability and Voting
- International Standards and Remedies as Indirect Instruments for Climate Change and Green Transition Challenges
- Models, methods, and indicators for the social impacts assessment of the hydrogen deployment
- Conflicts of the deep transition: theories, practices, and models for a political ecology of war.
- The Ethics and Politics of Plant Conservation in the Anthropocene
- Ethical, Political and Institutional Profiles of Sustainable Development and Climate Change
- The new trends in climate change litigation
- Energy Communities and Local Authorities: a Meeting Point between Public and Private Law
- The Ecological Humanities and Ecocriticism across the Global North and the Global South
- Understanding sustainable development between institutional arrangements and market regulation. A comparative law perspective.

#### CU5: Agriculture and Forestry

- Holistic strategies to contrast climate change impact in maize value chain
- State and regional legislative power on agroenergy in light of the fight against the climate crisis
- Modeling for climate change adaptation
- Climate adaptation and environmental sustainability of tropical fruit crops in Mediterranean area.



- Combining crop models and seasonal forecasts for a climate-resilient farming system
- Forest ecosystem services under climate change
- Impacts of climate change and its uncertainty on agriculture
- Hyperspectral detection of plant diseases to support global food security and safety
- Central Italy Emmer wheat types: healthy foods from sustainable agriculture
- Management of dairy farm sustainability
- Exploring new ways of monitoring good agricultural practices also with the support of EO products
- A polyamine metabolism-based strategy to improve stress tolerance of crops
- Study of mass and energy exchanges between ecosystems and the atmosphere in the Alpine region

#### CU6: Health and Ecosystems

- Identification of preclinical candidates for the treatment of waterborne parasites
- Genomic and transcriptomic response to environmental changes in aquatic animal species
- Neuro-organoids and assembloids for a sustainable and personalized medicine
- Neuro-cognitive evidence on the assessment and treatment of climate change anxiety
- Sustainable integrated nanostructured analytical platforms for on-site analysis and bioresearch
- ASTRA - Antimicrobial solutions for extraterrestrial human explorations
- Conserving the evolutionary potential of endemic species under global changes
- Climate Change Climate Change Impacts in Polar and Alpine permafrost areas
- Monitoring of the T-related infections by Photobacterium damsela piscicida in farmed sea bass
- Green and blue infrastructures and impacts on soil health and human health
- Element speciation in a changing environment
- Bioproducts for ecosystems protection and human health (BREATH)
- The relationship between the exposome, the socioeconomical context and health
- Microplastics and climate change: potential threat to human health
- Enzyme-based bio-devices for CO<sub>2</sub> conversion to chemicals and biofuels



*Curriculum: CU1 - Earth Systems and the Environment*

## **Short- and long-lived climate forcing compounds in urban areas**

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

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

**Research Keywords:** Atmospheric monitoring  
Atmospheric modelling  
Urban areas

**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**

Urban environments, hosting more than half of world's population, are critical for climate change, being among the largest emission source of climate forcing compounds.

To better constrain environmental policies, in line with Horizon Europe's Mission 'Climate neutral and smart cities', it is critical to improve the understanding of the variability in levels and emissions of short-lived and long-lived climate forcers in urban areas. These latter compounds include regulatory pollutants (e.g. NO<sub>2</sub>, O<sub>3</sub>), unregulated pollutants (e.g. Black/Brown carbon aerosol), greenhouse gases (e.g. CO<sub>2</sub>, CH<sub>4</sub>), with several of them having large spatial and temporal variability within the urban areas. The project will focus on the investigation of these atmospheric species in a pilot urban area with the final goal of defining a methodology to reduce the uncertainty in urban emission estimates. The activity will start with a literature review to gain an up-to-date view on this topic, on the available datasets and the most suitable analysis tools. The main activity is expected to leverage on experimental concentration and flux data, combined with remotely sensed data and eventually ad-hoc atmospheric dispersion simulations and vegetation-atmosphere exchange models, to produce a reliable description of the urban atmosphere. Finally the proposed methodology will be tested under different scenarios, e.g. other urban areas or possible future conditions, in line with specific IPCC SSP or EU policy pathways

### **Research team and environment**

The main hub of the research activities will be the LARMA Lab of the Dept. of Engineering "Enzo Ferrari" ([www.larma.unimore.it](http://www.larma.unimore.it)). The group includes scientists with skills on remote



sensing, atmospheric modelling and monitoring by regulatory and non-regulatory devices. The team includes 10 members among professors, research technicians, postdoc and PhD students. The lab has International collaborations in Europe with several partners of the ACTRIS and ICOS Infrastructures and collaborates with the local Environmental Agency and the municipality of Modena. The team is also in charge of the Geophysical Observatory of Modena ([www.ossgeo.unimore.it](http://www.ossgeo.unimore.it)) and of the local AERONET sun photometer.

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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 and atmospheric modelling are considered an asset.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Integrated and environmentally sustainable water resources management in the Mediterranean area**

**Reference Person:** Bonaccorso Brunella (bbonaccorso@unime.it)

**Host University/Institute:** Università di Messina / Ingegneria

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**Research Keywords:** sustainable water resources management

climate and land use changes

environmental requirements

**Reference ERCs:** PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution

PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics

SH7\_8 Land use and planning

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 6: Clean Water and Sanitation, GOAL 13: Climate Action

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

The Mediterranean region is experiencing a broad range of threats to water security related to the reduction of water resources availability mainly driven by water overexploitation and pollution and land degradation, due to the rising urbanization, mass tourism and intensive farming. Furthermore, climate change is expected to exacerbate the existing water scarcity issue in the region, leading to unprecedented challenges and risks, especially in arid and semi-arid regions. To address such emerging threats, the research project aims at developing a holistic and dynamic approach integrating biophysical models, current and future scenarios of climate and water demand, as well as land use, to identify optimal water resources management options under different conditions in representative water supply systems in the Mediterranean region. In particular, the Ph.D. candidate will develop and implement a dynamic modeling framework for simulating the impact of climate and land use change, and related land and water management practices, on water resources and ecosystem services in selected case studies. The requirement for environmental flows to maintain ecosystems, such as wetland and in-stream environments, will be also considered in the modeling framework to redefine sustainable rules of competition for water and land use between the economic sectors and the environment.

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### **Research team and environment**





The research activity will be carried out at the Department of Engineering, University of Messina. Within the Research Group of Water Engineering and Hydrology coordinated by Prof. Giuseppe T. Aronica. The Group includes an Associate Professor and other members (Ph.D. students, Post-Docs, and Research Assistants) and covers 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 civil/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**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Assessing the impacts of climate change and extreme events on water resources**

**Reference Person:** D'Oria Marco (marco.doria@unipr.it)

**Host University/Institute:** Università degli studi di Parma / Dipartimento di Ingegneria e Architettura

**Research Keywords:** Impacts of climate change on water resources  
Impacts of climate change on climate extremes  
Climate models combined with hydrological models

**Reference ERCs:** PE10\_3 Climatology and climate change  
PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution  
PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics

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

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

Climate change is having a significant impact on water resources. Changes in temperature and precipitation patterns as well as climate extreme events are affecting the availability, quality, and distribution of water in various regions. The use of general circulation models (GCMs) and regional climate models (RCMs) is crucial for generating future climate projections based on different scenarios. The climate variables provided by these models can be used to drive basin-scale hydrological models or surrogates of such models, which are effective tools for assessing the potential impact of climate change on water resources. This research proposal aims to assess how climate change is affecting climate extremes and water resources focusing on Italian areas, particularly in the Po River basin. The proposal intends to analyse data at different timescales, including seasonal and decadal forecasts and long-term projections, to evaluate future climate and extreme occurrences. These analyses are fundamental to develop and implement adaptation plans from the short- to the long-term. Statistical methods will be used to adapt the climate model outputs to a local scale preserving local heterogeneities and to estimate climate characteristics on a sub-daily scale where necessary. Physically based hydrological models or surrogate models will be driven by the climate projections to provide quantitative information on water resources and the frequency and intensity of future dry and wet periods.

### **Research team and environment**



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The research will take place at the Department of Engineering and Architecture of the University of Parma.

The research team involved includes:

Marco D'Oria (applicant) – PhD. Associate Professor of Hydraulic and Maritime Constructions and Hydrology – SSD ICAR/02

Maria Giovanna Tanda – Full Professor of Hydraulic and Maritime Constructions and Hydrology – SSD ICAR/02

Valeria Todaro – PhD. Assistant professor (RTD/a) of Hydraulic and Maritime Constructions and Hydrology – SSD ICAR/02

Daniele Secci – PhD student, PhD program in co-tutorship with Polytechnic University of Valencia (Spain), prof. Jaime J. Gómez-Hernández.

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

Master's degree in either Civil Engineering with a curriculum focused on hydraulics or Environmental Engineering.

Proficient in basic software such as Office, intermediate in programming using Matlab and GIS. Possess extensive expertise in statistical hydrology.

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### **Source of fundings**

DM118/2023 – 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Microplastic pollution: exchanges between ocean and atmosphere**

**Reference Person:** Di Carlo Piero (piero.dicarlo@unich.it)

**Host University/Institute:** Università 'G. d'Annunzio' di Chieti-Pescara / Tecnologie innovative in medicina e odontoiatria

**Research Keywords:** Pollution  
atmosphere  
ocean

**Reference ERCs:** PE10\_1 Atmospheric chemistry, atmospheric composition, air pollution  
PE10\_4 Terrestrial ecology, land cover change  
PE10\_8 Oceanography (physical, chemical, biological, geological)

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

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

Global plastic litter pollution is one of the current concerns in different environment. Usually it is assumed that once plastics enter the ocean they are there to stay, retained permanently within the ocean currents, biota or sediment until eventual deposition on the sea floor or become washed up onto the beach. In this PhD project we would understand how sea salt, bacteria, virus' and algae could be a plastic particles carriers allowing exchange of microplastic between ocean and atmosphere.

### **Research team and environment**

Our team includes two professors, 4 researchers and 2 post-doc with experience in monitoring of the atmospheric and ocean pollution. See this webpage for more details: [www.atmo.unich.it](http://www.atmo.unich.it)

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

The requested skills of a successful candidate are: 1) good knowledge of physics and mathematics, 2) good ability to analyse data, 3) knowledge of Matlab, or Python or R.

### **Source of fundings**

DM118/2023 - M4C1 - Inv. 4.1 - Ricerca PNRR

### **Period of research abroad**

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



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### **Internship**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Simulating Climate-Chemistry Scenarios to Assess Changes in Air Quality in Italy**

**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:** Climate-chemistry Modeling

Future emission scenarios

Radiative Forcing

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

PE10\_3 Climatology and climate change

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

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

The observed increase in global average temperature of 1.1°C above pre-industrial levels, as highlighted in the Sixth Assessment Report by the IPCC, is a clear indication of the urgent threat posed by climate change to both environment and society. This rise in CO<sub>2</sub> and CH<sub>4</sub> atmospheric levels is further amplified by the expected emission increase of volatile organic compounds and ammonia, resulting from changes in temperature and precipitation patterns. Likely, these conditions will also worsen the ozone formation and enhance the frequency and intensity of wildfires. To cope with climate alterations, the present research proposal aims at investigating the modifications in concentrations of regulatory (e.g. O<sub>3</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, etc.) and unregulated (Black/Brown carbon aerosol) air pollutants under different climate scenarios over Italy, with a particular focus on the Po valley in collaboration with the local Regional Environmental Agency (Arpae). The main goals of the project are to provide a better understanding of the impact of climate change on air quality and radiative forcing, and identify effective strategies for mitigating its effects. Climate-chemistry simulations for present-day and future scenarios will be performed from global scale down to a spatial resolution of a few kilometers, pursuing a reliable design of air quality plans for the next decades.

### **Research team and environment**

Research activities will be carried out 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). The team consists of experts in chemical-transport and urban dispersion modeling, remote sensing and monitoring of gasses and aerosols, providing a challenging training environment. The



research group includes professors, research technicians, postdoctoral fellows and foreign PhD students. The laboratory has established collaborations with international (e.g. ACTRIS and ICOS research infrastructures) and national (e.g. local Regional Environmental Agency and National Institute of Geophysics and Volcanology) partners.

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

- Master/Diploma or equivalent in the field of Meteorology, Physics, Geophysics, Mathematics, Chemistry, Computer Science or related disciplines
- Analytical skills and ability to work both, independently and as part of the team
- Experience in working on Linux systems and preferably experience with working on High Performance Computing Systems (Linux)
- Preferably experience in analyzing large data-sets (preferably climate and model output data)
- Preferably a background in atmospheric chemistry/aerosol dynamics with knowledge of climate sciences
- Preferably experiences in atmospheric modeling and programming (e.g. R, Python, Fortran, etc.)

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Impacts of climate change related stressors and anthropogenic pollution on marine biodiversity.**

**Reference Person:** Gorbi Stefania (s.gorbi@staff.univpm.it)

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

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**Research Keywords:** Multiple stressors  
Marine ecosystems  
Biodiversity conservation

**Reference ERCs:** LS8\_5 Biological aspects of environmental change, including climate change  
LS8\_13 Marine biology and ecology  
LS8\_14 Ecophysiology, from organisms to ecosystems

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 13: Climate Action, GOAL 14: Life Below Water

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

CO<sub>2</sub>-related ocean changes pose a major threat to the marine biodiversity in coastal environments of the Mediterranean sea, highlighted as one of the most vulnerable basins. Indeed, marine heatwaves, acidification and freshening, to cite a few, may be amplified given the semi-enclosed morphology and overall shallow depths. Nonetheless, this basin is characterized by a consistent anthropogenic footprint, as an important area for fishery and aquaculture, tourism, oil and gas exploitation, riverine effluents and urban sewers that impact organisms' health status and biodiversity through the introduction of relevant loads of organic and inorganic contaminants.

The project aims to address the effects and of such multiple stressors on organisms' biology and ecosystem integrity through a multidisciplinary approach, unravelling mechanisms of action and typologies of interactions between stressors on key biological processes at various level of biological organization, as well as thresholds of tolerance and resilience in species with economic and ecological interest. Field activities aimed to collect abiotic data, sediments and water samples, and bioindicator species will be integrated with laboratory investigations and mesocosms exposures, to produce findings that will be crucial to i) predict the impacts of CO<sub>2</sub>-related ocean changes and anthropogenic contaminants on marine biodiversity and ii) provide solutions for its conservation and management.

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### **Research team and environment**





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The project will be carried out at the Department of Life and Environmental Sciences of the Polytechnic University of Marche (DISVA).

DISVA includes more than 100 interdisciplinary laboratories, ranging from biological physics, cell and molecular biology, biochemistry and genetic organic biology, microbiology and applicative biotechnology, physiology and reproductive biology, marine ecotoxicology and oceanography.

<http://www.disva.univpm.it/>

The DISVA offers the possibility to use the Actea Mobile Laboratory to sampling activities and hosts the "Aquarium" Laboratory representing a unique infrastructure at National level.

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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 climate change, anthropogenic pollutants, and sustainable development goals. Preferred skills reflect the ability to process biological samples using spectrophotometric, gas-cromatographic, brightfield and fluorescence microscopy, modern molecular biology techniques.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Remote sensing and machine learning techniques for river monitoring**

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

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

**Research Keywords:** River Monitoring  
Earth Observation  
Machine Learning

**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  
PE10\_14 Earth observations from space/remote sensing

**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 concomitant impact of global warming, population growth, and pollution. There is therefore an urgent need to identify new strategies for river monitoring to support water budget and quality assessment. The main goal of the present research is the development of a new generation of monitoring systems exploiting Earth Observations (EO) and Artificial Intelligence (AI) to provide a qualitative and quantitative characterization of space-time dynamics of river systems. In fact, EO offers increasing potentials in terms space-time resolution and number of sensors, which provide an extraordinary amount of EO-based information. The aim of the present research is to combine available observations in order to improve our ability to describe river systems taking into account the overall dynamics occurring at the river basins scale such as soil moisture state, land use changes, and vegetation state. These information combined river observations and machine learning algorithms may help interpreting the river basin response in along the river leading to a new smart monitoring approach.

### **Research team and environment**

Activities will be carried out at the Department of Civil, Building and Environmental Engineering (DICEA) of the University of Naples Federico II which is a leading institute in hydraulic and hydrological studies. In addition, there will be a close collaboration with the



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Department of Electrical Engineering and Information Technologies, which is leading the development of new technologies and remote sensing. 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**

Remote sensing, hydrology, Machine Learning

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Integrated Ecohydrological Modeling for in Data-Scarce Environments**

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

**Host University/Institute:** University of Naples Federico II / Department of Civil, Building and Environmental Engineering (DICEA)

**Research Keywords:** Hydrological Modelling

Remote Sensing

Climate Change

**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

PE10\_14 Earth observations from space/remote sensing

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

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

Water security is crucial for sustainable development, especially considering the effects of climate change on the hydrological cycle, including altered rainfall patterns, outflows, and aquifer recharge. Consequently, assessing water availability in current and future scenarios is imperative.

The focus of this proposal is to develop an ecohydrological modeling approach that encompasses large-scale interactions among soil, water, and vegetation. One of the primary challenges in ecohydrological modeling, particularly in data-scarce environments like southern Italy, is the model calibration. Thus, special attention will be given to establishing a consistent and reliable parametrization. Therefore, a novel model procedure will be developed, leveraging spatio-temporal information obtained from Earth Observations data for model calibration and validation.

The main objectives are: 1) Provide a comprehensive description of hydrological dynamics i.e. mass and energy exchanges in soil-vegetation-atmosphere continuum, by exploiting available ground observations and remote sensing products; 2) Investigate the impact of climate change on water needs; 3). Develop scenarios and strategies for effectively managing and optimizing water resources.



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Our primary goal is to advance our understanding of water resource dynamics, strengthen our readiness to handle the impacts of climate change, and actively promote sustainable management of water resources.

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### **Research team and environment**

The PhD will carry out the activities under the guidance of Prof. Salvatore Manfreda (Department of Civil, Building and Environmental Engineering of the University of Naples Federico II) and Prof. Guido D'Urso (Dept. Agricultural Sciences) which are leading institute in hydrology and remote sensing applications. University of Naples Federico II is developing new innovative technologies for hydrological modelling and environmental monitoring using remote sensing from spaceborne platforms and unmanned aerial 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**

Hydrological modelling, remote sensing, Matlab coding, data processing

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at Autorità di bacino distrettuale dell'Appennino Meridionale

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Enhanced weathering as a climate solution: modeling and field aspects**

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

**Host University/Institute:** Università degli studi di Palermo / Ingegneria

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**Research Keywords:** Carbon sequestration

Climate solutions

Enhanced weathering

**Reference ERCs:** PE10\_9 Biogeochemistry, biogeochemical cycles, environmental chemistry

PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution

PE10\_21 Earth system modelling and interactions

**Reference SDGs:** GOAL 13: Climate Action, GOAL 15: Life on Land

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

Among the strategies to combat climate change, one of the most promising is Enhanced Weathering (EW), which aims to sequester atmospheric CO<sub>2</sub> by increasing the rates of naturally occurring chemical reactions in soils, using highly reactive minerals (i.e., silicates). Reacting with CO<sub>2</sub>, silicate minerals may lead to the increase in the alkalinity of soil water and the formation of dissolved bicarbonate and carbonate ions, that if are leached out of the soil, transported by groundwater, and eventually reach the oceans, form the carbon sequestration. From the experimental point of view, only some mesocosm or pilot-scale experiments of EW exist and are conducted in controlled conditions. Existing models, instead, allow to quantify the impact of hydroclimatic fluctuations, or soil and vegetation parameters on the involved biogeochemical processes. Applying for this research project, the candidate may be involved in modeling EW process. The candidate may help improving one of the most complete models existing in literature about EW, which already provides reliable carbon sequestration estimations, as compared to the recently published mesocosm experiments. The candidate may interface with several research groups that are conducting laboratory experiments on soil plots and calibrate/validate the model with their data. The candidate can also carry out an extensive application of the model to simulate EW yields at the global scale.

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### **Research team and environment**



The research activity will be held at the University of Palermo 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 some researchers, post-doc, and Ph.D. students with great experience in the above-mentioned topics. Particularly, Dr. Giuseppe Cipolla, has a strong experience on modeling enhanced weathering processes for carbon sequestration, cooperating with Prof. A. Porporato (Princeton Univ.), and Dr. S. Calabrese (Texas A and M Univ.). The candidate will thus find an enthusiastic team to carry on working on the modeling aspects of this technology.

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

The candidate will need to have some knowledge about hydrological processes and biogeochemistry. 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**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Fate of nanoplastics in the environment and in wastewater treatment plants**

**Reference Person:** Passananti Monica (monica.passananti@unito.it)

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

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**Research Keywords:** Nanoplastics  
Photodegradation  
Wastewater treatment

**Reference ERCs:** PE10\_9 Biogeochemistry, biogeochemical cycles, environmental chemistry  
PE4\_15 Photochemistry  
PE4\_5 Analytical chemistry

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

Plastic pollution has been widely reported since the 1970s and nowadays it is an important environmental, societal and economic problem. The goal of this PhD project is to better understand the environmental impact of nanoplastics (NPs), and to investigate their potential effect on wastewater treatments. Small microplastics (MPs) and NPs can interact with abiotic components (such as light and oxidants) in natural waters; these interactions could disrupt natural processes, contribute to degrade plastic debris and release degradation products in aqueous phase. This project will study these interactions under laboratory conditions to simulate natural environments.

The project will focus also on the release of chemicals from plastic particles during wastewater treatment. Interactions between organic pollutants and NPs will be evaluated, in the framework of a study on the potential effect of MPs and NPs on the efficiency of Advanced Oxidation Processes (AOPs). AOPs are aimed at the degradation of organic contaminants that are recalcitrant to traditional treatment processes. The rationale here is that the oxidising conditions found in AOPs could modify plastic particles, affecting their degradation and the associated release of chemicals. On the other hand, interaction between plastics and AOP oxidants might scavenge the latter and affect (e.g., inhibit) the way contaminants are degraded.

This PhD project will help to elucidate the potential effect of MPs and NPs pollution.

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### **Research team and environment**





The project will be carried out at the Department of Chemistry of UNITO (which is one of the Department of Excellence 2023-2027 selected by MUR), in the Chemistry Energy and Environment (CEA) research group. CEA group has a long history in studying processes and mechanisms that define the chemistry of surface waters, and the mechanisms involved in the advanced oxidation processes (AOP). The Department of Chemistry and the CEA group have a wide range of instrumentation for simulating AOP and environmental-like conditions (reactors, lamps, etc...), and for the analysis of liquid and particle phase. The research environment is dynamic and stimulating, suitable for carrying out this PhD project.

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

The candidate should be fluent in English and have communication, organization, and interpersonal skills. Applicants should have a background in environmental science and/or analytical chemistry. The candidate should have basic knowledge on kinetic competition methods and kinetic simulations, on polymers, radical chemistry, environmental degradation, mass spectrometry and spectroscopic techniques.

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **From hazard to eco innovation : the new role of harmful minerals in the view of resource efficiency**

**Reference Person:** Punturo Rosalda (rosalda.punturo@unict.it)

**Host University/Institute:** Università di Catania / Dipartimento di Scienze Biologiche, Geologiche ed Ambientali

**Research Keywords:** Asbestos-bearing geomatrices  
Soil and water management  
Advanced methodologies for eco innovation

**Reference ERCs:** PE10\_10 Mineralogy, petrology, igneous petrology, metamorphic petrology  
PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
SH7\_5 Sustainability sciences, environment and resources

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

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

As it is known, fibrous minerals (regulated and not), present in geological matrices represent a cause of danger to health, as they are potential environmental pollutants. Indeed, although today many countries have banned the use and marketing of asbestos, the environmental or occupational exposure of the population represents an environmental problem that is still unresolved. Human activities (e.g. agriculture, mining) can accelerate/trigger the processes of release of fibrous minerals into the environment, causing at the same time soil consumption and degradation. This proposal intends to deepen the study of innovative methods for the automatic classification of combined optical and X-ray images of geomaterials, with particular reference to potentially harmful constituents for humans and the environment, while giving at the same time useful quantitative results aimed at inertization of the same and their potential recycling and/or reuse in a circular economy key. The classical and advanced analytical methodologies for characterizing asbestos-bearing geomatrices may shed new light towards waste management and will permit to consider them from neglected geomaterial to a precious resource of metals and minerals of industrial interest. At the same time, knowledge of the natural occurrences of asbestos-bearing geomatrices will bring benefits in term of quality of available water and soil management and their availability in the context of climate change.



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### **Research team and environment**

The responsible is part of a research group, whose members are also from other universities, with which she has been collaborating for years. Laboratories of the Department of Biological, Geological and Environmental Sciences to be used: a) Geoinformatics; b) electron microscopy; c) fluorescence and X-ray diffractometry; d) non-destructive analysis XRF, Raman, FT-IR and petrophysics; e) optical microscopy; f) geochemistry.

Activity will be also carried out with the start-up CIRTAA S.r.l, which has patented procedures for the inertization of geomaterials containing asbestos, and agreements with ARPA Sicily and the Elettra synchrotron of Trieste will allow the development of protocols.

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

The candidate's skill must comprise the techniques in the field of recognition and automatic digitization of optical, X-ray and micro-tomographic images of artificial and natural stone materials.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Risk assessment of ports exposure to extreme winds**

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

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

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**Research Keywords:** Extreme Winds

Port Areas

Experimental and Numerical Techniques

**Reference ERCs:** PE10\_2 Meteorology, atmospheric physics and dynamics

PE8\_4 Computational engineering

PE8\_5 Fluid mechanics

**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**

Ports are key players in the global trade and the Maritime Safety is one of the key areas identified by EU Commission, where further work is needed to strengthen the competitiveness of the sector while enhancing its environmental performance. Many activities usually carried out in these areas also imply high risks for human beings. The consequences of accidents in port areas may be not only economic losses but also human losses. Among geophysical, meteorological and climatological events, the wind is one of the most destructive natural phenomena and the prime cause of accidents occurred in coastal and port areas.

The goal of this research project is to develop an innovative and multidisciplinary downscaling approach to improve the knowledge of local wind conditions for the safety management of port infrastructures and reduce economic losses associated with port disruption due to extreme wind events. Simulations of Computational Fluid Dynamics (CFD) will be carried out with different numerical methods at various spatiotemporal scales on high-resolution grids including ships, cranes, port infrastructures as well as other environmental features. Simulated data will be validated with experimental database from anemometers, LiDAR and reduced-scale tests of wind tunnels and wind simulators. Future scenarios of wind risk will be evaluated based on the most recent climate projections available after IPCC AR6.

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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 the Giovanni Solari Wind Engineering and Structural Dynamics (WinDyn) research group of the Department of Civil, Chemical and Environmental Engineering at the University of Genoa (UniGe). The student co-supervised from IUSS and UniGe will benefit from the extensive experience of the two groups in climatology, wind measurement and modeling; wind effects on infrastructures and environment; impact assessment of extreme natural events; risk management of natural and anthropogenic hazards; formulation and proposal of new economic and political models of sustainable development.

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

The candidate should have knowledge of Computational Fluid Dynamics, numerical modeling, 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 desirable.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **sustainable sediment management in hydropower reservoirs in a climate change scenario**

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

**Host University/Institute:** Libera Università di Bolzano / Facoltà Ingegneria

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**Research Keywords:** reservoirs silting  
sustainable sediment transport management  
sediment ecologic and economic trade-off

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

PE8\_5 Fluid mechanics

PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 13: Climate Action, GOAL 15: Life on Land

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

Sediment trapped behind dams reduces reservoir capacity, leading to the loss of hydropower production and depriving downstream reaches of sediment essential to support diversified aquatic communities. Increase of rainfall erosivity and on glacier melt induced by climate change will enhance sediment flow to reservoirs, threatening sustainability of alpine reservoir.

Sediment release operations, performed to regain reservoir storage capacity, entail the release of large amounts of fines to the downstream channel with detrimental effects for aquatic life. The research study will consider as case studies some hydropower reservoirs South Tyrol, for which an active collaboration with Alperia (a society active in hydropower production).

The research activity will be both theoretical and experimental, aiming to:

- calculating soil erosion and stream sediment transport yields at the catchment scale;
- applying Cutting-edge 2D/3D CFD models of sediment transport in the feeding stream and through the reservoir, along with habitat modeling and biological monitoring surveys



- evaluating best soil conservation practices and sediment management that reduce both the storage capacity loss and related environmental impacts, with clear environmental and economic benefits.
- The project will propose new strategies of integrated sediment management, to realize the sustainable utilization of water resources and ecological environment protection, and achieve harmony between humans and nature.

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### **Research team and environment**

The PhD candidate will work at the Free University of Bozen, Fac. of Engineering. The research team he will join consists of young researchers expert in Fluid mechanics, CFD, Hydropower, ecosystems and sediment transport. The team is supported by a laboratory equipped with advanced research instruments both for the laboratory and in field measurements. The contact person for this research topic usually co-operates with local hydropower companies and provincial authorities in order to jointly develop monitoring activities in some reference reservoirs and rivers, creating a dialogue between the them, regarding sustainable management of reservoirs and related economical and ecological issues.

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

The main skills required are the willingness to be part of the working team, working together towards a common goal, by taking responsibility for their own work, creating a relaxed environment but pursuing clear research aims. The candidate should be curious, proactive and willing to learn. For what concerns technical skills, the candidate should have the basics of hydraulics and sediment transport, programming (Fortran/Matlab) or the use of at least 2D hydraulic modelling software (Basement, Flow-2D, etc.). He/she should show willingness to perform field measurements that will mainly concern flow rates, turbidity, substrate sampling and as support to interaction with local authorities.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate



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*Curriculum: CU1 - Earth Systems and the Environment*

## **Foraminifera in the Sedimentary Record as Proxies of Climate Change and Anthropogenic Pollutants**

**Reference Person:** Sabbatini Anna (a.sabbatini@univpm.it)

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

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**Research Keywords:** Marine organisms and Foraminifera  
Anthropogenic impact and emerging pollutants  
Geochemistry and environmental proxies

**Reference ERCs:** PE10\_9 Biogeochemistry, biogeochemical cycles, environmental chemistry  
PE10\_6 Palaeoclimatology, palaeoecology  
PE10\_3 Climatology and climate change

**Reference SDGs:** GOAL 4: Good Quality Education, GOAL 13: Climate Action, GOAL 14: Life Below Water

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

Marine ecosystems have been progressively affected by new threats like extreme weather events, ocean acidification, eutrophication, and anthropogenic contaminants due to global warming. Planktonic and benthic foraminifera play a key role in reconstructing climatic and paleoceanographic changes through sedimentary record; on the other hand, the use of foraminifera in environmental studies suggests their importance as valuable sentinel species in monitoring human activities. The aim of the project is improving the current knowledge on the effects of climate change and human activities (e.g., anthropogenic impact, emerging pollutants) including the identification of a wide spectrum of methodological approaches (paleoenvironmental, geochemical, environmental and experimental ones) on foraminifera at biological, community and ecosystem functioning level. Paleoceanographic and paleoenvironmental researches in the context of global change are facing rapid challenges, and the application of new technologies and new indicators will refine the accuracy of the use of Foraminifera for studies climate change-addressed.

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### **Research team and environment**

The Stratigraphy Sedimentology and Paleocology laboratory at the Polytechnic University of Marche (UNIVPM - Department of Life and Environmental Science - DISVA), is the laboratory where the project will be developed. The research activities are focused on the study of sediments and their textural and (paleo)ecological content. The Research Team is young and





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dynamic, and it is devoted to the study of foraminifera to understand the ongoing changes either due to anthropogenic or natural changes.

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

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

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Development and application of computational strategies for tropospheric condensed phase chemistry**

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

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

**Research Keywords:** Quantum-chemical calculations  
Atmospheric reactivity, kinetics and spectroscopy  
Aerosol, fog and cloud chemistry

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

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

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

Condensed phase particles and aerosols play a fundamental role in the atmosphere, however, our understanding of their impact on atmospheric chemistry and physics, as well as on climate, is hampered by the limited knowledge on their formation mechanisms, chemical composition and morphology and their evolution. While current laboratory studies are performed using reaction-chambers, the obtained experimental outcomes are of difficult interpretation and do not provide access to the full mechanistic details required to develop predictive models. Given these premises, the research topic aims at investigating the atmospheric reactivity taking place on the surface or within aerosol particles by using state-of-the-art computational strategies based on quantum-chemical or hybrid quantum-chemical/molecular-mechanics methods. From the determined reaction mechanisms, thermochemical data are evaluated and used to predict kinetic rate constants. Attention will be given to reactions of atmospheric radicals, non-radical oxidants, organic accretion reactions, other type of reactions such as hydrolysis and nucleophilic substitutions, and eventually photochemical reactions. The outcomes of the research are expected to provide the scientific community with atomistic details of environmentally relevant reaction mechanisms, and their accurate thermochemical and kinetic data capable of explaining real-world measurements and needed for predictive modeling.

### **Research team and environment**



The research will be carried out in the STARK group (<https://www.sns.it/en/stark-spectroscopy-thermochemistry-and-reaction-kinetics>) at Scuola Normale Superiore. The group activity focuses on the development and application of theoretical-computational methods for the structural and spectroscopic characterization and the study of chemical reactivity and kinetics of molecular systems in the gas or condensed phase. The group manages the Village Cluster that includes nodes with 80-240 cores and 4-6 TB of RAM.

Team STARK:

- Nicola Tasinato (Associate professor)
- Daniela Alvarado Jimenez (PhD)
- Pietro Maria Curzietti (PhD)
- Nadjib Rais (PhD)
- Gianluca Rinaldi (PhD)
- Zoi Salta (Researcher)

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

Basic knowledge in Thermochemistry, spectroscopy, chemical kinetics, electronic structure and quantum chemistry.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Genomics consequences and adaptive chances for natural populations in fast changing environments**

**Reference Person:** Trucchi Emiliano (e.trucchi@univpm.it)

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

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**Research Keywords:** Adaptation genomics

Genetic load

Rapid evolution

**Reference ERCs:** LS8\_5 Biological aspects of environmental change, including climate change

LS8\_4 Population biology, population dynamics, population genetics

LS8\_3 Conservation biology

**Reference SDGs:** GOAL 13: Climate Action, GOAL 14: Life Below Water, GOAL 15: Life on Land

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

Sustainable integrated nanostructured analytical platfors for on-site analysis and bioresearch

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### **Research team and environment**

The Department of Life and Environmental Sciences has high-quality expertise in a wide range of relevant disciplines including marine biology and ecology, and protection, conservation and restoration of marine environments (<http://www.disva.univpm.it/>). The research group, supervised by Trucchi, where the PhD will be integrated, is currently including two postdocs, one Marie Curie fellow and one visiting, three PhD students, and three Master students. The PhD student will have access to research samples, equipment and resources required, as well as the DiSVA high-throughput computational and storage resources which is necessary to tackle questions in evolutionary genomics.

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

Successful candidates are expected to have relevant background in evolutionary biology, population genetics, genomics, and molecular ecology. Preferred skills include bioinformatics, computational and scripting background, genomics data analyses, population dynamics data modelling, and simulation of genomic data.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*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 / 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

PE10\_1 Atmospheric chemistry, atmospheric composition, air pollution

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. Alessandro Fassò, prof. Francesco Finazzi, prof. Michela Cameletti, Dr. Rodolfo Metulini, Jacopo Rodeschini (PhD student), and Alessandro Fusta Moro (Research assistant).

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 Leibniz University Hannover.

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 statistical science, 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**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU1 - Earth Systems and the Environment*

## **Every drop counts. Towards new sustainable territorial water footprints**

**Reference Person:** Velo Luca (lucavelo@iuav.it)

**Host University/Institute:** Università Iuav di Venezia / Culture del Progetto

**Research Keywords:** Drought, visions for specific territories

Climate Change

Hydraulic crisis

**Reference ERCs:** SH7\_5 Sustainability sciences, environment and resources

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

SH7\_8 Land use and planning

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

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

The phenomena of desertification, sea level rise, salt wedge and extreme weather events identify water as one of the new main challenges for future territories. From the Adriatic coasts to the hinterland, the most relevant issue coincides with an increasing drought problem after decades of interventions aimed at containing flooding beside weak policies of reducing consumption. Extended periods of water criticality are also the results of inadequate forms of management and design both in terms of investments and spatial experimentations. The need of a transcalar re-design water-related spaces for a sustainable water footprint becomes more relevant than the past. The topic of water storage and management (connected to endemic problems of heat island, fire danger) imposes new declinations of design issues for the territory. The main objective of the doctoral program is to explore new analytical and conceptual approaches to develop possible innovative spatial design for saving the hydraulic resource by overcoming the short-term solutions in favor of measurable and applicable long-term proposals. The doctoral path aims at developing new strategies and scenarios saving ground and surface water. Considering climate forecasts and depolluting needs, the scenario includes blue and green infrastructures with mobility and production spaces considering new monitoring technologies as tools to integrate visions to maintain the indispensable resource for human and ecological survival.

### **Research team and environment**



The PhD candidate will take advantages of the laboratories and tools of the research clusters based at luav University. The multidisciplinary task force includes urban designers, planners, economists, ecologist conducting international research on the interaction between environment, 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 is rich of interaction with other candidates and with professors in several disciplines, with the opportunity to attend seminars and courses. The group has intense research contacts with other institutions in Italy and abroad.

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

The candidate is expected to have a background in architecture, urbanism, planning as well as experience in the analysis and design of territories with special frame on hydraulic, territory regeneration issues. Previous training in architecture urban design and urban and territorial planning, will be considered a plus.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **Italian Inner Areas as Engine for Green Transition and Recovery**

**Reference Person:** Arbolino Roberta (rarbolino@unior.it)

**Host University/Institute:** Università degli Studi di Napoli L'Orientale / Dipartimento di Scienze Umane e Sociali

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**Research Keywords:** Inner Degraded Areas  
Economic Recovery  
Green Transition

**Reference ERCs:** SH1\_3 Development economics; structural change; political economy of development  
SH1\_12 Environmental economics; resource and energy economics; agricultural economics

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

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

The coronavirus pandemic has changed the relationship between Urban and Inner areas, posing the focus on the need to redevelop and recover the latter from a social and economic point of view, still protecting their social, cultural and environmental heritage.

As highlighted by the National Strategy for Inner Areas, this group gathers 60% of Italian surface, hosting less than 30% of population. Together with demographic crisis, other problems characterize these areas: i.e., unemployment, land use, low levels of public and private service supply, social costs such as geological instabilities deriving from both abandonment and degradation of cultural and landscape heritage.

However, the renewed attention towards these areas is an opportunity to boost their socioeconomic recovery, in green and sustainable ways. The policy framework set after the pandemic recognizes these potentials and offers a large set of fiscal, financial and policy instruments to boost these processes. On the one side, the National Plan for Recovery and Resilience (PNRR) lists the enhancement of inner areas among its objectives, based on investments of about one billion on industries (through the SEZ), infrastructures, service provision, connectivity, modernisation and green transition.

In this context, the present project aims at studying the potential of inner degraded areas to become the engine of Italian green and digital transition, as well as the flywheel of economic recovery.

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### **Research team and environment**



The PhD will take place at the Department of Social and Human science of the University of Naples L'Orientale. The student will be integrated in a multidisciplinary environment, with courses and conference addressing different aspects of knowledge. In such an environment, the student will be given the opportunity to develop critical view on different aspects of sustainable development. However, the focus will be on economic aspects, thanks to the participation in the economic research activity of the department, with experience in policy evaluation, investment planning, sustainable investment selection, regional sustainable development, quantitative assessment of sustainability.

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

The ideal candidate should prove a good level of knowledge of English language and computer skills.

Moreover, an at least basic knowledge of econometrics will be considered in the evaluation phase.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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

## **Risk based design and management of urban solutions decisions**

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

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

**Research Keywords:** Risk based decisions  
Climate impacts  
Complex systems

**Reference ERCs:** PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics  
PE1\_15 Generic statistical methodology and modelling  
PE7\_8 Networks, e.g. communication networks and nodes, Internet of Things, sensor networks, networks of robots

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

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

In today's intricate socio-technological world, assessing the risk of metropolitan areas (e.g., Milan) to natural hazards induced by climate change is an important and challenging problem.

In this context, the scope of this research will promote a paradigm shift in the design and management of urban solutions that offer services to society: shifting to sustainability analysis based on the assessment of the associated systemic and integrated risk. The research should address a cost benefit analysis based on the parameterization of the total costs of implementing the solutions (also in relation to the actions of the Air and Climate Plan of the Milan Municipality), calculate the risk for different scenarios, estimate the benefit obtained from the reduction of the risk and seeking the solution that offers the minimum cost/benefit ratio and the most suited to social expectations.

The research will progress on the activities at IUSS on holistic approach (Arosio et al., 2020, doi:10.5194/nhess-20-521-2020) that allows to analyze systemic risk based on a graph, in particular to assess properties, to propagate the damage and account for the resilience characteristics. The candidate needs:

- to critically review the recent literature, tools and database
- to develop a risk-based approach for a sustainable design and management of hard and soft urban solutions



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- to collaborate in a multi-disciplinary context of IUSS research team and the Urban Resilience Dept. of Milan municipality

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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 and he/she 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.

For this scholarship a period of internship is planned at the Urban Resilience Dept. of Milan municipality.

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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 desire to join a inter-disciplinary research team, open to learn new topics from other sectors and effectively communicate to colleagues with different background. Competence on programming languages is preferable.

Fluency in Italian is preferable, due to the tight collaboration with the Municipality of Milan.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*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 / Economia, Management e Diritto dell'Impresa

**Research Keywords:** urban sustainable mobility  
transport supply and demand analysis  
urban empirical analysis

**Reference ERCs:** SH7\_9 Energy, transportation and mobility  
SH7\_7 Cities; urban, regional and rural studies  
SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

### **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**

Host University's fundings

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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**

For this scholarship it is not planned a period of internship

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

## **Robust design of financial risk hedging tools for climate change adaptation**

**Reference Person:** Castelletti Andrea (andrea.castelletti@polimi.it)

**Host University/Institute:** Politecnico di Milano / Elettronica, Informazione e Bioingegneria

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**Research Keywords:** Climate Change adaption  
Water resources management  
Climate Risk hedging

**Reference ERCs:** PE10\_17 Hydrology, hydrogeology, engineering and environmental geology, water and soil pollution  
PE10\_3 Climatology and climate change  
PE7\_1 Control engineering

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

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

Worldwide, climate change is increasing the frequency and severity of extreme events such as floods and droughts, and is causing significant increases in socio-economic and human losses. To manage financial risks and reduce the economic losses caused by extreme events, risk hedging tools, such as index-based insurances, can play an important role for different stakeholders. These proactive tools, offer significant benefits particularly compared with the reliance on reactive post-disaster aid or the scale up of hard protection, investment-intensive infrastructure. However, if not appropriately structured, these tools can lead to unwanted consequences, as for example providing disincentives for risk reduction or may neither benefit the most vulnerable stakeholders nor foster climate resilience.

The PhD research will develop novel financial risk-hedging tools to strengthen multi-sector resilience to climate change, mainly droughts and floods. In particular, the research activity will focus on:

- 1) Designing optimal and robust insurances based on both the frequency and severity of insurance claims for hydro-meteorological risks.
- 2) Testing alternative Machine Learning techniques to optimally design a multivariate insurance index to pay out stakeholders, and estimate the probabilities of an extreme event happening at a target spatial resolution from forecasts and satellite data.



3) Evaluating the value of the insurance across multiple sectors using a multiobjective approach.

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### **Research team and environment**

The research will be carried out at the Department of Electronics, Information, and Bioengineering (DEIB), Politecnico di Milano. DEIB facilities several high-performance computing facilities on site and free access to national supercomputing cores, and scientific publications. A large warehouse of case studies, models and software tools for planning and management of water resources is available. The selected candidate will conduct research in the Environmental Intelligence Lab. EI-Lab's mission is advancing environmental decision-analytics for supporting human decisions in complex engineering systems including multiple actors and exposed to evolving multisector demands and global change.

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

Qualifications for this position include an M.Sc. in Environmental Engineering or Economics or related fields. Profiles with a background in Artificial Intelligence, Applied Mathematics, Meteorology or Atmospheric/Climate Science will be also considered. Strong numerical and computational skills are required as well as English language skills both in oral and written communication.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **Statistical data science methods for climate change risk perception based on textual data**

**Reference Person:** Claudio Conversano (conversa@unica.it)

**Host University/Institute:** Università degli Studi di Cagliari / Dipartimento di Scienze Economiche e Aziendali

**Research Keywords:** Data science

Machine Learning

Causal inference

**Reference ERCs:** PE1\_19 Scientific computing and data processing

PE1\_21 Application of mathematics in sciences

PE1\_22 Application of mathematics in industry and society

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 9: Industry, Innovation and Infrastructure, GOAL 13: Climate Action

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

This research project focuses on developing statistical data science methods to assess climate change risk perception by analyzing textual data such as social media posts, news articles, and public opinion surveys. The research aims to achieve three objectives: developing a machine learning model to extract and classify climate change risk perception keywords and phrases, conducting sentiment analysis to determine overall sentiment towards climate change risks, and investigating the relationship between climate change risk perception and mitigation/adaptation strategies. The methodology involves data collection, preprocessing, feature extraction, machine learning model development, sentiment analysis, and relationship analysis. The expected results include the development of an accurate machine learning model, analysis of sentiment towards climate change risks, and identification of the relationship between risk perception and mitigation/adaptation strategies. These methods can help policymakers and stakeholders develop effective strategies to mitigate and adapt to the impacts of climate change.

### **Research team and environment**

The Ph.D. candidate will work under the supervision of Prof. C. Conversano and Prof. F. Mola and will be part of a research team specialized in Statistics and Data Science. The team has a strong research background in computational statistics, multivariate analysis, statistical learning, big data analytics, sentiment analysis, and comprehensive textual data analysis. The team has a tradition of publishing in esteemed international journals, including but not limited



to the Journal of the American Statistical Association, Journal of the Royal Statistical Society, Statistics and Computing, Applied Stochastic Models in Business and Industry, Journal of Classification, Journal of Computational and Graphical Statistics, Computational Statistics and Statistical Analysis, and Data Mining.

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**Suggested skills for this research topic**

Knowledge of the basics of data science and statistical learning

Knowledge of at least one of the following software: R, Python, Matlab, Mathematica, SAS

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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

## **Regenerative-resilient Circular Supply Chains through network relationships: impact models for SMEs**

**Reference Person:** Creazza Alessandro (acreazza@liuc.it)

**Host University/Institute:** Università Carlo Cattaneo LIUC / Scuola di Ingegneria Industriale

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**Research Keywords:** Impact models  
Circular supply chains  
Network relationships

**Reference ERCs:** SH1\_11 Human resource management; operations management, marketing  
SH1\_9 Industrial organisation; entrepreneurship; R&D and innovation  
PE8\_9 Production technology, process engineering

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

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

The development of Circular Supply Chains (CSCs) has been recognized as a crucial transition for sustainable and resilient production processes: CSCs maximize systems' effectiveness, regenerate, and mitigate supply risk. Several are the impacts for sustainable development, but appropriate models for measuring these impacts and fostering the transition towards CSCs still need to be investigated especially at the meso-level (i.e., how companies contribute to a circular transition of supply chains while adopting CE principles), where supply chain network relationships are needed for realizing circularity. Network relationships are critical for the circular transition of manufacturing SMEs (the backbone of the European economy) given their typical resource constraints, which lead them to depend on networked environments. This project wants to explore how by leveraging supply chain network relationships involving players such as logistics providers (as network facilitators/orchestrators with asset and capacity sharing), intermediaries with technology-enabled platforms, etc., it is possible to generate an impact for manufacturing SMEs in the transition towards CSCs and how to qualitatively and/or quantitatively measure the impact of this transition. By developing and applying impact models related to a transition towards CSCs that leverages network relationships, it will be possible to promote better resource use and facilitate the realization of circularity for manufacturing SMEs.

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### **Research team and environment**



The Research Team at the school of Industrial Engineering of LIUC University is composed of: Alessandro Creazza (associate professor - sustainable Logistics and CSCs), Andrea Urbinati (assistant professor - CE business models), Fabrizio Dallari (full professor - logistics), Raffaella Manzini (full professor - sustainable performance measurement and innovation management). The Research Environment is the Green Transition Hub (GTH), the competence centre of LIUC University on ecological transition and Circular Economy. The GTH conducts research and dissemination activities through an advisory board composed of research centers and universities, associations, SMEs and multinational companies.

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

The candidate should have adequate knowledge of bibliometric analysis tools (e.g., VoS Viewer) and of network analysis tools (e.g., Pajek). Other skills that are welcome regard abilities in text mining and text coding to conduct bibliographic reviews. Also, the candidate should have knowledge of the basis of quantitative methods such as Structural Equation Modelling and Interpretive Structural Modelling. These skills will serve well in the modelling of the supply chain network relationships and help in developing and applying the SMEs impact models to company data.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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

## **Statistical data science: Measurement issues of Social Sustainability**

**Reference Person:** Crocetta Corrado (corrado.crocetta@uniba.it)

**Host University/Institute:** Università degli studi di Bari A. Moro / Dipartimento di Ricerca e Innovazione Umanistica

**Research Keywords:** Social sustainability  
Inequalities  
Multidimensional statistical indicators

**Reference ERCs:** SH3\_4 Social integration, exclusion, prosocial behaviour  
SH3\_9 Poverty and poverty alleviation  
PE1\_15 Generic statistical methodology and modelling

**Reference SDGs:** GOAL 1: No Poverty, GOAL 3: Good Health and Well-being, GOAL 11: Sustainable Cities and Communities

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

The research topic concerns measurement issues of Social Sustainability. A society that offers equal opportunities of upward social mobility and reduces marginalization creates the conditions for better institutions, trust and social capital that in turn foster economic growth. In this project, we plan to address social sustainability from an interdisciplinary perspective using quantitative and theoretical methods from social sciences. We will advance our knowledge on social sustainability by overcoming measurement issues of a phenomenon that is inherently multidimensional.

This project is financed by PNRR, PE9 (Economic-financial sustainability of systems and territories), GRINS (Growing Resilient, INclusive and Sustainable). The project is focused on the construction of the AMELIA platform, that combines "geo-spatial knowledge" from the most advanced sources of geospatial data and information (e.g. ISTAT/EuroStat databases, Copernicus Land Monitoring Services and Sentinel images, LiDAR) with environmental, socio-economic and sentiment data.

We will focus our attention on data about social and cultural participation, and social cohesion, at the regional and provincial levels in Italy. We intend to study also the inequalities in Social Sustainability across Italian regions and provinces. At the end we will produce dashboards able to measure the evolution of the main aspects of social sustainability in different areas and times.



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### **Research team and environment**

The research group is composed by the statistician of the spoke 8 of project GRINS - Growing Resilient, INclusive and Sustainable PNRR chaired by prof. Cellini. The PhD student will work at University of Bari along with statisticians, and colleagues from economic and business areas.

PhD students will have access to all the spaces available in the Department of Humanistic Research and Innovation.

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

The candidate should have basic statistical skills.

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of internship

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

## **Environmental policies and consumption choices for low carbon and circular transitions**

**Reference Person:** D'Amato Alessio (damato@economia.uniroma2.it)

**Host University/Institute:** Università degli Studi di Roma Tor Vergata / Economia e Finanza

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**Research Keywords:** Policy design  
Sustainability Transition  
Drivers and barriers

**Reference ERCs:** SH1\_12 Environmental economics; resource and energy economics; agricultural economics  
SH1\_7 Behavioural economics; experimental economics; neuro-economics  
SH1\_8 Microeconomic theory; game theory; decision theory

**Reference SDGs:** GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

The aim of this research project is to make advancements in the analysis of the barriers and drivers of the low carbon and circular economy transitions, adopting an economic and econometric lens but in a way that will be open to interdisciplinary approaches. The scrutinized transitions require actions both from institutions and from firms and consumers, in order to be feasible, and a significant number of potential complementarities and trade-offs needs to be addressed. This project will contribute and provide food for thought both for research and for policy making. More specifically, the aims of this project will be twofold:

1. Highlight relevant (traditional and innovative) policies that are expected to enhance the transition, measuring at the same time the degree of implementation, and
2. Analyse empirically and rationalize theoretically the most relevant drivers of the low carbon and circular economy transitions, by measuring consumers' attitudes and behaviours, and by understanding relevant drivers that may potentially improve or worsen policy and other interventions' results by triggering complementarities or trade-offs.

Under a policy perspective, a broad as well as case-study based approach may be adopted, focusing on interventions ranging from traditional ones (e.g. from environmental market based approaches to demand side Green Public Procurement strategies), to "behavioural" ones, for example based on consumers' motivation and choice architecture.

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### **Research team and environment**

The project will benefit of the very lively and high level research environment of the Department of Economics and Finance (DEF), in Tor Vergata. Research in Environmental Economics has a long tradition in the context of the Department's activities, and researchers from DEF that work in the fields of Environmental and Ecological Economics have been and are involved in high level publication efforts on topics related to the project. Finally, project development will also benefit from the involvement of the University of Tor Vergata in the SEEDS inter-university network ([www.sustainability-seeds.org](http://www.sustainability-seeds.org)).

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

The ideal candidate for this project has a degree in economics or related fields, and also features a good quantitative background (statistics and/or econometrics), together with knowledge of environmental and resource economics and a strong interest in learning advanced techniques for analysis. The interdisciplinarity of the project may also imply, in principle, the possibility of mixed approaches (quantitative/qualitative).

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **Transformative role of energy communities and business actors for the clean energy transition**

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

**Host University/Institute:** Scuola Superiore Sant'Anna / Istituto di Management

**Research Keywords:** Energy communities  
Business strategy  
Sustainability Management

**Reference ERCs:** SH7\_6 Environmental and climate change, societal impact and policy  
SH7\_5 Sustainability sciences, environment and resources  
SH1\_10 Management; strategy; organisational behaviour

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

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

The central theme of the research will concern the development of energy communities and their transformative role in the energy sector. Energy communities organizing collective and citizen-driven increase public acceptance of renewable energy projects, provide direct benefits to citizens through energy efficiency, make it easier to attract private investments in the clean energy transition and create job opportunities. The research will focus on processes, strategies and actors that can support the development of energy communities. The analysis of energy communities will explore enabling factors to promote innovative ways to aggregate investments and different economic actors such as technology providers, municipalities, companies, etc. Moreover, the project may explore the impact energy communities and related business strategies have at a policy level. The project is built around key research questions: 1) What is the role of different economic actors have in implementing and adopting energy communities? 2) How can energy communities create and share value by contributing to the clean energy transition? 3) How may innovative business strategies support energy communities? 4) What are the impacts of energy communities on existing energy sector and related policies?

The research will contribute to the literature on sustainable innovation management and sustainable development.

### **Research team and environment**



The research will take place at the Sustainability Management Lab of the Institute of Management. The Institute of Management has been running for more than ten years a Ph.D. in Management Innovation, Sustainability and Healthcare. The Sustainability Management Lab, composed of more than 40 researchers, is active in research on sustainability for eighteen years. More than 30 projects funded by the European Commission and 150 national projects or projects commissioned by companies have been carried out. Topics include, among others, circular economy, sustainable production and consumption, efficient use of resources, energy transitions, valuation of natural capital, and ecosystem services.

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

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

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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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:** La Rocca Michele (larocca@unisa.it)

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

**Research Keywords:** Neural Networks and Deep learning  
Multivariate time series  
Financial risk measures and ESG scores

**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, IEEE Transactions on Engineering Management, Technological Forecasting and Social Change, 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**

DM118/2023 – 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**

For this scholarship it is not planned a period of intership

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

## **A multicriteria framework for Raworth's doughnuts with a focus on the working time-waste NEXUS**

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

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

**Research Keywords:** Measuring Sustainable Development

Multicriteria Evaluation

"Working time-waste" nexus

**Reference ERCs:** SH7\_5 Sustainability sciences, environment and resources

SH1\_6 Econometrics; operations research

SH1\_9 Industrial organisation; entrepreneurship; R&D and innovation

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 8: Decent Work and Economic Growth, GOAL 12: Responsible Consumption and Production

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

The research will start framing SDGs indicators within the Doughnuts Economics approach (Raworth 2017), which is gaining momentum in the academic literature and in real life projects. This will allow 1) assessing countries' ability to live within the doughnut, 2) comparing countries via multicriteria assessment and/or robust composite indicators, 3) exploring trade-offs among the SDGs.

The candidate will then go deeper into one of the most crucial sustainability puzzles, the working time-waste nexus. Why hasn't Keynes' prediction of a sharp reduction in the working week come true? Phenomena like planned obsolescence suggest that the impressive efficiency gains went to increase waste rather than reduce working time (Luzzati et al. 2022). Reducing both working time and waste would simultaneously affect the ecological and social variables of the doughnut.

The candidate, together with the tutoring team, will decide the spatial level and geographical areas, the mix of the analytical tools, and the balance between the first and the second phases.

Cited References:

- Keynes, J.M., 2010 [1931]. Economic possibilities for our grandchildren. In: Essays in Persuasion. Palgrave Macmillan



- Luzzati et al. (2022). The circular economy and longer product lifetime: framing the effects on working time and waste. Journal of Cleaner Production, 380, 134836  
Raworth, (2017) A Doughnut for the Anthropocene: humanity's compass in the 21st century. The lancet planetary health 1, no.2

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### **Research team and environment**

The research will be conducted within the Responsible Management Research Center at the Dip. di Economia and Management, a high interdisciplinary center in the field of SD to which I am affiliated. In particular, the expertise of professors D. Fiaschi, L. Gianmoena, A. Parenti, and dr V. Rios Ibanez in the fields of econometrics and theoretical growth models will complement mine in SD, multicriteria assessment and composite indicators. The student will also profit of the several competences available at two interdisciplinary Research Centers on sustainability of the University of Pisa (Energia per lo Sviluppo Sostenibile, CIRESS; Studio degli Effetti del Cambiamento Climatico, CIRSEC).

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

Good knowledge and skills in quantitative economics/econometrics and traditional statistical tools (like PCA). Acquaintance with micro- and macroeconomics, particularly Industrial Organisation and Growth theory.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **Sustainability and complexity of the reverse logistics process in the circular economy**

**Reference Person:** Maggi Elena (elena.maggi@uninsubria.it)

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

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**Research Keywords:** Circular economy  
Sustainable reverse logistics  
Complex system

**Reference ERCs:** SH7\_9 Energy, transportation and mobility  
SH1\_9 Industrial organisation; entrepreneurship; R&D and innovation  
SH7\_6 Environmental and climate change, societal impact and policy

**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 transition from linear to circular economy requires the materials recovery, recycling and refurbishment, the de-manufacturing and remanufacturing and reuse/resale of products at the end of their life cycle, of packaging and of industrial processes' wastes. All these materials and components create very consistent and often geographically dispersed goods' flows from the end of a supply chain backward and often from an industry to other industries. A very complex reverse logistics system has to manage these flows in an efficient way, guaranteeing sustainability and energy savings. Since freight transport is still mainly based on road, logistics is considered one of the most important sources of greenhouse gas emissions. The identification of effective and efficient strategies and policies for improving the sustainability of "circular reverse logistics" has become a key issue, so far neglected. The aim of the project is to fill in the research gaps on this field, particularly focusing on the role of cooperation between the different actors involved in the system, the process costs and on the environmental impacts deriving by different reverse logistics organizations. The analysis will be applied to one or two industries. Key Performance Indicators will be used to analyze the level of sustainability of the process and agent-based modelling will be applied to design the complexity of the circular reverse logistics processes, also adopting a multidisciplinary approach.

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### **Research team and environment**

The PhD student will be involved in the research of the Department of Economics of University of Insubria, that has been promoted by the University and Research Ministry as Department of Excellence 2023-2027 and offers a Ph.D. in Methods and Models for Economic Decisions (MMED), where Elena Maggi is a lecturer and member of the board. The PhD student will have the chance to take part to the research area "Transport, regulation and sustainable development", which currently includes six PhD students and one post-doc researcher. This research area is coordinated by Elena Maggi and collaborates with several national and international universities specialized on Transport Economics and Policy.

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

The PhD student should have good skills in data analysis and modelling. A background in economic studies and a good knowledge of Stata software and agent-based modelling software are particularly appreciated. Good quantitative skills and transport and logistics economics knowledge are valuable assets. Fluency in English, both written and spoken, and, possibly, a good knowledge of Italian (to perform interviews to Italian companies) is required. Ability and willingness to work in collaborative, multi-disciplinary environment and experience of both quantitative and qualitative research works are also very appreciated skills.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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

## **Socio-economic analysis of climate-related risks and adaptation and mitigation actions**

**Reference Person:** Marin Giovanni (giovanni.marin@uniurb.it)

**Host University/Institute:** Università di Urbino Carlo Bo / Dipartimento di Economia, Società, Politica

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**Research Keywords:** Socio-economic risk

Resilience

Climate policy

**Reference ERCs:** SH7\_6 Environmental and climate change, societal impact and policy

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

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

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

The aim of this research project is to investigate the socio-economic vulnerability and the level of socio-economic exposure to the damage caused by climate change across different areas, while accounting for their different socio-economic conditions. The project will consider both extreme climate-related events and changes in average temperature and precipitation.

The research will also focus on an assessment of resilience as a crucial component of effective mitigation and adaptation policies and strategies. Particular attention will be devoted to the theoretical and empirical study of how countries, regions and local communities cooperate with each other, taking into account strategic interactions between them.

The project aims to focus on particularly vulnerable sectors such as agriculture, residential and manufacturing. With regard to the agricultural sector, the project will: i) map the hazard of different areas with respect to climate change and to extreme events; ii) evaluate innovative responses to change, in terms of innovative agricultural practices and economic-financial instruments; iii) evaluate the contribution of the agricultural sector in terms of emission mitigation. As for the manufacturing sector, particular attention will be paid to the economic dynamics related to the increasing stringency of emission containment policies, such as the European Emission Trading Scheme.

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### **Research team and environment**



Research will be carried out within the Department of Economics, Society, Politics (DESP) of the University of Urbino Carlo Bo. The DESP is a multidisciplinary department featuring 53 professors and researchers in the fields of economics, management, mathematics, statistics, political science and sociology. The department activated an international PhD programme in Global Studies in 2017 with two thematic areas: i. International economic policy, business and governance (with a focus on economic and political relations across national borders); ii. Global society, cross-border mobility and law.

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

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

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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

## **Skills in the green transition: the relation between university education, research, and innovation**

**Reference Person:** Marzucchi Alberto (alberto.marzucchi@gssi.it)

**Host University/Institute:** Gran Sasso Science Institute / Area di Scienze Sociali

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**Research Keywords:** Skills  
Green jobs  
Green transition

**Reference ERCs:** SH7\_6 Environmental and climate change, societal impact and policy  
SH1\_9 Industrial organisation; entrepreneurship; R&D and innovation  
SH3\_14 Social studies of science and technology

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

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

The green transition rests on the availability of individuals who can perform “green jobs” (Consoli et al 2016, Vona et al 2018), and operate complex technologies (Barbieri et al 2020). Looking at the implications on the employment and work-content, the green transition is not a “walk in the park”, with potential winners and losers. Academic research is called to provide an evidence base on the right skill-set for a green transition, upon which policies can be designed and assessed. First, new data can be collected (e.g. on skills supplied by universities); these can be consolidated with extant ones (e.g. from employment condition surveys) to map the readiness of regions in terms of green jobs and skills, thus helping define scenarios and inform policy actions. From a more analytical viewpoint, it is fundamental to assess: the extent to which university programmes evolve consistently with skills requirements; the relations between skill provision and economic / innovation performances; how science and knowledge developed through publicly funded research projects trickles down into improvements of the skill provision. This would enable an analysis of green transition effectiveness of two relevant pillars in the policy mix (education and science). Additional research opportunities arise when considering a new policy priority: the twin transition. Research could consider the interplay between the dynamics arising from the provision of green and digital skills.

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### **Research team and environment**



The research will be carried out within the Social Sciences Area (SSA) of the Gran Sasso Science Institute (GSSI), L'Aquila. The SSA is engaged with frontier research and high-level doctoral education, i.e. a PhD Programme in Regional Science and Economic Geography (<https://www.gssi.it/education/regional-science-economic-geography>). Within the SSA, applied economists and economic geographers (<https://www.gssi.it/people/professors/lectures-social-science-gssi-cities>) fruitfully interact. The PhD research project will intersect the research tracks pertaining to: innovation and global futures; education skills and human capital; environment and climate change.

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

Ideal candidates have a Master's degree (or equivalent) in Economics, or related quantitative social sciences. They are familiar with innovation, environmental and labour economics. They can work with data analysis packages (like R, STATA). They have the willingness (and ability) to explore unstructured and new types of data that will assist the empirical analysis. Finally, they have the willingness to work in an interdisciplinary research environment.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at Inter-university center SEEDS - Sustainability Environmental Economics and Dynamics Studies

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

## **Impact of climate change on water resources management and water uses in Italy**

**Reference Person:** Massarutto Antonio (antonio.massarutto@uniud.it)

**Host University/Institute:** Università degli Studi di Udine / DIES - Dipartimento di Scienze Economiche e Statistiche

**Research Keywords:** WATER RESOURCES MANAGEMENT

WATER SERVICE REGULATION

INFRASTRUCTURE FINANCE

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

SH1\_15 Public economics; political economics; law and economics

SH1\_6 Econometrics; operations research

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

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

Il Piano Nazionale di Adattamento ai Cambiamenti Climatici (PNACC) delinea scenari molto critici per la disponibilità di acqua e più in generale per gli eventi estremi legati al ciclo dell'acqua. Sono da attendersi con maggiore frequenza sia croniche stagioni siccitose, sia fenomeni meteorici

Si intende costruire, adattandola alla situazione italiana, una curva di costo dell'acqua ispirata ai modelli proposti dal "2030 Water Resources Group" per la World Bank, finalizzata a comprendere le possibili azioni tramite le quali è possibile garantire un approvvigionamento idrico più regolare e un'eventuale espansione delle quantità messe a disposizione degli utenti finali.

La ricerca si focalizza su tre settori: civile, agricolo e idroelettrico e si propone di analizzare con varie metodologie meglio descritte nel progetto di dettaglio:

- l'impatto (ex post) della siccità 2022, sia in termini macroeconomici che settoriali
- il costo delle misure di mitigazione e adattamento proposti e le possibili modalità di finanziamento

### **Research team and environment**



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The research team includes the PI and colleagues that are specialized on agricultural economics (Francesco Marangon, Stefania Troiano); Time series analysis and econometrics (Luca Grasseti); GIS-based regional development analysis (Salvatore Amaduzzi); Finance (Josanco Floreani); ESG and CSR (Paolo Fedele)

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

- Master degree or equivalent in economic disciplines
  - Basic knowledge of environmental & resource economics and ecological economics
  - Skills in time series analysis, stochastic frontiers and DEA (software: R or STATA)
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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **The role of co-operative firms in the digital and green transition**

**Reference Person:** Mazzanti Massimiliano (mzzmsm@unife.it)

**Host University/Institute:** Università di Ferrara / economia e management

**Research Keywords:** Co-operative firms

eco-Innovations

Social Innovations

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

SH1\_3 Development economics; structural change; political economy of development

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

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

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

The ongoing digital and green transition requires efforts by firms from different sectors worldwide to comply. To this extent, the aim of the research is to identify the barriers and drivers of the co-operative business model in this transition, as they implement various forms of innovation at a regional, European, and international level observing different types of co-operatives. The development of this business model and the overall cooperative movement is diverse and quite extended requiring an interdisciplinary form of analysis.

Furthermore, as the digital and green transition has led to the increase of green jobs, this requires an analysis also of the potential divergence and mismatch between the employed who require reskilling, youth who enter the labor market and require efficient training at different educational and vocational levels, and the same firms who find themselves requiring new professionals. Hence, the research aims is to highlight the efforts made by co-operatives in this urgent transition and their position in a capitalistic market that now requests to readapt and implement forms of innovation, such as eco and circular economy innovation, by remaining competitive, while challenged in order to reach economic, social, and environmental sustainability as set by the United Nation Sustainable Development Goals (SDG).

### **Research team and environment**



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CERCIS and SEEDS research centers at UNIFE

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**Suggested skills for this research topic**

Statistics and econometrics tools; inter disciplinary thinking; basic political economy.

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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

## **Different economic impacts of climate change in rural and urban areas: the role of migration**

**Reference Person:** Modica Marco (marco.modica@gssi.it)

**Host University/Institute:** Gran Sasso Science Institute / Area di Scienze Sociali

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**Research Keywords:** Migration  
Climate change  
Rural/urban

**Reference ERCs:** SH7\_7 Cities; urban, regional and rural studies  
SH1\_12 Environmental economics; resource and energy economics; agricultural economics  
SH3\_1 Social structure, social mobility, social innovation

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

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

The research topic aims at analysing the different socio-economic impacts that climate change might produce on urban and rural context, in particular on the migration flows between these two areas. In fact, the relationship between environment, climate change and migration historically focused on the impact of the CC on basic resources (e.g. water) that in some cases also increase the probability to conflicts between different actors in under-developed or developing countries. However, despite the importance of the issue and the relevance that this phenomenon will have in the next future, there is limited evidence about this topic in developing countries. The effects of Climate Change will impact urban and rural areas in different ways and the capacity to adapt or recovery to this type of slow-burn event will depend on the interrelation between environment and socio-economic characteristics of the affected places. In particular it would be relevant to analyse the impact of climate change in fragile areas such as mountainous regions, where it is possible to argue that there are factors that will push people to leave these areas while other factors might pull people there. Particular focus will be given to the role of PA in addressing this issue through the study of public policies (especially regional policy) and supporting the PA in developing more tailored adaptation strategies that take into consideration the potential migration flows between different urban and rural areas.

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### **Research team and environment**



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The research team will include dr. Andrea Membretti, senior researcher of University of Eastern Finland; dr. Gianni Tartari as responsible of Associazione Euclipa and Elena Di Bella - Dirigente del la Direzione -Sviluppo montano e rurale della Città metropolitana di Torino, where the student will held his/her internship.

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**Suggested skills for this research topic**

The candidate should know basic quantitative analysis and GIS knowledge. Furthermore, the knowledge of Italian would be relevant for the internship

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at Città Metropolitana di Torino

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

## **Reuse, reduce, recycle: challenges and opportunities in the fashion industry**

**Reference Person:** Morone Piergiuseppe  
(piergiuseppe.morone@unitelmasapienza.it)

**Host University/Institute:** UnitelmaSapienza Università di Roma / Dipartimento di Scienze Giuridiche ed Economiche

**Research Keywords:** Fast fashion  
Behavioral economics  
Global North / Global South

**Reference ERCs:** SH1\_12 Environmental economics; resource and energy economics; agricultural economics  
SH1\_7 Behavioural economics; experimental economics; neuro-economics  
SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

Europe is currently facing several environmental, economic and social challenges, aggravated by the COVID-19 pandemic and the Ukrainian war. However, the ongoing challenges could provide an opportunity to rethink economic and business models and policies, to favor a sustainability transition. In this regard, there is growing interest in the development of new production and consumption models.

This need to deploy new consumption and production models also applies to the fashion industry. The fashion industry is responsible for 8-10% of global emissions of CO<sub>2</sub> (Niinimäki et al., 2020), and textile production is a big water consumer, reaching 93 billion cubic meters annually (Ellen McArthur Foundation, 2017). Additionally, clothing consumption has increased rapidly due to the fast-fashion phenomenon, which encourages the purchase-discard model leading to large volumes of unwanted items. Since the fashion supply chain is one of the most complex ones, many activities during the design, manufacture, consumption and disposal of fashion items occurring on a global scale cause unforeseen and less explored problems.

Against this background, this research will be articulated along the following three research lines: (1) assessing the impact of current unsustainable production/consumption behaviors;



(2) identifying measures (e.g. nudging) to prompt the needed behavioral changes; (3) assessing the impact of global trade in a Global North/ Global South perspective.

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### **Research team and environment**

Research at UnitelmaSapienza is carried out in various Laboratories, Research Centers and Research Groups. The Bioeconomy in Transition Research Group (BiT-RG) is involved in research concerning the emergence of a circular and bio-based economy relying on the use of renewable resources for the production of novel products for various applications. The group is composed by 20 researchers from various European universities. It also includes three PhD students. The scientific coordinator is Piergiuseppe Morone, Full Professor of Economic Policy at UnitelmaSapienza. Most of the BiT-RG research activities are channeled in the Sustainability Transition strategic area.

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

Knowledge of quantitative and qualitative methods for empirical research in behavioural economics, including survey analysis for consumers and field and laboratory experimental economic analysis; interdisciplinary skills and motivations to create bridges between fields.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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

## **Green technologies, digitalization and regional diversification: the role of global linkages**

**Reference Person:** Morrison Andrea (andrea.morrison@unipv.it)

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

**Research Keywords:** Clean technologies  
Regional diversification  
Global linkages

**Reference ERCs:** SH1\_9 Industrial organisation; entrepreneurship; R&D and innovation  
SH7\_6 Environmental and climate change, societal impact and policy  
SH7\_1 Human, economic and social geography

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

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

There is a broad consensus among scholars and policy makers that the development and diffusion of clean and related digital technologies are crucial steps towards a global green economy (OECD, 2011). However, not all countries own the technological capabilities needed to carry out such a transition (Corrocher et al. 2021). Global linkages (FDI, cooperation, trade) can represent important channels to tap into these missing capabilities and speed up the process of greening the global economy.

This project will investigate this process by looking at both advanced and emerging economies. The empirical analysis will rely on two main data sources: patents, foreign direct investments. Patent data will be extracted from PATSTAT, which covers patents registered at national patent offices around the world. Foreign direct investments data come from ORBIS, with a focus on multinationals with green investments.

The project addresses the following main research questions: To what extent and how (if at all) do Global Linkages contribute to the deepening of sustainability-oriented innovative capacity in the host regions? Do they drive an expansion of the variety of green technologies or a specialisation in distinct sustainability-related technology domains?

Answering these questions provides important insights for scholars and policy makers on the role of international connections in fostering the diffusion of green technologies.



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### **Research team and environment**

The team is formed by Andrea Morrison and Roberta Rabellotti.

Andrea Morrison is associate professor of Applied Economics at University of Pavia and Adjunct Professor of Innovation and Sustainability at Bocconi University. He has developed a research agenda around clean technologies.

Roberta Rabellotti is Professor of Economics and regularly provides academic advice to international organisations. Her research is focused on innovation in developing countries, clusters, Global Value Chains.

The project will be developed in collaboration with Prof. Ron Boschma at Utrecht University. The PhD candidate will have the opportunity to visit Utrecht University.

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

- Strong and proven interest on the topics of the project (climate change, innovation, regional diversification, role of global linkages).
  - Background in social sciences (e.g. economics, geography, international relations, management, innovation studies) or environmental sciences, but with a strong interest on its socio-economic impact.
  - Strong quantitative skills.
  - Excellent communication and writing skills in English.
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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **Climate Extremes and Workplace Safety**

**Reference Person:** Palma Alessandro (alessandro.palma@gssi.it)

**Host University/Institute:** Gran Sasso Science Institute / Area di Scienze Sociali

**Research Keywords:** Climate extremes

Workplace Safety

Adaptation policy

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

SH1\_14 Health economics; economics of education

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

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 8: Decent Work and Economic Growth, GOAL 10: Reduced Inequality

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

The frequency, duration and intensity of 'climate extremes' have dramatically increased over the last 5 years in a scenario that is becoming the 'new norm'. This poses unprecedented challenges for the labor market as workers employed in sectors that are more exposed to weather variability will face additional on-the-job risks deriving from external factors. These workers are also likely to deal with heavier physical efforts, to be immigrants, more health-vulnerable and with weaker labor market attachment, this also raises distributional concerns. A clearer understanding of environmental factors would help policy makers improve the job safety and quantify the costs associated with the local manifestation of climate change externalities. This project contributes to fill this gap by empirically investigating the role of environmental factors in affecting workplace safety in Italy. It considers two relevant margins of analysis: the risk associated with environmental factors (on accidents, injuries and workers' health), and the costs for both private firms and the society. Both outcomes are analyzed using unique administrative data on work-related accidents aligned with granular environmental data. Accidents data contains detailed information on firms as well as workers' and injuries' characteristics, which also allows for a rich heterogeneity analysis of the distributional effects. The analysis relies on state-of-the-art econometric methods for causal identification strategies.

### **Research team and environment**



The research will be carried out within the Social Sciences Area (SSA) of GSSI located in L'Aquila, with a period of 6/12 months at the Department of Medicine, Epidemiology, Occupational and Environmental Hygiene (DMEILA) of INAIL. The GSSI-SSA team is made up of about 20 researchers actively involved in the GSSI mission of carrying out frontier research, and offers a 4-year International PhD Program. The candidate will interact with PhD students of the house and top-scholars in climate change economics who will be actively involved. Together with scholars from other GSSI areas, the synergy with INAIL will also allow the candidate to benefit from a truly interdisciplinary environment.

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

We are looking for a master student with a great enthusiasm for economic research, with good time management and attitude for team working. The ideal candidate should have an intermediate background of environmental and health economics, and an intermediate level of econometric skills. Moreover, a good command of statistical software for data manipulation and analysis (Stata or R) will be a key asset.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **Statistical data science: evaluation of inequalities in Social Sustainability**

**Reference Person:** Perchinunno Paola (paola.perchinunno@uniba.it)

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

**Research Keywords:** Social sustainability  
Inequalities  
Multidimensional statistical indicators

**Reference ERCs:** SH3\_4 Social integration, exclusion, prosocial behaviour  
SH3\_9 Poverty and poverty alleviation  
PE1\_15 Generic statistical methodology and modelling

**Reference SDGs:** GOAL 1: No Poverty, GOAL 3: Good Health and Well-being, GOAL 11: Sustainable Cities and Communities

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

The research topic concerns Evaluation of Inequalities in Social Sustainability

The project will realize the following activities:

- Collecting and harmonizing data from different sources (including two surveys from ISTAT, namely the Household Budget Survey and the Multipurpose Survey on Households: Aspects of Daily Life);
- Providing a preliminary evaluation of inequalities in SS across Italian regions and provinces
- Measuring poverty using a multidimensional complex indicator.

This project is financed by PNRR, PE9 (Economic-financial sustainability of systems and territories), GRINS (Growing Resilient, INclusive and Sustainable) spoke 8 WP 1. The project is focused on the construction of the AMELIA platform, that combines "geo-spatial knowledge with environmental, socio-economic and sentiment data.

We plan to address social sustainability and, in particular, cultural and social participation, and social cohesion from an interdisciplinary. We intend to study also the inequalities in Social Sustainability across Italian regions and provinces.

### **Research team and environment**



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The research group is very articulated and is composed by the coordinator of the spoke 8 project GRINS - Growing Resilient, INclusive and Sustainable PNRR prof. Cellini and colleagues from the statistical, economic and business areas.

PhD students will have access to all the spaces available in the Department of Economics, Management and Business Law.

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**Suggested skills for this research topic**

The candidate should have basic statistical skills.

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**Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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

## Using Machine Learning for climate-related environmental and socio-economic vulnerability

**Reference Person:** Righini Margherita (margherita.righini@iusspavia.it)

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

**Research Keywords:** Copernicus  
Common Agricultural Policy  
Space Economy

**Reference ERCs:** PE10\_4 Terrestrial ecology, land cover change  
PE10\_13 Physical geography, geomorphology  
PE10\_14 Earth observations from space/remote sensing

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 15: Life on Land

### Description of the research topic

Climate change has wide-ranging impacts on ecosystems, economic sectors and human well-being. The effectiveness of climate-related risk assessment depends on the spatial and temporal accuracy of the information to offer more up-to-date modelling tools to produce reliable vulnerability analysis. The main objective of the research is to develop a new approach to define the climate environmental and socio-economic vulnerability in coastal and/or urban areas through the use of Machine Learning techniques and multi-source data, including Earth Observation data.

The PhD should:

- (1) Develop new vulnerability models through Machine Learning techniques;
- (2) Combine indicators across the three components of exposure, sensitivity, and adaptive capacity, and construct or improve vulnerability indices;
- (3) Assess the ECV land cover change and its environmental and socio-economic impacts in terms of ecosystem services degradation;
- (4) Develop a decision support system (DSS) to build a sustainable management strategy for resilience to climate change.

The research is aligned with the objectives of the PNRR, contributing to improve the advanced and integrated forecasting system to counter anthropogenic and climate change



impacts and to support ecosystem services by leveraging the most advanced modelling techniques, data and analytical processing solutions, to identify possible risks and their impacts at an early stage developing new tools to support decision making.

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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 in the fields of Science, Technology, Engineering and Mathematics (STEM), and Human, Social and Life Sciences. At IUSS, PhD candidates will find an open multidisciplinary environment offering real opportunities for developing academic and professional tools for facing the challenges arising from increasing complexity and fast changes in the society and the environment. IUSS is always and actively committed towards internationalisation, inclusion and diversity. The selected candidate will join the research centre on Climate change impAct studies for RiSk Management (CARISMA). The CARISMA team is composed by STEM and Social scientists working in the prism of climate change on data analysis including Copenricus and modelling of Earth System and economic system processes; impact assessment of extreme natural events and anthropogenic activities on human and natural environments; risk assessment and management of natural and anthropogenic hazards; formulation and proposal of new economic, political and legal models of sustainable development. The research activity will be carried out in collaboration with the Space Unit and Data Unit of the Italian Institute for Environmental Protection and Research (ISPRA) and may include stays at the ISPRA Research Centre (Rome).

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

- Knowledge of artificial intelligence approaches (e.g., fuzzy logic, Bayesian systems) applied to determine the response of ecosystems to climate change;
- Experience in the implementation of integrated decision support systems for the innovative tool in coastal, agroforestry and urban domain;
- Experience in using the European Earth Observation Program (Copernicus).

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### **Source of fundings**

DM118/2023 – 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**

For this scholarship it is not planned a period of intership

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

## **Sustainable mobility: models, methods and case studies.**

**Reference Person:** Rotaris Lucia (lucia.rotaris@deams.units.it)

**Host University/Institute:** Università degli Studi di Trieste / Dip. di Scienze Economiche, Aziendali, Matematiche e Statistiche DEAMS

**Research Keywords:** sustainable logistics  
acceptability of sustainable mobility policies;  
sharing mobility

**Reference ERCs:** SH7\_9 Energy, transportation and mobility  
SH7\_6 Environmental and climate change, societal impact and policy  
SH1\_12 Environmental economics; resource and energy economics; agricultural economics

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

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

The EU goal is to reduce by 90% the greenhouse gas emissions produced by the transport sector by 2050. The research project could study how production and consumption models within the transport sector should change to reach this ambitious goal and which policies should be introduced to support this change, with a special focus on the sharing economy paradigm and its implications in terms of social inclusion, environmental impact, public transport use and car ownership.

The project could also study how to design innovative systems for collecting, integrating, sharing and distributing products and information to optimize the agri-food supply chains. Best practices of short supply chains and alternative food networks should be analyzed to detect how to increase the value shared by all the members of the supply chain while improving the environmental and social sustainability of the agri-food sector.

An additional research topic could deal with the use of biofuels, e-fuels and green and clean energy vehicles within the supply chains for freight transport. Indeed, cost-benefit analysis and life cycle assessment of reverse logistics and clean energy freight vehicles is seldom performed especially in some industries such as in the agri-food sector. The role played by consumers in fostering the transition of the supply chains and the logistic activities toward more sustainable models could be studied too.



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### **Research team and environment**

The research team is interdisciplinary drawing from the fields of transport, political, regional and agricultural economics and includes doctoral fellows, research fellows and professors in economic geography, financial economics, econometrics, statistics and mathematics. Our activities include participation to national and international research projects, seminars with doctoral fellows and visiting professors. The recently renewed building hosting the Department and located within the main campus of the University of Trieste includes rooms for doctoral fellows. A large variety of electronic journals in the fields of economics, finance, business, and statistics is also available.

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

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

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **The role of Public Administration in the transition towards a sustainable and circular bioeconomy**

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

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

**Research Keywords:** Circular bio-economy  
Public administration  
Sustainability 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 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

Achieving a sustainable and circular bioeconomy (BE) is among the EU's priorities. A sustainable and circular bioeconomy requires innovative technical solutions, but also a proper policy structure and administrative guide able to stimulate a change of production and consumption patterns and the use of waste and recycling material, taking into account possible rebound effects. Thus, understanding the Public Administration (PA) role in the transition towards a sustainable and circular bioeconomy is key because PA should promote, facilitate and enable the transition to a circular and climate-neutral economy.

Candidates are invited to present research proposals which may investigate one or more of the various areas of the bio-economy, may refer to different levels of PA and government approaches (local, regional, national, international), and may have various object of analysis (cities, materials, technologies, etc.), but should always focus the attention on the sustainability assessment of the investigated circular bio-economy strategies/options and how PA can promote, facilitate and enable the transition.

The main goals of the proposals within this call should be oriented in the understanding of: a) circular bioeconomy initiatives adopted by the PA in their operational and strategic activities; b) successful policies and practices able to accelerate the transition; c) assessment methods to measure the extent of the sustainability of circular bio-economy strategies/options.

### **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. At the moment the researchers working at the Sustainability Lab are involved in the following projects: ELETTRORIGENERA and ILCIDAF.

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

We are looking for candidates with a background or experience in environmental systems analysis, like life cycle assessment and Material Flow Analysis. The person we look for is expected also to have: Good command of written and verbal English; Proficiency in advanced computer skills including all the products included in Microsoft Office 365 Business; ability and willingness to work in collaborative, multi-disciplinary environment, with an interdisciplinary approach, and preferably with documented experience of both quantitative and qualitative research work; availability to stably work in Messina but also to travel and move whenever required.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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

## **Governance issues in climate action**

**Reference Person:** Santosuosso Amedeo (amedeo.santosuosso@iusspavia.it)

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

**Research Keywords:** Governance and climate action (CA)  
Multilevel and polycentric approach to CA  
Communities and participatory processes

**Reference ERCs:** SH2\_1 Political systems, governance  
SH3\_14 Social studies of science and technology

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

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

Action on climate change suffers from a gap between the "naturally" global approach that action and policy require and the current crisis of multilateral instruments. The current international legal system, based mostly on nation states, shows problems in agreeing on measures to be taken, distribution of burdens and benefits, and more. International law has so far been ineffective in reducing climate change, although various multilateral agreements are potentially relevant.

For these reasons, governance appears to be the thorniest issue for climate action, and innovative approaches need to be developed.

Reports of the Intergovernmental Panel on Climate Change (IPCC) have emphasized in many ways that climate change governance is not limited to state activities, but requires a multilevel and polycentric approach, from the international to the national level to cities and communities, using creative methods and participatory processes.

In this perspective, civil society can also play an important role in pressuring governments and institutions to meet their international obligations. According to recent data, climate change litigation continues to grow in importance as a means of advancing or delaying effective action on climate change. Globally, the cumulative number of climate change-related lawsuits has more than doubled since 2015.

All this makes governance one of the most innovative and exciting fields of research in climate action.

### **Research team and environment**



The research activity will be carried out in the context of the IUSS Pavia University School, which has in interdisciplinarity a distinctive mark and in collaboration with the students of the proposing professor. In addition, the candidate will be able to carry out his/her activity also in connection with some international institutions in which the proposing professor is active, in particular the COMEST commission of UNESCO.

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

The candidate may have either a scientific, sociological, political or legal background. The important thing is that whatever his or her starting point, he or she has aptitude and willingness for interdisciplinary and cross-cultural work.

Knowledge of languages other than English can be a distinguishing factor.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Sustainable Solvents and Technologies: Unlocking Greener Synthetic Strategies**

**Reference Person:** Blangetti Marco (marco.blangetti@unito.it)

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

**Research Keywords:** sustainable synthetic chemistry

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

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

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

The increasing awareness of the harmful impact of chemical manufacturing processes has pressured companies to become more proactive in the development of new sustainable technologies. The implementation of greener solvents, mild and eco-friendly reaction conditions and synthetic approaches, and enabling technologies into new efficient protocols for the production of target molecules represents nowadays one of the main challenges of industrial research. The main goal of this project is therefore the replacement of traditional organic solvents in synthetic processes with biodegradable, recyclable, safe and low-cost sustainable alternatives. In particular, the research topic is focused on the design of telescoped chemo- and stereoselective synthetic approaches under bench-type conditions, potentially combined with enabling technologies, to upgrade of the traditional chemistry of short-lived and highly reactive species to the use of green, safe solvents and of alternative reaction media. The scientific goal of the project is to create novel and highly competitive synthetic methods towards a variety of new pharmacologically relevant molecular scaffolds with controlled chemoselectivity. Unprecedented synthetic sequences will be developed in a more sustainable perspective by using biomass-derived solvents and simple reaction conditions, potentially in combination with enabling green technologies.

### **Research team and environment**

The PhD candidate will join a research group composed by one full professor, two associate professors, one tenure-track researcher, one postdoc and three PhD students. The research activity of the PhD candidate will be carried out in a fully equipped organic chemistry laboratory, under the supervision of a research group with a solid experience in organic synthesis and a well-defined network of (inter)national scientific collaborations, with particular regards to the sustainability aspects involved in the development of novel synthetic methodologies.

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



The ideal PhD candidate should possess a proper background in organic chemistry and an early-stage experience in organic synthesis. The candidate should have experience on the use of the common purification techniques such as flash column chromatography, HPLC, preparative TLC, distillation, recrystallization and knowledge on the common characterization techniques of organic compounds including nuclear magnetic resonance (NMR), mass spectroscopy (GC-MS) and infrared spectroscopy (IR). The knowledge of English language is required.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Bio-conjugation of Enzymes to develop robust catalysts for C-H activation catalysts**

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

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

**Research Keywords:** catalysis  
Cu-enzyme  
bio-conjugation

**Reference ERCs:** PE5\_11 Biological chemistry and chemical biology  
PE5\_16 Supramolecular chemistry  
PE4\_10 Heterogeneous catalysis

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

The research activities of the present PhD project are part of the ERC-Synergy project "Unraveling the secrets of Cu-based catalysts for C-H activations" started in May 2020. The PhD student will complete the efforts of some other PhDs that started in the previous 2 cycles, contributing to the development of new catalysts based on copper ions, for the selective activation of the C-H bond to give partial oxidation reactions. In CUBE we are developing Cu-Zeolites, Cu-complexes, Cu-MOFs and modified LPMO enzymes. In this specific project, we will develop a new generation of enzymes modified from the original LPMO, making it more robust and still active towards a selection of reactions on a variety of substrates (also waste). The activities will be developed in close collaboration with NMBU (one unit in CUBE) and will imply the modification of the enzyme and the development of new strategies to make it robust, keeping its activities in the envisaged reaction conditions.

### **Research team and environment**

The PhD activities will take place in Turin at the Innovation Centre building, part of the Chemistry department at Turin University (<https://www.chimica.unito.it/do/home.pl>) and at NMBU (Norway). Being part of an ERC-Synergy project, the PhD candidate will spend some time also in the other labs involved in the project and will be part of all the activities of the CUBE's consortium (<https://www.cube-synergy.eu>).

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

Biotechnology, enzymology, chemistry, spectroscopy, materials science, catalysis



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**Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU3 - Technology and Territory*

## **Photoelectrocatalytic artificial-leaf devices for sustainable and resilient energy management**

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

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

**Research Keywords:** artificial leaf devices

resilient energy

photoelectrocatalysis

**Reference ERCs:** PE4\_10 Heterogeneous catalysis

PE4\_8 Electrochemistry, electrodialysis, microfluidics, sensors

PE8\_9 Production technology, process 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**

The research aims to develop integrated competencies for the organisation and strategic direction in the renewable energy value chain public administrations. The Doctorate aims to develop by using a specific case example on which focus the study, knowledge, and competencies for innovative strategies for the renewable energy value chain, valorise management competencies, leadership, and communication skills for public organisations and reinforce the administration capabilities to develop public politics and decision, implementation, and evaluation tools in the energy sector.

The specific case example around which are built above competencies is a key technology to accelerate the transition to the replacement of fossil fuels and close the carbon cycle: the development of devices called artificial leaves to produce solar fuels in a distributed approach capable of integrating more effectively with the territory and its resources, enhancing its resilience, and with a direct boosted contribution to reducing the emissions of CO<sub>2</sub> (both reusing this molecule and using solar energy for its conversion) and the territory impact on climate changes. The study also addresses visionary directions such as the production of fertilisers and food (proteins) directly from air components (CO<sub>2</sub>, N<sub>2</sub>) and sunlight. This objective requires a holistic system approach, which integrates fundamental knowledge of applied, engineering and industrial, and socio-economic aspects.

### **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/>). The centre has about 600 m2 of laboratories, fully equipped with equipment for the preparation, characterisation and testing of catalysts, and where operate about 8 permanent scientists and 15-20 non-permanent researchers. 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, also analysing socio-economic aspects and mitigation impact. Specific techno-scientific capabilities are integrated with educational aspects to promote human capabilities for proper management and strategic direction of energy. 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**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Manufacturing sustainability of production chains through Digital Twin**

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

**Host University/Institute:** Politecnico di Bari / Meccanica, Management e Matematica

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**Research Keywords:** digital twin;  
supply chain;  
life-cycle thinking

**Reference ERCs:** PE8\_7 Mechanical engineering  
PE8\_9 Production technology, process engineering  
PE7\_8 Networks, e.g. communication networks and nodes,  
Internet of Things, sensor networks, networks of robots

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

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

The Digital Twin (DT) emulates the physical systems along its entire lifecycle phases utilizing real-time data to enable the users to predict instantly and respond to any issue in the system. A DT is defined as the cyber model that emulates the real physical objects by using sensor information, system models, input data, and communication capabilities to predict the system's performance and optimize it accordingly.

The implementation of a digital model of the entire product life cycle, including the entire production chain upstream and downstream of the DFV painting company is the main focus of the research theme. Part of the research activities will concern the methods to characterise the production chain to optimise manufacturing sustainability at all stages, by also endeavouring a real-time data acquisition system distributed throughout the production chain, in order to optimise control of the product life cycle through artificial intelligence techniques.

This is a quite new problem, provided the not usual scale of concern, and this represents the true challenge of the PhD theme. System theory and complexity theory are two of the potential candidate for searching for adequate solutions to appropriately design and run a supply chain DT.

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### **Research team and environment**



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!ful professor (proponents); 2 associate profesores; 1 young researcher; 1 professionals with PhD for the Company

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**Suggested skills for this research topic**

Simulation Theory; Engineering; Manufacturing Technology

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Monitoring and modelling of a ZEB (Zero Energy Building)**

**Reference Person:** De Carli Michele (michele.decarli@unipd.it)

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

**Research Keywords:** Zero Energy Buildings and Positive Energy Houses  
Building envelope, HVAC and RES technologies  
Living lab

**Reference ERCs:** PE8\_6 Energy processes engineering

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

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

Residential buildings are responsible of about 26% of CO2 emissions in Europe. The target of zero emissions in 2050 requires to test solutions and systems for the envelope, for the HVAC systems and integrated RES, looking at Zero and Positive Energy Buildings.

For this purpose, a laboratory of Zero Energy Buildings (UniZEB) is almost finished in the University of Padua. The building is equipped with innovative technologies for the envelope and the HVAC systems, with a novel BMS (Building Management System).

The doctorate activity will start when the panel of occupants is going to enter in the building. The monitoring activity will include a heating and a cooling season. The Ph.D student will have to analyze first the building envelope measurements and has to develop different models for each component: a well insulated vertical wall, a ventilated wall, three types of roofs and the ventilated basement. Once tuned the models against the measurements, the technologies will be simulated in other conditions.

Once finished this activity the Ph.D student has to integrate the models in an overall building model including the envelope and the HVAC system. The new model will be used as digital twin to better understand the energy and comfort measurements, considering innovative strategies to manage the building and the HVAC plant.

The research activity will be carried out together with KTH of Stockholm, having already established a joint activity on living labs and digital twins.

### **Research team and environment**

BETALAB (Building Energy & Technology Assessment Research) group (<https://research.dii.unipd.it/betalab/>) is composed by Michele De Carli (Full Professor), two



Associate Professors, one Assistant Professor, 5 PhD students, 2 post-doc researchers and 2 research fellows, working on buildings (Indoor Environmental Quality, advanced building envelope solutions, HVAC systems, integrated RES) and communities (UBEMs and district heating and cooling networks). In the last 15 years BETALAB worked on 60 researches for companies and public bodies, on 12 Regional projects and on 6 EU projects. The joint activity involves many national and international companies/universities/research centers.

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

The candidate should have a degree in Energy Engineering or Mechanical Engineering. He/she should have had experience in the master thesis and/or after the master thesis in research groups dealing with energy in buildings.

The candidate should have backgrounds on building dynamic energy models, and should have good knowledge on commercial tools for the building energy dynamic simulations (at least one, but better if more than one among ENERGYPLUS, TRNSYS and IDA ICE).

The candidate should also be familiar with sensitivity analyses on energy models, control of HVAC systems and building energy analyses.

The candidate should have backgrounds on simulation and modelling with MATLAB tool.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Artificial Intelligence for Precision Livestock Farming: Supporting Sustainable Production**

**Reference Person:** Distante Damiano (damiano.distante@unitelmasapienza.it)

**Host University/Institute:** University of Rome UnitelmaSapienza / Department of Law and Economics

**Research Keywords:** Artificial Intelligence  
Precision Livestock Farming  
Sustainable production, Food quality improvement

**Reference ERCs:** PE6\_7 Artificial intelligence, intelligent systems, natural language processing  
PE6\_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)  
LS9\_10 Veterinary and applied animal sciences

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

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

Precision livestock farming (PLF) is defined as the individual animal management by continuous real-time monitoring of health, welfare, production/reproduction, and environmental impact.

The use of sensors to collect data on animals' behavior and livestock farming production in PLF has several potentials, including: i) the early detection of diseases and other animal welfare issues; ii) the improvement of production performances; iii) the optimization of natural resources usage; iv) the minimization of environmental impact; v) the increase of livestock farming societal acceptance.

The proposed research project aims to apply artificial intelligence (AI) techniques and methodologies to data collected in real precision livestock farming (PLF) scenarios to experimentally support the achievement of PLF objectives and potentials.

Specifically, the research goal is to find the best trade-off between livestock farming productivity, natural resources usage, animal welfare and environmental impact, while improving food quality, guaranteeing food safety, and favoring the adaptation and mitigation to climate change.



Historical and new data collected in PLF systems will be analyzed by means of AI techniques and methodologies, with the aim of developing data analysis and prediction models able to determine the best balance between animal nutrition, emission of climate-altering substances and sustainable production requirements.

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### **Research team and environment**

The proposed research will be developed at the University of Rome UnitelmaSapienza in cooperation with the Research Center on Animal Production and Aquaculture of the Italian Council for Agricultural Research and Economics (CREA) under the supervision of Prof. Damiano Distanto, PhD (SSD INF/01, ERC: PE6\_7, PE6\_10, PE6\_11), University of Rome UnitelmaSapienza, in collaboration with the following researchers:

- Prof. Stefano Faralli, PhD, Computer Science Department, Sapienza University of Rome;
- Dr. Miriam Iacurto, Dr. Roberto Steri and Dr. David Meo Zilio, CREA Research Center on Animal Production and Aquaculture (agreement between UnitelmaSapienza and CREA to be signed).

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

The preferred candidate for conducting the proposed research should have the following knowledge and skills:

- Knowledge of machine learning and deep learning algorithms and techniques for the supervised and unsupervised learning of predictive models on heterogeneous, sparse and noisy data, including data in the form of time series.
- Programming skills with python and AI libraries and platforms.
- Experience with SQL and NoSQL databases and Web programming.
- Propensity to team working and interdisciplinary research.

The preferred candidate should possibly also have knowledge of precision livestock farming methodologies and technologies.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU3 - Technology and Territory*

## **Combining organocatalysis and ring strain: new opportunities for sustainable organic synthesis**

**Reference Person:** Frongia Angelo (afrongia@unica.it)

**Host University/Institute:** Università di Cagliari / Dipartimento di Scienze Chimiche e Geologiche

**Research Keywords:** Organocatalysis

Green chemistry

Ring strain

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

PE5\_13 Homogeneous catalysis

PE4\_12 Chemical reactions: mechanisms, dynamics, kinetics and catalytic reactions

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production

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

The past few years have produced important advances in the development of green and sustainable synthetic methods that have made possible access to new chemical space and unusual systems. Endeavors to this end have produced important discoveries in the field of C-H activation/functionalization, visible-light photoredox-controlled reactions and catalysis. An alternative sustainable way to rapidly increase the molecular complexity and/or to explore unique bond formations, in a step-, pot- and atom-economical manner, could be through "strained overbred intermediate" formation (and destruction of such complexity to generate new complexity). Cyclobutane and cyclopropane derivatives owing to their inherent ring strain, are considered classical overbred intermediates. The success of this synthetic strategy requires a careful understanding of the reactivities of such intermediates as well as the correct choice and/or design of the catalyst. This research topic plans to develop novel organocatalytic synthetic methods for the assembly of biologically active molecular targets and pharmaceuticals by taking advantage of such still largely underexplored reaction concept. At the same time, this proposal seeks to capitalize upon this unique opportunities afforded by the reactivity profiles/chemical peculiarities of strained carbocyclic systems to expand the synthetic potential of the modern organocatalysis, by providing new opportunities for reaction invention and catalyst design.

### **Research team and environment**



Research will be carried out within the Dipartimento di Scienze Chimiche e Geologiche of the University of Cagliari under the supervision of prof. Angelo Frongia. His research interests focus on the synthesis and reactivity of strained carbocycles including the organocatalytic transformation of cyclobutane and cyclopropane derivatives. A strong research partnership is currently active with several foreign research institutions such as the CP3A Organic Synthesis Group of the Université Paris Saclay (Prof. D. J. Aitken) and the Department of Pharmaceutical and Medicinal Chemistry of the Royal College of Surgeons in Ireland (Prof. Mauro Adamo).

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

The ideal candidate for this position will have a Masters degree or equivalent in chemistry with experience in the field of synthetic organic chemistry as well as in studying reaction mechanisms and structural characterization of organic molecules. The ability to work in a team as well as good communication skills is essential.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU3 - Technology and Territory*

## **Synthesis of bio-based products and study of their applications**

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

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

**Research Keywords:** Biomass  
Greener Chemical processes

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

**Reference SDGs:** GOAL 6: Clean Water and Sanitation, GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production

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

This project aims to develop novel chemicals from biomasses (bio-based products) for industrial applications. As is known bio-based products are obtained from renewable biogenic materials (also called "biomasses"), and could play a crucial role in preventing resource depletion and climate change in the near future. In fact, as they are derived from renewable feedstocks, bio-based products could reduce CO<sub>2</sub> emission and offer numerous advantages. This proposal is part of a consolidated research activity that our group is carrying out in the topic of greener industrial processes, in collaboration with industrial partners in Salerno province (see research project section). The main task of this project, is the synthesis of new products by functionalization of biomasses and the study of their applications in industrial processes. Based on our experience, the project will be focused mainly on cellulosic biomass such as carboxymethylcellulose (see publication 1) and cyclodextrins (see publications 3 and 4).

### **Research team and environment**

n° 2 associate professors, n° 2 postdoc students, n° 1 PhD student, and n° 2 PhD student with industrial characterization. On this topic, our group has active collaborations with foreign universities, research centers and chemical companies: Bi-QEM SPECIALTIES S.p.A., zona-industriale Buccino (SA) - MILANO (MI). Institute for Building Materials Engineering at Bauhaus-Universität Weimar, Prof. Andrea Osburg, Deputy Head of the F. A. Finger Institute for Building Materials Engineering at Bauhaus-Universität Weimar. National Research & Development Institute for Textiles and Leather, ICPI Research Division, Bucharest, Romania, prof. Elena Badea.

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



All the candidates must possess a Master Degree in Chemistry. It is required a full knowledge of (organic) synthesis and spectroscopic characterization (1D and 2D NMR, FT IR, mass spectrometry) of novel organic molecules. Propensity and passion for experimental laboratory research.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Fabrication of novel bio-based hybrid materials for water and soil purification**

**Reference Person:** GORRASI GIULIANA (ggorrasi@unisa.it)

**Host University/Institute:** UNIVERSITA' DEGLI STUDI DI SALERNO / DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

**Research Keywords:** Water remediation  
Green Chemistry  
Novel adsorbents from organic wastes

**Reference ERCs:** PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage  
PE11\_1 Engineering of biomaterials, biomimetic, bioinspired and bio-enabled materials  
PE11\_5 Engineering of composites and hybrid materials

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

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

The presence of pollutants in industrial effluents and soil is leading to environmental concerns due to their impact on ecosystems and human health. These compounds can retard photosynthesis process, limit the growth of aquatic biota, lead to the destruction of biodiversity. To overcome these issues, common adsorption technologies are being applied. Many of them are still very cost-prohibitive. Therefore, there is a rising interest in finding relatively effective, low-cost, and simply accessible adsorbents. Thus, the use of several low cost adsorbents is being taken into account such as waste food residues, natural fibers waste, sewage sludge or natural clay. To address the need of more sustainable and eco-friendly processes and technologies, the proposed project addresses the development of more sustainable hybrid (organic-inorganic) bio-based adsorbents with improved pollutants adsorption features by applying the principles of the circular economy and sustainability with a wide attention on life cycle assessment analysis. By stating that, the PhD student will be responsible for designing, fabricating, characterizing and testing novel organic-inorganic composite materials as potential adsorbents of pollutants in wastewaters and soil. The proposed strategy aims to reduce the dependence on typical adsorbents, for example activated carbon, which are often characterized by their expensiveness.

### **Research team and environment**



The PhD student will work at the Department of Industrial Engineering of University of Salerno. The research team is composed by two Associate Professors, three senior researchers and several PhD/Post Docs responsible of different National and International collaborative projects. The laboratory is equipped of an advanced synthesis apparatus for green chemistry applications. Moreover, novel nanometric materials could be fabricated by using coaxial and multi-needle based electrospinning apparatus. The average publication number of team is roughly 15-18 articles/year on high-impact international journals.

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

All the candidates must possess a Master Degree in Chemical Engineering. It is required a full knowledge of synthesis and physical chemical characterization of novel hybrid hierarchically structured materials. More in details, the applicant should show a multidisciplinary approach and previous experiences in fabrication of hybrid composite adsorbents from waste resources through ionotropic gelation techniques as well as synthesis of binary and ternary layered double hydroxides with their characterization are advisable.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Green infrastructure and nature-based solutions to support spatial planning at multiple scales**

**Reference Person:** Lai Sabrina (sabrinalai@unica.it)

**Host University/Institute:** Università degli Studi di Cagliari / Dipartimento di Ingegneria Civile, Ambientale e Architettura (DICAAR)

**Research Keywords:** Green infrastructures  
Ecosystem services  
Nature-based solutions

**Reference ERCs:** SH7\_8 Land use and planning  
SH7\_7 Cities; urban, regional and rural studies

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

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

The research topic develops through two integrated targets (T1,T2).

T1 aims at developing a method to identify a regional, multifunctional green infrastructure (GI), where multiple ecosystem services (ESs) are delivered by a network of natural and seminatural areas, with a view to providing recommendations to improve regional GIs. A set of ES-based criteria for mapping the suitability of green spaces to be included within a GI will be identified and modeled, while the connectivity will be spatially analyzed through ecological corridor modeling. By overlaying the layouts of GIs and ecological corridors, the suitability of ecological corridors to be part of a GI can be assessed, and environmental analysis of its features can be performed, thus highlighting strengths and weaknesses on which a set of actions to improve the environmental quality of the GI can be grounded.

T2 aims at developing an approach to identify a local GI through nature-based solutions (NBSs), aimed at integrating GIs within urban planning, as urban GIs also include NBSs, such as green roofs or rain gardens. After an analysis of best practices, a taxonomy of NBSs that support ES supply will be defined, together with a quali-quantitative evaluation framework allowing for the evaluation of ESs delivered by local GIs and for developing a method to be included in planning processes and tools at the metropolitan and urban scales.

Sardinia and its towns will be taken as a case study for T1 and T2, respectively.

### **Research team and environment**



The doctoral student will work within a research team specialized on sustainable spatial planning based at DICAAR, University of Cagliari. Besides the proponent, the team comprises Dr. C. Zoppi (Professor), Dr. F. Leone (Assistant professor, RTDA), two post-docs, two doctoral students. The team, well recognized for its specialization and scholarly publications, works on many collaborative projects and has long-term national and international networks. It is an excellent learning environment for early-stage researchers, who can enjoy hands-on training and unique mentoring opportunities, frequent meetings and seminars.

Cutting-edge research facilities are available through the Department.

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

The ideal candidates will have:

- A background in spatial planning, obtained through a Master's degree in environmental engineering, urban and territorial planning, architecture, or closely related field.
- Skills in quantitative analyses and Geographic Information Science (GIS) techniques.
- Interest in collaborative and interdisciplinary work.
- Willingness to advance their knowledge and skills, both independently and in a supervised manner.
- Good command of both written and spoken English.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Real Time Risk Analysis to Decision Support System for Critical Infrastructures' resilience**

**Reference Person:** Lombardi Mara (mara.lombardi@uniroma1.it)

**Host University/Institute:** Sapienza Università di Roma / Dipartimento di Ingegneria Chimica Materiali Ambiente

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**Research Keywords:** Real Time Quantitative Risk Analysis

Critical Infrastructures Resilience

Decision Support System

**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

PE7\_3 Simulation engineering and modelling

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

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

Resilience is related to the issues of risk management, territorial vulnerability, sustainability, specifically applied to Critical Infrastructures (CIs) due to the greater risk and greater energy consumption associated with them. The aim to ensure the balance of the infrastructure through the integrated system services and its external effects determines a better assessment of the consequences induced by the interconnection with other systems. This meets the target of risk assessment and management of the CIs.

The research activity investigates systemic solutions (Systems and Technologies) aimed at an overall protection of CIs through a holistic approach implemented by means both data acquisition and modeling integrated system and finalized to define the algorithm of Decision Support System. Real time risk assessment is addressed to different levels: from single asset of Critical Infrastructure to surrounding territory, with focus on interdependencies and domino effects, considering emerging natural and anthropic risks. The aim is to design the adaptive response of the infrastructure in order to minimize the effect of hazards and manage residual risks by monitoring and verifying the compliance based on acceptability criterion. The implementation of a model based on As Low as Reasonably Practicable (ALARP) criterion for risk management is developed to carry out a quantitative Cost-Benefit Analysis (CBA) for evaluating the sustainability of maintenance actions.

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### **Research team and environment**

The research team, which integrates different skills, is inter-departmental and carry out study and research activities within specific thematic areas related to real time risk analysis to evaluate territorial resilience quantitative indicators specifically.

This activity develops single and multi-criteria strategies for risk reduction based on actions of strengthening, and optimization of information management, integrated models, rationalization of process control and databases, assessment based on the ALARP criterion. The main topics concern Fire Safety Engineering, geostatistical modeling, RAMS approach, risk analysis of complex systems, safety of road and rail critical infrastructures.

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

Required skills for successful conduct of the proposed research are:

- Master's degree in safety engineering, civil engineering or similar
  - Knowledge of programming languages.
  - Knowledge of technical mechanics, numerical optimization and machine learning.
  - Strong interest in independently investigating scientific issues
  - Willingness to work and cooperate with interdisciplinary team
  - Ability to convey and share ideas and information clearly and concisely with all one's interlocutors.
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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Paradigm capsized: planning with tangible, manageable and measurable NbS**

**Reference Person:** Marignani Michela Marignani Michela (marignani@unica.it)

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

**Research Keywords:** NbS multiple benefits  
Urban biodiversity  
Mediterranean coastal areas

**Reference ERCs:** LS8\_1 Ecosystem and community ecology, macroecology  
SH7\_5 Sustainability sciences, environment and resources  
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**

Human pressure along the coastal zones grew worldwide: 1/3 of the Mediterranean population lives in coastal regions and cities, which will be the most affected by climate change and extreme events. Nature-based Solution (NbS) can help addressing such challenges by achieving ecosystem restoration and conservation, ensuring the sustainability of social and economic dimensions. Rely on NbS in cities allow to urban and peri-urban areas to deliver multiple benefits and ecosystem services, reduce biodiversity loss, restore degraded land, increase resilience, mitigate and adapt to climate change. Yet, while NbS potentially assure multiple benefits with the protection of the natural capital, a lack of comprehensive evidence remains on NbS reversibility, flexibility, cost effectiveness and long-term feasibility and sustainability compared to grey approaches. Aim of the research proposal is to generate scientifically robust NbS monitoring methods, to facilitate a full NbS integration into planning and design of urban coastal Mediterranean areas. Data will exemplify the positive effects that NbS integration into decision-making can provide in strategic urban planning processes, to support NbS efficiency and cost- effectiveness vs more traditional approaches. Results will support sustainable management, to minimize the impacts on ecological integrity; also, they will contribute to reduce the lack of coordination in the integration of NbS into decision-making and strategic urban planning.

### **Research team and environment**



The scholarship will work within the framework of the Department of Life and Environmental Sciences – Botany division of University of Cagliari. The researcher will have the possibility to work in a multidisciplinary team, under the responsibility of Prof. Michela Marignani. Main scientific interests focus on landscape ecology, with studies on the effects of habitat fragmentation on multi-taxonomical diversity, the definition of ecological networks at different scales and spatial planning in urban and peri-urban environments. The team performs multidisciplinary research activities, thanks to the collaboration with environmental engineers, urban planners, zoologist, geologist and ecologists.

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

We are looking for candidates with a good knowledge of ecology and ecological processes, as well as in natural resource planning and human dimension integration. The ideal candidate has a Master's degree related to sustainability science, natural and environmental sciences, ecology, biology or similar. Experience with statistics, spatial planning, environmental impact assessment and ecosystem services evaluation will be welcomed.

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### **Source of fundings**

DM118/2023 – 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Rethinking, Engineering and Optimizing the value chain of Italian food processing residues**

**Reference Person:** MICCIO Michele (mmiccio@unisa.it)

**Host University/Institute:** UNIVERSITÀ DEGLI STUDI DI SALERNO / Dipartimento di Ingegneria Industriale

**Research Keywords:** food processing residues

Waste valorization

Biorefinery engineering

**Reference ERCs:** PE8\_2 Chemical engineering, technical chemistry

LS9\_11 Biomass production and utilisation, biofuels

PE8\_9 Production technology, process engineering

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production, GOAL 17: Partnerships to Achieve the Goal

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

#### OBJECTIVES

- To improve and make green i. extraction techniques of bioactive and valuable compounds; ii. thermal-chemical pre-treatments for conversion into fuels and/or precursors of green chemicals
- To provide the basis for math modelling and process engineering design, e.g., rate equations of conversion reactions; mathematical correlations between process performance indexes, reactor configuration and operating conditions

#### ACTIVITIES

##### 1. REASONED SELECTION OF FEEDSTOCKS

Among Italian food processing residues like winery wastes, spent coffee powder, citrus residues.

##### 2. VALORISATION FOR THE ENERGY SECTOR

Torrefaction: thermochemical treatment (typically < 50 °C/min up to 200–300 °C) in an inert environment for a residence time of 10 to 120 min. A low-BTU gas (torgas) is produced in addition to the torrefied solid.



HydroThermal Carbonization: thermochemical treatment to be set up with a new lab-scale facility.

Pelletization: torrefied solids, by themselves or in mixture with other residual biomass, will be set up with a new lab-scale pelletizer.

### 3.ENGINEERING SEPARATION

This focuses screening and optimization at lab scale of separation methodologies, which are suitable to be upgraded according to a process engineering approach.

### 4.MATH MODELING AND TECHNICAL-ECONOMIC-ENVIRONMENTAL (TEE) ANALYSIS

This yields process optimization and automatic control, economic assessment and environmental impact of the investigated value chains, using the biorefinery cascade approach and LCA.

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#### **Research team and environment**

Lab of Biomass Conversion at Department of Industrial Engineering (DIIIn). Staff and integrated expertise on process engineering (flowsheeting, equipment sizing, investment and operating costs), control engineering (math modeling, dynamic simulation, advanced control, digitalization and automation), renewable energy from biomass and wastes, sustainability and circular economy (resource conservation, recovery and separation of compounds, supply chain management, waste minimization, LCA, climate change).

A start-up consulting company has already expressed interest: eLoop Srl

V. A. Gramsci 17b 80122 Napoli

P.IVA 08922291219

eloop@pec.it

info@eloop.consulting

<http://www.eloop.consulting>

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

Chemical Engineer

Environment Engineer

Food Technologist

Mastering of differential calculus and empirical modeling.

Basic acquaintance of chemical lab equipment and process instrumentation.

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#### **Source of fundings**



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DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **How to tackle urban climate fragility: making possible with regenerative design**

**Reference Person:** Morganti Michele (michele.morganti@uniroma1.it)

**Host University/Institute:** Sapienza Università di Roma / Dipartimento di Ingegneria Civile, Edile e Ambientale

**Research Keywords:** building and neighbourhood vulnerability  
urban microclimate adaptation  
nature-based solutions

**Reference ERCs:** PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics  
SH7\_6 Environmental and climate change, societal impact and policy  
SH7\_7 Cities; urban, regional and rural studies

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action

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

This research addresses urban climate fragility nature proposing a cross-scale approach framework, helpful in assessing climate impacts and evaluating adaptive design solutions for buildings, urban spaces, and neighbourhoods. Existing adaptive design methods integrate with some difficulties all dimensions and scales that affect the environmental performance of buildings and cities. Our work proposes to include these dimensions and scales into different natures of physical fragility: climatic, microclimatic, morphological, typological and related to the building components. For each fragility, the research provides different levels of knowledge, both in terms of analysis and design scenario evaluation: urban system, physical characteristics, metrics and performance indicators, spatial and climate database, impacts and adaptation scenarios.

In this framework, the study investigates two main issues: the effect of physical characteristics of buildings and neighbourhoods on the environment and the associated energy performance; the ability of the regenerative design to be useful in climate adaptation of cities. The proposed research methodology implies sequential and logical steps aiming at:

1. developing a cross-scale workflow able to combine data, modelling and analysis tools;
2. addressing physical fragility natures in existing urban areas and evaluating the associated impacts;





3. proposing and assessing the effect of building and neighbourhood adaptation design strategies.

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### **Research team and environment**

The PhD candidate will be involved in the "SOS Urban Lab", a multi-disciplinary research team at the DICEA Department. The SOS Urban Lab has more than 15 active members. Among the main research streams are:

- Mediterranean built environment: climate change, urban microclimate, building energy performance and comfort
  - urban-building energy modelling
  - urban and building vulnerability analysis
  - climate change adaptation by design: cross-scale advanced methods and tools
  - multi-objective urban and building performance analysis and design: digital simulations and tools
  - public housing regenerative design
  - circular building design.
- 

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

The ideal candidate possesses experience in Sustainable building design, microclimate and energy analysis. In particular, knowledge and skills for managing environmental and energy dynamic simulations – both at urban and building scales – are required. Previous expertise in GIS, BIM and parametric environment (Rhino + GH) are highly appreciated.

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### **Source of fundings**

DM118/2023 – 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**

For this scholarship it is mandatory a period of Min 6 months – Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Declining the circular economy for fastening systems in construction**

**Reference Person:** Muciaccia Giovanni (giovanni.muciaccia@polimi.it)

**Host University/Institute:** Politecnico di Milano / Ingegneria Civile ed Ambientale

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**Research Keywords:** Environmental impact indicators

Fastening in constructions

Circular economy models

**Reference ERCs:** PE8\_9 Production technology, process engineering

PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics

**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**

Both in new constructions and in the refurbishment of existing buildings there is a great use of fastening systems, essential to connect structural elements and to support ancillary components. The environmental impact of fastening systems is considerable because fasteners are spread everywhere in buildings and they are mostly made out of non-recycled material, nor follow a consolidated path of sustainable production processes.

At the moment, there is a total lack of laws, codes or guideline to assess the environmental impact of these products, and also of a specific circular economy model for the fasteners sector which would support policymakers, manufacturers or end users, as well as any authority entitled to assess the suitability of such products.

It is proposed to establish procedures to define the impact indicators for fastening systems in the construction sector, with a specific focus on the possibilities of recovery and / or reuse of the products, with the final goal of implementing such procedures in European codes or guidelines. To establish a circular economic model, several issues need to be addressed, as impact assessment on increasing the amount of recycled material, possibility to migrate towards alternative materials, reconsider the concept of fasteners performance in construction, currently strongly based on marketing needs, rather than on actual design needs, which should also include environmental performance criteria.

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### **Research team and environment**



Besides the Principal Investigator, the Research Team currently counts on 3 research assistants (post-docs) and 7 PhD students. All the activities in the team are carried out in close relationship with the industrial and professional sectors (having cooperated with more than 20 industrial companies in Europe to develop specific fastening solutions), as well as international research groups in Europe and US. The basic and applied research have a strong experimental basis. R&D in the specific field of seismic behavior of fastening to concrete represents one of the key specializations of the group at international level, which is significantly active in codes and guidelines development.

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

Open minded person with technical background in civil engineering, open to transversal approach between academic, industrial and social topics.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Innovation in passive technologies to deliver summer comfort under XXI century climate conditions**

**Reference Person:** Pagliano Lorenzo (lorenzo.pagliano@polimi.it)

**Host University/Institute:** Politecnico di Milano / Dipartimento di Architettura e Studi Urbani (DASTU)

**Research Keywords:** Passive techniques for thermal comfort  
Weather files (for simulation) and climate change  
Net daytime radiation towards sky

**Reference ERCs:** PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics  
PE8\_7 Mechanical engineering  
PE11\_5 Engineering of composites and hybrid materials

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production

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

Climate change is providing progressively harsher boundary conditions, posing strong challenges both to the traditional, climate aware, construction traditions and to the new construction archetypes which became prevalent under perceived abundance and low cost of energy, materials and environmental "space", conditions that are rapidly vanishing. This research will develop innovative applications of passive principles adapted to the new climate and urbanization conditions, with e.g. the inclusion of new materials (able to provide daytime net radiation to the sky and sub-air temperature under sunshine), new comfort models based on ASHRAE Global Comfort Database II, a new generation of climate weather files designed to represent local weather in 2050 and 2080 climate scenarios. Some of the developed improvements will be tested in case study buildings in Africa and Europe, taking profit of the research network initiated within the EU funded project "Africa-Europe Bioclimatic Buildings for XXI Century" (<https://www.abc21.eu/>), coordinated by Prof. L. Pagliano and Prof. S. Erba. A monitoring campaign will allow to corroborate the results of simulations and to fine-tune the control strategies of the passive elements and their synergy with local renewable generation. Local materials (bio and geo-sourced) will be integrated into the analysis, thanks to the connection to a network of manufacturers and ongoing efforts towards certification of physical parameters.

### **Research team and environment**



end-use Efficiency Research Group ([www.eERG.polimi.it](http://www.eERG.polimi.it)), active since 1996 under the direction of Prof. Pagliano, collaborates with a number of European Universities and international research bodies.

eERG has participated in, promoted and directed more than 50 research projects and studies funded by e.g. European Union, Regional Governments, Energy Companies, on various aspects of buildings monitoring, analysis and simulation and comfort surveys. We participated and currently participate in activities under the International Energy Agency, such as: IEA ECBCS Annex 5; IEA EBC Annex 58; IEA SHC Task 40 / ECBCS Annex 52 - "Towards Net Zero Energy Solar Buildings"; IEA Annex 83 PED

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

The ideal candidate should have good foundations in building physics and control methods, being acquainted with measurement procedures in buildings, being able of critical and evolutive use of building simulation. Good knowledge of English language, interest in scientific communication both at conferences and via peer reviewed journal papers.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Sustainable Energy Communities**

**Reference Person:** Raugi Marco (marco.raugi@unipi.it)

**Host University/Institute:** università di Pisa / Ingegneria dell'energia dei sistemi del territorio e delle costruzioni

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**Research Keywords:** Energy Communities  
Sustainable energy  
renewable energies

**Reference ERCs:** PE8\_6 Energy processes engineering  
PE8\_4 Computational engineering  
PE8\_11 Environmental engineering, e.g. sustainable design, waste and water treatment, recycling, regeneration or recovery of compounds, carbon capture & storage

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production

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

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

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### **Research team and environment**



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

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

The candidate should have a good mathematical background and computer programming skills. Energy systems and energy systems integration knowledge and understanding.

Computer programming skills are necessary. Big data analytics and artificial intelligence methods (neural Network, machine learning etc).

The candidate should be open minded and able to dialogue with colleagues with socio-economic skills in order to understand the socio-economic interactions into an Energy Community

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU3 - Technology and Territory*

## **Sustainable and Circular Digital Manufacturing**

**Reference Person:** Rosa Paolo (paolo1.rosa@polimi.it)

**Host University/Institute:** Politecnico di Milano / Dipartimento di Ingegneria Gestionale

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**Research Keywords:** Circular Economy

Industry 4.0

Twin Transition

**Reference ERCs:** PE8\_9 Production technology, process engineering

PE8\_10 Manufacturing engineering and industrial design

PE7\_3 Simulation engineering and modelling

**Reference SDGs:** GOAL 12: Responsible Consumption and Production

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

Given the direct exploitation of materials and natural resources, the manufacturing sector is on the forefront of sustainability and circular economy. This way, the negative impact of this sector in terms of sustainable development and climate changes must be adequately monitored and reduced. During the last decade, both circular economy and Industry 4.0 approaches have been adopted by manufacturing companies in order to cope with environmental issues and technological advances. However, current researches are showing that digital technologies could support and enable even more sustainable practices if adequately integrated and managed. The intent of this research is to establish new ways to do it in practice and support companies during the transition from linear to circular behaviours.

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### **Research team and environment**

The team will be constituted by Paolo Rosa (he got his PhD in Pavia), as reference person. Prof. Sergio Terzi of the Manufacturing Group of the School of Management POLIMI will also be involved. The research activity will consider the collaboration with other PhD students and post-doc operating in the Manufacturing Group. This will create a stimulating environment for the new PhD candidate. One main idea is to create cooperation with the MADE Competence Centre Scarl (where University of Pavia and Politecnico di Milano are academic partners). Some of these activities will be implemented within the Manufacturing Groups' Industry 4.0 Lab.

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

good knowledge of circular economy practices and industry 4.0 technologies

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Novel energy conversion and electric propulsion systems for electric vessels**

**Reference Person:** Serpi Alessandro (alessandro.serpi@unica.it)

**Host University/Institute:** Università degli Studi di Cagliari / Dipartimento di Ingegneria Elettrica ed Elettronica

**Research Keywords:** electric propulsion systems  
energy storage and management systems  
more electric vessels

**Reference ERCs:** PE7\_2 Electrical engineering: power components and/or systems  
PE7\_3 Simulation engineering and modelling  
PE7\_12 Electrical energy production, distribution, applications

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

The electrification of the maritime transport sector represents a priority goal for reducing polluting emissions, especially in port areas, to make them sustainable from an energy and environmental point of view. However, the development and use of electric vessels is still limited, mainly due to the weak energy performance of the energy storage systems currently available on the market. The development of innovative energy conversion and electric propulsion systems on board vessels can overcome these issues, by ensuring adequate performance and efficiency through the synergistic use of different energy storage systems, thus favouring the electrification process also through suitable vessel-to-grid paradigm. In this context, the research activity to carry out will initially concern the study and analysis of the different configurations of the energy conversion and electric propulsion systems on board vessels, especially focusing on the several pilot projects in the sector. Subsequently, integrated configurations of energy conversion, storage and electric propulsion systems will be developed, with particular reference to multi-source, multi-level and/or modular solutions. Advanced energy management and control systems will be also developed with the aim of achieving better performance than existing solutions, not only during propulsion stages (energy saving, cruising range), but also when connected to the port grid (smart charging, power and energy services).

### **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 to carry out will mainly regard electrical engineering topics, more specifically 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 fair knowledge of MATLAB and a basic knowledge of some programming languages (e.g. C, VHDL, Python) are also very advisable. These skills can be refined appropriately during the PhD thanks to the attendance of specific training courses, including, for example, national and/or international PhD schools on power electronics, electric machines and drives, as well as seminars, conferences and workshops.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

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

**Reference Person:** Sinicropi Adalgisa (adalgisa.sinicropi@unisi.it)

**Host University/Institute:** Università degli studi di Siena / Dipartimento di Biotecnologie, Chimica e Farmacia e Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente

**Research Keywords:** Photovoltaics  
Life Cycle Thinking  
Full-spectrum Sustainability Assessment

**Reference ERCs:** PE4\_18 Environment chemistry  
PE4\_1 Physical chemistry  
SH7\_5 Sustainability sciences, environment and resources

**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**

Since its first introduction, the market share of photovoltaics (PV) has expanded exponentially, and it is now the fastest-growing source of renewable energy. The strengthening of the PV share in the electricity market is expected to accelerate also supported by the emerging PV technologies that are approaching commercialization. To compete with fossil fuel-based sources not purely on economic grounds, many technological enhancements are being pursued to either reduce manufacturing costs or increase the PV cells' conversion efficiencies. To this aim, various solutions have been addressed by using new materials, implementing innovative processing routes and modifying cell architectures, leading to numerous cell design. Such technological enhancement and diversification are going at a fast pace, posing an issue for ex-ante assessment of the long-term impacts of successful PV innovations prior to their application. The earlier the technological development stage, the harder it is forecasting pros and cons of the PV system. But an early assessment is essential, given that design changes are easier to make during R&D stages. The PhD project aims to develop a full-spectrum sustainability assessment framework based on the life cycle thinking perspective for investigating the socio-ecological performances of innovative PV in a comprehensive way. Such comprehensive evaluative framework will be implemented with a bottom-up approach based on real built environment application.

### **Research team and environment**



The project will be carried out at the Research on Renewable Energy and Sustainability Laboratory (R2ES Lab) at the Dep. of Biotechnology, Chemistry and Pharmacy of the University of Siena, under the supervision of Prof. M.L.Parisi and Prof. A. Sinicropi, and in strict collaboration with the Ecodynamics Group (EG), under the supervision of Prof. Federico M. Pulselli, at the Dep. of Physical Sciences, Earth and Environment, University of Siena. Such a multidisciplinary environment will benefit from the wide international scientific experience in various fields of physical and organic chemistry of the R2ES Lab and from the EG's extensive experience in footprint accounting and carbon neutrality

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

Candidates should have a scientific/technical background and a strong interest in energy issues, besides a Master degree in a relevant science subject or in engineering. He/she would ideally have experience and technical competence in the use of methodologies for sustainability and resource efficiency analysis. To be successful in this role he/she should: have good analytical and quantitative skills to analyse and manage large amounts of data and interpret results; speak and write clearly in English; have good interpersonal and communication attitudes, available to develop and share the experience in a multidisciplinary environment; available to stay in Siena and travel for research purposes

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **E-mobility and Smart-Grids**

**Reference Person:** Testa Antonio (atesta@unime.it)

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

**Research Keywords:** Decarbonisation of electric systems

Smart Grids

Electric mobility

**Reference ERCs:** PE7\_2 Electrical engineering: power components and/or systems

PE7\_12 Electrical energy production, distribution, applications

SH7\_9 Energy, transportation and mobility

**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**

Smart-Grids and E-Mobility are key pillars of the transition towards a carbon neutral society, which are closely related. In fact, E-Mobility is about to become a new important form of end-use of electricity and Smart-Grids will become the main energy source for transport.

The scholarship will start with a deep insight on some possible interactions between E-Mobility and Smart-Grids. Among them:

- The low range and long charging times of electric vehicles could be addressed in the near future with E-Roads integrated into Smart-Grids.
- Parked electric vehicles can be turned into active elements of Smart-Grids, providing highly valued demand response services (V2G).
- Fast charging stations which are rapidly spreading must be suitably integrated into smart grids.
- Millions of tons of lithium-ion batteries decommissioned from electric vehicles could be reused in grid ancillary applications.
- Naval and air electric vehicles will spread rapidly in the coming decades setting new issues for the electricity grid.



• Power electronics is an enabling technology for both E-Mobility and Smart-Grids. Innovative SiC and GaN power devices will allow in the next years to overcome the limits of conventional silicon devices in terms of efficiency, operating temperature and power density.

One of these topics will be selected and innovative solutions will be addressed, either from a theoretical point of view, either from an experimental one.

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### **Research team and environment**

The E-mobility and Power Electronics research team at the Department of Engineering of the University of Messina is composed of a full professor, an associate professor, a lecturer and two Phd students. Experimental research activities are accomplished in the fields of industrial automation, power converters, electric mobility, electric grids, exploitation of renewable energies, reliability of Lithium batteries and development of power hardware in the loop systems. The team is partner of ST-Microelectronics, CNR and some Italian Universities and firms in research activities in the fields of E-Mobility and Smart-Grids.

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

The candidate should have a master's degree in electrical or electronic engineering and be familiar with simulation environments such as Simulink, Plecs, Psim, or Spice. Furthermore, a consolidated experience in laboratory activities is highly recommended, and in particular in the design, realization and experimental evaluation of electrical, electromechanical and electronic systems.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Eco friendly nanosponges for CO2 capture and utilization**

**Reference Person:** Trotta Francesco (francesco.trotta@unito.it)

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

**Research Keywords:** CO2 capture  
CO2 utilisation  
dextrin nanosponges

**Reference ERCs:** PE4\_18 Environment chemistry  
PE5\_7 Biomaterials synthesis  
PE5\_15 Polymer chemistry

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

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

Carbon dioxide annual emission in the atmosphere is continuously growing by at least 70 years reaching the amount of 37,12 billions metric tons in 2021. Dramatically reducing current greenhouse gas emissions is essential and urgent to slow global warming in order to avoid irreversible effect on the life of the planet. There are several ways to capture CO2 from power or industrial plants. Adsorption, membrane separation, cryogenic separation and reaction with organic amines have been proposed to reduce the amount of emitted CO2 in the atmosphere. It is generally accepted that adsorption is a promising method to remove CO2 because it is cost effective. Activated carbons are suitable candidates for CO2 capture, but they have low loading capacities at low pressure and relatively high temperature. In the recent years we discovered that cyclodextrin (natural starch derivative) nanosponges can host a relevant amount of CO2 stronger than activated carbon even at relatively high temperature and atmospheric pressure. We would like to investigate more in depth this adsorption in order to optimize the new material coming from renewable sources to capture CO2 and favour its utilization especially in the production of carbonates or its use as a growth stimulator for selected plant species.

### **Research team and environment**

The professor Trotta's research team is composed by 1 senior assistant professor (RTDB) and 2 junior assistant professors (RTDA) beside 1 Ph.D student and 3 Post doc students. The group has internationally recognized expertise in the field of naturally derived nanosponges (248 articles, 8315 citations, h-index 52 for T.F.). The department of Chemistry is fully equipped for the polymer syntheses and characterization. The Department of Chemistry at Unito is recognized as department of excellence 2023-2027





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**Suggested skills for this research topic**

The candidate should have an expertise in polymer chemistry with particular regard to the synthesis of cross-linked biopolymers and their characterization.

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU3 - Technology and Territory*

## **Removable photocured inks and coatings for fully recyclable packaging**

**Reference Person:** Vitale Alessandra (alessandra.vitale@polito.it)

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

**Research Keywords:** Recyclable packaging  
Easily removable inks and coatings  
Reversible photocuring

**Reference ERCs:** PE5\_15 Polymer chemistry  
PE11\_4 Engineering of polymers and plastics  
PE4\_15 Photochemistry

**Reference SDGs:** GOAL 12: Responsible Consumption and Production

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

Packaging waste is one of the principal sectors that has an important impact on plastic pollution, due to the increasing plastic packages production and complex recycling operations. For these reasons, the European Commission launching its Green Deal has set as an ambitious target the increase of plastic packaging recycling up to 55% by 2030. However, recycling of packaging is still a scientific challenge, mainly because they are made of several layers of different materials. Even monomaterial plastics (e.g., PET or PE films) have printed layers or coatings, which hinder efficient recycling and reuse, especially because they are thermoset, thus insoluble and non-reprocessable.

In this scenario, this project focuses on printed plastic packaging and wants to contribute to its complete recycling by developing inks and coatings that can be easily depolymerized and detached from their plastic substrates at the end of the packaging's life. The inks and coatings to be developed will be processable through radiation curing technologies, which are in the area of green technologies for their sustainable characteristics: no use of solvents, processing at room temperature, high productivity. Efforts will be made to ensure that their curing and adhesion to substrates are reversible. In the field of inks and coatings, therefore, the objective of the project will implement a sustainable and circular industrial economy.

### **Research team and environment**

The activities of the Research Team POLYMAT are mostly addressed to the synthesis, modification and characterization of polymers prepared by photoinduced processes. The



POLYMAT laboratory is fully equipped for carrying out the synthesis of polymers by photopolymerization and crosslinking, the preparation of polymeric and composite films and membranes, and the characterization of polymeric materials (e.g., FT-IR, DSC, rheometer, DMA, SEM, permeometer, contact angle meters are available). For the project, researchers will also have full access to the department (Department of Applied Science and Technology) central facilities, and will benefit from its multidisciplinary environment.

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

The PhD candidate should preferably have an education in Materials Science or Engineering, Chemistry, or Environmental Engineering. A background in polymer synthesis, processing and characterization, photopolymers, polymer recycling is also welcome, as well as knowledge on resource criticality and LCA. A good knowledge of English is required.

Practical attitude for the lab activities, problem-solving skills, and high motivation to learn through advanced research are recommended. Moreover, adaptability in different environments and positive interactions with the other groups members are appreciated.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU3 - Technology and Territory*

## **Energy transition, Air Quality and Low Carbon technologies and policies**

**Reference Person:** Volta Marialuisa (marialuisa.volta@unibs.it)

**Host University/Institute:** Università degli Studi di Brescia / Dipartimento di Ingegneria Meccanica e Industriale

**Research Keywords:** Energy transition  
Low carbon and air quality policy  
Integrated Assessment modeling

**Reference ERCs:** PE7\_3 Simulation engineering and modelling  
SH7\_6 Environmental and climate change, societal impact and policy  
SH7\_9 Energy, transportation and mobility

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

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

In 2019, approximately 79% of global GHG emissions came from the sectors of energy, industry, transport, and buildings (IPCC 2023). Renewable energy, energy efficiency (technological and behavioral) measures, transport electrification, distributed energy production, bioenergy new energy vectors, CCS (Carbon Capture and Storage) energy storage are energy transition options with different costs and effectiveness on GHGs and atmospheric pollutant emissions.

The research activity aims at the study, definition, implementation of methodologies to structure multidisciplinary knowledge in Integrated Assessment Models to design energy transition policies, optimizing environmental objectives (CO2 emissions neutrality at 2050 and air quality improvement) and economic values (technological costs of primary and secondary energy carriers, health benefits), assessing the health impacts.

The research will assess measures in road traffic, heating, shipping, hard-to-abate industry, waste treatment, agriculture and energy production and conversion, CCS.

Database and models will be collected, developed and tested over Northern Italy.

### **Research team and environment**



The Integrated Assessment Modelling Lab is a research group at DIMI-UNIBS. The group has a twenty-year experience in descriptive (prognostic and data-driven) and decision (multi-objective, cost-effective, cost-benefit, multi-criteria) modelling of environmental systems and Integrated assessment modeling. The research group is involved in national and EU project aiming at identifying air quality and low carbon efficient policies (including energy, end-of-pipe and behavioral measures) and assessing population exposure and health impact. The group cooperates with atmospheric chemistry and physics, technology, socio-economics, health impact experts.

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

Mathematical modelling (fundamentals). Use (fundamentals) of office, statistical, mathematical software suites. Interest in interdisciplinary contamination. Teamwork aptitude.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Diachronic Webfare and Transgenerationality. In memory of engineer Franco Tatò**

**Reference Person:** Andina Tiziana (tiziana.andina@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Filosofia e Scienze dell'Educazione

**Research Keywords:** Transgenerationality

Welfare System

Social Justice

**Reference ERCs:** SH3\_4 Social integration, exclusion, prosocial behaviour

SH5\_10 Ethics and its applications; social philosophy

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 11: Sustainable Cities and Communities, GOAL 16: Peace and Justice Strong Institutions

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

Many social practices implemented through information technologies create value: documedia capital, i.e. the value of the data generated by processing and sharing the traces we produce on the web. It is increasingly exploited by digital platforms but rarely conceptualised for community's or future generations' benefit.

Particularly urgent problems highlight what Gramsci already pointed out: the exploitation of the south by the north was linked to the dynamics of industry and the production system and to the exploitation of the territory. They also make it clear that 'the preservation of time' is at least as urgent as that of space, hence the recent updates to the Italian Constitution with reference to future generations.

We invite proposals that address the crucial problems opened up by transgenerationality and the impact that new technologies have on environmental sustainability and welfare systems. They concern but are not limited to:

the nature of transgenerational pact, and future and past generations;

the emotions that strengthen transgenerational cooperation;

the formulation of criteria for intra- and transgenerational justice;

the ways in which these criteria can be transferred to the social, political, and economic spheres;



the evolution that new technologies are bringing about in the way transgenerational relations and social and environmental sustainability are being managed;

the narrative models that can enhance the organisation of transgenerational societies.

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### **Research team and environment**

The PhD Student will work together with Labont - Center for Ontology, an interdepartmental center of Unito involving the Departments of Philosophy and Education, Psychology, Law, Management, and Culture, Politics and Society. It seeks to promote scientific research on topics that intersect different subject areas by focusing on ontology (understood as the philosophical discipline that aims at providing an inventory of what exists in a certain domain), and in particular on social ontology and ontology of social organizations, of art, of economics, of law, of gender, of biology, political ontology, ontology of architecture and design, ontology and cognitive science, and psychology.

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

The ideal candidate has a good knowledge of philosophy, its history and concepts; he or she possesses the conceptual tools suitable for the development of independent, but above all interdisciplinary research; has good interpersonal skills; has the ability to work in a team in a fruitful manner, expounding one's own point of view, but also adapting to teamwork.

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership



*Curriculum: CU4 - Theories, Institutions and Cultures*

## **The Documedial Capital for Future Generations**

**Reference Person:** Andina Tiziana (tiziana.andina@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Filosofia e Scienze dell'Educazione

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**Research Keywords:** Future generations

Welfare

Education for sustainability

**Reference ERCs:** SH3\_4 Social integration, exclusion, prosocial behaviour

SH5\_10 Ethics and its applications; social philosophy

**Reference SDGs:** GOAL 4: Good Quality Education, GOAL 11: Sustainable Cities and Communities, GOAL 16: Peace and Justice Strong Institutions

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

Technological progress, social complexities, and ecological and health crises are forcing us to reconsider the terms of our existence and the nature of our relations with the natural and social reality.

We know that many social practices implemented through information technologies create value, namely a "documedial" capital – i.e., the value of the data generated by processing and sharing the traces we produce using the Web. This capital is exploited by digital platforms but is rarely conceptualised or capitalised for the benefit of the community or future generations like a "webfare". An integration between the theory of transgenerationality and the theory of documedial capital seems therefore promising for identifying economic resources that policy makers can use to support the implementation of transgenerational policies aimed at social and environmental sustainability.

Possible research lines:

- Institutions. Characteristics of national and European institutions functional to a transgenerational society;
  - Representation. Representing future generations: philosophical, legal and political instruments;
  - Education. How to educate to sustainable development to prevent climate change and demographic impacts, and create and strengthen resilient and OSS-centred school systems.
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### **Research team and environment**





The PhD Student will work in the "Labont - Center for Ontology", an interdepartmental center of Unito involving the Departments of Philosophy and Education, Psychology, Law, Management, and Culture, Politics and Society. The Labont seeks to promote scientific research on topics that intersect different subject areas by focusing on ontology (understood as the philosophical discipline that aims at providing an inventory of what exists in a certain domain), and in particular on social ontology and ontology of social organizations, of art, of economics, of law, of gender, of biology, political ontology, ontology of architecture and design, ontology and cognitive science, and psychology.

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

The ideal candidate has a good knowledge of philosophy, its history and concepts; she/he possesses the conceptual tools suitable for the development of independent, but above all interdisciplinary research; she/he has good interpersonal skills, the ability to work in a team in a fruitful manner, and the interest in expounding her/his own point of view.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Environmental and climate migrations? A critique of definitions. A political ecology of migrations**

**Reference Person:** Avallone Gennaro (gavallone@unisa.it)

**Host University/Institute:** Università degli studi di salerno / dipartimento di studi politici e sociali

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**Research Keywords:** environmental migration  
political ecology  
socio-ecological changes

**Reference ERCs:** SH7\_2 Migration  
SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 13: Climate Action

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

The proposed research delves into the emerging definitions proposed by international agencies for environmental migration and climate migration, which have gained significance in the last two decades amidst the global acceleration and intensification of the effects of climate change and human mobility.

International migration data shows a steady rise in the absolute number of people moving from one country to another for various reasons. Within this movement, the number of people recognized by international agencies as refugees, asylum seekers, stateless persons, or internally displaced persons has steadily increased in the last two decades, with a significant acceleration since 2011.

The proposed research has three main objectives. The first one is to reconstruct the international debate on these definitions. The second aim is to understand if these definitions are sufficient to understand the current migrations related to environmental changes from the point of view of the political ecology, who traditionally focuses on the structural forces underlying ecological degradation. The third aim is to understand if a political ecology of migrations approach, based on a politicization of the issue of migration within socio-environmental changes, is useful to better understand the relationships between climate and environmental changes and human mobility and migration.

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### **Research team and environment**



The project proposer, Gennaro Avallone, is a member of the international network Agromig, which comprises researchers working on sustainable agriculture and migrant labor in agriculture. He is also a member of the inter-university center "Politics, Ontology, Ecology", which coordinates researchers focused on political ecology. Furthermore, Gennaro Avallone has translated the works of Jason W. Moore, the leading proponent of the world-ecology approach, into Italian and benefits from a close association with the international Network of World-Ecology researchers, who primarily study the links between climate change and socio-political change.

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

Some suggested skills for a candidate working on the proposed research project are the following: Knowledge of political ecology theory and concepts, including critical analysis of the relationships between power, society, and the environment; knowledge of migration studies, including an understanding of the different theoretical approaches to migration, and familiarity with current debates and policies related to migration; ability to conduct field research and engage with different communities, including marginalized populations affected by environmental degradation and climate change. The knowledge of English is sufficient to conduct the proposed research.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Psycho/neurolinguistic approaches to the use of language in climate change communication**

**Reference Person:** Bambini Valentina (valentina.bambini@iusspavia.it)

**Host University/Institute:** Scuola Univeritaria Superiore IUSS Pavia / Classe di Scienze Umane e della Vita

**Research Keywords:** communication

language

metaphor

**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 4: Good Quality Education, GOAL 11: Sustainable Cities and Communities

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

The research will revolve around the relationship between language, communication and the comprehension of issues related to climate change and sustainability. Topics will encompass key linguistic patterns characterizing climate change communication, with a special focus on metaphor and other pragmatic uses of language. Methodologies will include psycho/neurolinguistic investigations to disentangle the processing costs and benefits associated to the targeted expressions, as well as computational approaches aiming at building a figurative archive including the characterization of items along multiple dimensions. Theoretically, the project will ground in pragmatics, as well as in theories of situated and multimodal cognition.

### **Research team and environment**

Laboratory of Neurolinguistics and Experimental Pragmatics (NEP) at IUSS, 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, equipped with EEG facilities. The team includes the PI, postdoctoral fellows and other PhD students, in an interdisciplinary and lively research environment.

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



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Knowledge of linguistics and pragmatics and as-native knowledge of Italian are requested. Previous experience in psycho/neurolinguistics and/or computational linguistics investigations is a plus.

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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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:** Università Cattolica del Sacro Cuore / Dipartimento di Sociologia

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**Research Keywords:** Institutions  
Interdisciplinarity  
European Green Deal

**Reference ERCs:** SH2\_1 Political systems, governance  
SH7\_6 Environmental and climate change, societal impact and policy  
SH7\_5 Sustainability sciences, environment and resources

**Reference SDGs:** GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

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### **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.

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### **Research team and environment**

Università Cattolica (UCSC) is one the largest non-state universities in Europe, with 98 courses, 147 post-graduate masters, and 17 doctoral schools. UCSC pursues multidisciplinary and interdisciplinary approaches to scientific research, in particular aiming at a synthesis between the responsible use of methodologies of empirical sciences and speculative



knowledge. The research team for the PhD program includes political scientists, sociologists, economists, and research methodologists. Part of the research team is affiliated to ASA, a postgraduate school that UCSC created 13 years ago to gather competencies on the environment existing in different faculties and departments.

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

Skills required: 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**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **The Dieselgate Returns - Liability of Corporations for environmentally unsustainable behaviors**

**Reference Person:** Bertelli Francesca (francesca.bertelli@unitelmasapienza.it)

**Host University/Institute:** Unitelma Sapienza / Dipartimento di scienze giuridiche ed economiche

**Research Keywords:** Dieselgate emission scandal  
Sustainable development  
Green Transition and Private Law

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

**Reference SDGs:** GOAL 11: Sustainable Cities and Communities, GOAL 12: Responsible Consumption and Production, GOAL 17: Partnerships to Achieve the Goal

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

The answers given by the European Court of Justice in cases C-145/20 and C-873/19 are groundbreaking considering their impact on consumer law. Indeed, the decisions bring together two areas of law traditionally kept apart, coordinating private law and technical regulations concerning polluting emissions in the light of the need to ensure both consumer and environmental protection. The approach suggests an evolutive interpretation of national law, capable of collecting contemporary regulatory trends and to give implementation to the principle of sustainable development. Therefore, it is necessary to investigate how and to what extent national law can ensure the access to justice and effective remedies in case of violation of environmental laws by corporations and to clarify the terms of their liability to stakeholders.

### **Research team and environment**

The research team will be composed by Gaetano Edoardo Napoli (full professor) and Francesca Bertelli (researcher). The different areas of expertise and the different knowledges of the research team will ensure the smooth implementation of project activities, which will be carried out considering the team members' longstanding experience





both in traditional private law and in modern issues connecting private law and sustainability. The research team will also share international contacts with other colleagues and foreign university, to foster a comparative/international approach to tackle a globally relevant topic such as the liability of corporations for violations of environmental laws.

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**Suggested skills for this research topic**

- Legal background
  - Attitude for research
  - Expertise in Private Law
  - Fluent English
  - Good knowledge of German would be preferred
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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Citizens, Sustainability and Voting**

**Reference Person:** Conti Nicolò (nicolo.conti@unitelmasapienza.it)

**Host University/Institute:** Università degli Studi di Roma Unitelma Sapienza / Dipartimento di Scienze Giuridiche ed Economiche

**Research Keywords:** Politicisation of sustainability  
Demand and supply on sustainability  
Issue voting

**Reference ERCs:** SH2\_1 Political systems, governance  
SH3\_5 Attitudes and beliefs  
SH3\_6 Social influence; power and group behaviour

**Reference SDGs:** GOAL 16: Peace and Justice Strong Institutions

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

In this project, we aim to study how public attitudes affect voting behaviour. More specifically, our analysis systematically sets out to investigate the following questions: Does a link exist between parties and their voters regarding sustainability? Do sustainability issues play a significant role in the voting preferences of citizens in the elections?

First, this is done by analysing if citizens' votes for a given party increase when they are positioned closer to each other on issues pertaining to sustainability. Second, we are interested in understanding if the salience parties assign to sustainability issues moderates the effects of the positional distance on voting. Third, we compare the relative impact of sustainability issues on voting to other issue divides. Fourth, we break-down the analysis on sustainability into different dimensions (i.e. economic viability, environmental protection, social equity) and assess their individual effects on voting. Fifth, we examine how citizens perceive the role of the EU in managing some of the major challenges to sustainability, and the conditions under which they would be ready to support greater EU integration especially in those areas more subject to the authority of the member states.

The analysis is conducted on the EU27 countries and makes use of a mix of large-scale data from various sources, including individual-level and party-level data.

### **Research team and environment**

This project can rely on the supervision of a full professor of Political Science (Nicolò Conti) and of an assistant professor of Political Science (Luca Carrieri) established at the host institution (Unitelma Sapienza University) who are very experienced in research on public



opinion, parties and political behaviour. This will not only guarantee specialised supervision, it will also allow socialisation of the Phd candidate to the relevant international research networks.

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

The candidate will need to have a basic understanding of probability and inferential statistics for the social sciences and should be ready to work with heterogeneous data and various modelling techniques (appropriate training will be provided). No other language than English is required.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **International Standards and Remedies as Indirect Instruments for Climate Change and Green Transition Challenges**

**Reference Person:** Napoletano Nicola (nicola.napoletano@unitelmasapienza.it)

**Host University/Institute:** Università degli Studi di Roma "Unitelma Sapienza" /  
Dipartimento di Scienze Giuridiche ed Economiche

**Research Keywords:** Climate Change and Green Transition  
International Remedies and Access to Justice  
Green Conditionalities and Sustainable Taxonomies

**Reference ERCs:** SH7\_6 Environmental and climate change, societal impact and policy  
SH2\_4 Legal studies, constitutions, human rights, comparative law  
SH2\_3 Conflict resolution, war, peace building, international law

**Reference SDGs:** GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions, GOAL 17: Partnerships to Achieve the Goal

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

The international action on climate change and the green transition has been mostly focused on the establishment of standards and medium- and long-term targets in international treaties. On the contrary, much less has been done regarding the financial means to achieve climate and environmental targets, as well as in terms of access to justice before international tribunals and monitoring bodies on these matters. The Research aims at analysing the design and implementation of two international financial tools, which can be crucial for a "green" recovery and which are largely overlooked in the current academic debate despite their huge relevance for international actors: 1) "green" conditionalities that are ever more called upon to incentivise compliance with environmental goals and to steer the use of public resources towards addressing climate concerns and contributing to the green transition; and 2) sustainable taxonomies that, with the increase of public and private investments allegedly related to "green" objectives, are essential classification schemes identifying which economic activities, assets and products qualify as "sustainable". The Research will also tackle the procedural and substantive hurdles (i.e. the absence of the right to a healthy environment, the "victim" status) hindering access to domestic and international judicial remedies in environmental matters, with special attention to the rising climate change litigation before national and international courts.

### **Research team and environment**



The RT comprises two international lawyers: Nicola Napoletano (Scientific Coordinator - Associate Professor) and Marco Fisicaro (Assitant Professor). The RT will benefit from the participation in the Jean Monnet Network (EP-JMN), of which are Partner also the Universities of Salamanca, Rome (Sapienza), Paris (Panthéon-Sorbonne), Amsterdam (VU), Konstanz and Groningen. The TM will be carried out in Laboratories, Research Centers and Groups and will investigate how and to which extent international (quasi-)judicial remedies in environmental matters, green conditionalities and sustainable taxonomies can develop into indirect instruments to enforce climate change and green transition objectives.

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

Knowledge of International and European Environmental and Human Rights Law, along with a solid expertise and knowledge of the judicial and quasi-judicial body established by Human Rights Treaties at International and Regional level. Interdisciplinary skills and motivations to create synergies with other research areas and sectors and to work in a transdisciplinary perspective that takes into account different humanities and social science approaches.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Models, methods, and indicators for the social impacts assessment of the hydrogen deployment**

**Reference Person:** Padovan Dario (dario.padovan@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Culture, politica e società

**Research Keywords:** Energy transition  
Social impact  
Hydrogen technology

**Reference ERCs:** SH3\_14 Social studies of science and technology  
SH7\_6 Environmental and climate change, societal impact and policy

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 9: Industry, Innovation and Infrastructure, GOAL 13: Climate Action

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

The project intends to investigate the social impacts of the energy transition. If not well managed and planned the energy transition might imply inequalities and conflicts between social groups and economic sectors. The change towards new modes of organizing energy implies the definition of WHAT the new system will be, HOW that transformation is carried out and WHO will be the beneficiaries or the payers of this process. The proposal focuses on "Social Impact Assessment" perspective that includes the analysing and monitoring the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) of the transition towards the large-scale deployment of renewable hydrogen and hydrogen related technologies. The project is aimed to the following objectives: 1) the identification of the main theories of socio-technical change and impact and how these are incorporated into energy transition policies; 2) Analysis of the main social implications of the deployment of renewable hydrogen within the energy transition in terms of way of life, well-being, inequalities; 3) The development of a kit of methods necessary to identify and evaluate the social impact of hydrogen related technologies deployment: Social LCA, Rational Planning, Participatory Impact Assessment; 4) An analysis of renewable energy policies – with a focus on hydrogen – of cities and regions to identify their potential social implications and impacts.

### **Research team and environment**

The PhD candidate will find an extremely innovative and creative environment in which to carry on her/his research activity. Our research environment is made by the following



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organization: Unesco Chair in Sustainable development and territory management; CENTRE FOR INTERUNIVERSITY RESEARCH ON SOCIO-ECOLOGICAL CHANGES AND SUSTAINABLE TRANSITION - CRISIS; Interuniversity School on Ecology, politics, and society; Culture of Sustainability Journal.

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

Competences required:

Quantitative and qualitative social research competences

Preliminary competences in the social aspects of energy transition

Preliminary competencies on the sociology of justice, inequalities and conflicts

Preliminary competences on the Social Impact Assessment methodologies

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Conflicts of the deep transition: theories, practices, and models for a political ecology of war.**

**Reference Person:** Padovan Dario (dario.padovan@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento "Culture, Politics and Society"

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**Research Keywords:** Socio-ecological transition

Political ecology of war

Energy and geo-capitalism

**Reference ERCs:** SH2\_3 Conflict resolution, war, peace building, international law

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

SH3\_14 Social studies of science and technology

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

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

The project intends to investigate with the tools of the social sciences the global scenarios of the deep socio-ecological transition aimed at radically contrasting climate change. If not well managed and planned the socio-ecological transition implies exacerbating inequalities, temporal and spatial asymmetries, conflicts involving social classes, states, sectors of the global economy, even overt wars. The radical change in the way of organizing and exercising production and consumption activities evoked by EU is now carried out in a polychrome confusion of transitional forms that cannot forget the global consequences that they can have. The transition must define not only WHAT the new system will be, but also HOW that transformation is carried out and WHO will be the beneficiaries or the victims of these processes. The proposal focuses on the understanding the impacts of the transition in the energy field (but not only), with a focus on conflicts and wars. Its objectives are: 1) the identification of the main theories of transition and their nexus with the changing global order of geo-capitalism; 2) the development of a kit of indicators necessary to identify and evaluate the socio-political impacts of the transition at the global level 3); the investigation of the unexpected consequences of the transition in terms of injustices, conflicts, unrests, local and global wars; 4) an analysis of global energy policies of transition and their consequences for the global order.

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### **Research team and environment**





The PhD candidate will find an extremely innovative and creative environment in which to carry on her/his research activity. Our research environment is made by the following organization: Unesco Chair in Sustainable development and territory management; CENTRE FOR INTERUNIVERSITY RESEARCH ON SOCIO-ECOLOGICAL CHANGES AND SUSTAINABLE TRANSITION - CRISIS; Interuniversity School on Ecology, politics, and society; Culture of Sustainability Journal.

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

Preliminary competences in the social aspects of ecological transition

Preliminary competencies on the sociology of justice, inequalities, conflicts, and war

Preliminary competences on the global aspects of energy transition

Quantitative and qualitative social research competences

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **The Ethics and Politics of Plant Conservation in the Anthropocene**

**Reference Person:** Pellegrino Gianfranco (gpellegrino@luiss.it)

**Host University/Institute:** Luiss - Libera Università Internazionale degli Studi Sociali Guido Carli / Dipartimento di Scienze Politiche

**Research Keywords:** Anthropocene  
Plant Ethics  
Mitigation

**Reference ERCs:** SH2\_7 Political and legal philosophy  
SH5\_10 Ethics and its applications; social philosophy  
SH7\_6 Environmental and climate change, societal impact and policy

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

### **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.

### **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 Pietro De Giovanni, whose work concerns circular economy and economic



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sustainability, 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**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Ethical, Political and Institutional Profiles of Sustainable Development and Climate Change**

**Reference Person:** Pirni Alberto (alberto.pirni@santannapisa.it)

**Host University/Institute:** Scuola Superiore Sant'Anna - Pisa / Istituto di Diritto, Politica e Sviluppo (DIRPOLIS)

**Research Keywords:** Ethics of Climate Change

National/International Actors and Climate Change

Political Theory of Climate Change

**Reference ERCs:** SH5\_10 Ethics and its applications; social philosophy

SH2\_7 Political and legal philosophy

SH2\_6 Humanitarian assistance and development

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

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

Proposed projects address ethical, political and institutional issues that fall within the thematic area of sustainable development and climate change. In particular, projects are expected to contribute to contemporary ethical and theoretical-political debates related to sustainability, environmental ethics, theories of justice (including intergenerational) and global political theories, through a critical discussion of issues such as allocation of responsibilities, potential redistribution of benefits/disadvantages, mitigation of discrimination and inequalities resulting from climate change, at supranational and global level. Also of interest are projects concerning the policy debate on human-driven global warming, the roles of governmental and non-governmental actors in shaping and implementing climate change policies, the relation between climate change and conflict, and other germane topics. Selected candidates should critically assess issues such as allocation of responsibilities, potential redistribution of benefits/disadvantages, mitigation of discrimination and inequalities resulting from climate change, at supranational and global level. Interdisciplinary research projects are encouraged, addressing issues relevant to the advancement of ethical, political and institutional knowledge and research, but capable of benefiting from and possibly contributing to other disciplines, including law.

### **Research team and environment**

The research will be carried out in the highly engaging academic environment of the Sant'Anna School of Advanced Studies and, specifically, within the Institute of Law, Politics



and Development. The Institute conducts innovative and interdisciplinary research in the fields of law, political science, moral and political philosophy, public ethics. Its manifold projects and activities on environmental-related issues, within a network gathering a number of scholars from various European and non-European universities, promote high level scientific researches in the field of climate change and sustainable development.

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**Suggested skills for this research topic**

Openness towards interdisciplinary approaches will be appreciated.

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**Source of fundings**

DM118/2023 - M4C1 - Inv. 4.1 - Patrimonio Culturale

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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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **The new trends in climate change litigation**

**Reference Person:** Pozzo Barbara (barbara.pozzo@uninsubria.it)

**Host University/Institute:** Università dell'Insubria / Dipartimento di Diritto Economia e Culture

**Research Keywords:** Climate Change  
Litigation  
Comparative Law

**Reference ERCs:** SH2\_4 Legal studies, constitutions, human rights, comparative law  
SH2\_5 International relations, global and transnational governance  
SH2\_7 Political and legal philosophy

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 5: Gender Equality, GOAL 10: Reduced Inequality, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action, GOAL 16: Peace and Justice Strong Institutions

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

In the aftermath of COP 26 in Glasgow, where lot of attention was devoted to climate change litigation, the rapid development of suits related to climate issues around the world is inducing comparative lawyers to reflect on the underlying dynamics driving this phenomenon.

Among the aspects that will be taken into consideration in the research project there will be the importance of having an international binding treaty as the Paris agreement, for the evolution of climate change liability.

Further, the research project will analyze the different paths developing in the various national contexts and in particular:

1. Human-rights based claims,
2. Tort law claims,
3. Greenwashing claims,
4. Public trust claims,
5. Claims in favor of indigenous people and vulnerable groups



Other aspects of relevant importance that might be taken into consideration concern the role of attribution science in the development of climate change litigation, as well as the role of NGOs in the spreading out of litigation patterns.

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### **Research team and environment**

At the University of Insubria there are two Research Centers devoted to study climate change related issues: the CENTER FOR STUDIES ON ENVIRONMENTAL AND TERRITORIAL POLICIES and the CLIMATE CHANGE RESEARCH CENTER (CCRC).

The Department of Law, Economics and Cultures further organizes every year an International Summer school Program on Comparative environmental law, together with the universities of Utrecht (NL), Aix-en-Provence (France) and Opole Univeristy (Poland) focusing on comparative climate change law.

The resarch team involved is also collaborating with the European Environmental Law Forum (EELF), organising seminars and workshops together, as well as with the Rivista Giuridica dell'Ambiente, one of the prominent law reviews specialized on environmental law.

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

A good background in comparative law, international law and EU law.

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Energy Communities and Local Authorities: a Meeting Point between Public and Private Law**

**Reference Person:** Ruggeri Lucia (lucia.ruggeri@unicam.it)

**Host University/Institute:** Università di Camerino / Scuola di Giurisprudenza - SAS  
(International School of Advanced Studies)

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**Research Keywords:** Energy Communities

Contractual models

Partnership Agreement

**Reference ERCs:** SH2\_4 Legal studies, constitutions, human rights, comparative law

SH2\_5 International relations, global and transnational governance

SH2\_5 International relations, global and transnational governance

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 11: Sustainable Cities and Communities, GOAL 17: Partnerships to Achieve the Goal

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

At European and International level the Energy Communities (EG) constitute the main tool to enable consumers to become prosumers. As new actors of the Energy Market the EG may provide environmental or social benefits for its members or for the local areas. At domestic level the EG are no profit organizations in line with the subsidiarity principle (art. 118, par. 2, It. Const) and the next generation and environmental protection (artt. 9, 41 It. Const.). The project will analyze 2 different models of Local Authority (LA) involvement: 1) LA as a member of the EG; 2) LA in partnership with EG. The aim is to compare the 2 models to define a set of criteria to guide the best choice of the model for the LA based on the local area situation (developed/depressed area etc.). The Partnership Agreements models constitute a meeting point between public and private law. From this perspective, the new rules inserted in the code dedicated to Public Procurement Code (31 March 2023) will be analyzed to study the insertion of "DSNH principle" in the contracts of EG, the "due diligence" duties regarding the impact on the environment, the new kind of social responsibility in the public and private sector. A specific result of the project will be the drafting of contractual clauses to be inserted in the EC contracts models or Partnership Agreements to enforce the protection of





the most vulnerable citizens fostering the inclusion of all marginalized social groups in the EC objectives.

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### **Research team and environment**

The Phd Student will be inserted in a research group composed by 6 Phd Students and 1 RTDA who are developing studies on Energy Communities and in a international team composed by the Escop4Green researchers (40, from 8 nationalities- <https://escop4green.unicam.it>). He/She will enjoy a multisectorial environment thanks to collaborations with several research centers and stakeholder (e.G. ENSIEL, Federconsumatori). At international level the Phd Student can follow activities in several universities skilled in Energy and Social issues e.g. Toyo University (Tokyo). The internship is planned at Consorzio Interuniversitario Nazionale Energia e Sistemi Elettrici, Cassino (FR).

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

The following skills are useful to develop successfully the PHD Programme:

- attitude to work in team
  - English language knowledge: at least level B2
  - Italian language knowledge at least level B2
  - legal and in addition economic educational background is suitable, but not mandatory
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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **The Ecological Humanities and Ecocriticism across the Global North and the Global South**

**Reference Person:** Spinozzi Paola (szp@unife.it)

**Host University/Institute:** Università degli Studi di Ferrara / Dipartimento di Studi Umanistici

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**Research Keywords:** Ecological Humanities  
Ecocriticism  
Inter- and transculturality

**Reference ERCs:** SH5\_2 Theory and history of literature, comparative literature  
SH5\_8 Cultural studies, cultural identities and memories, cultural heritage  
SH6\_11 Global history, transnational history, comparative history, entangled histories

**Reference SDGs:** GOAL 10: Reduced Inequality, GOAL 11: Sustainable Cities and Communities, GOAL 16: Peace and Justice Strong Institutions

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

Scholars of anglophone literatures and cultures should be ready to encourage critiques of the hegemony they have enjoyed among the humanities and acknowledge a gradual relativization of their corpus and critical frameworks. Ecocritical and decolonial approaches have gained momentum (Vazquez et al. 2019; Rigby 2021; Cook and Denney 2022). However, it would be dishonest to stress the importance of decolonizing the critical gaze only because it is our expected scholarly duty to do so. A way of avoiding the proliferation of formulaic, rhetorical pleas for decolonial ecocriticism is offered by epistemologies of the South (de Sousa Santos 2014), because they provide critical perspectives that do not create a new centrality, a risk decolonial studies make themselves vulnerable to. Indigenous perspectives on planet Earth are not exclusive to countries that have experienced colonization, while those countries need to retrieve and foster the interconnectedness with the environment they had developed before being colonised. Decolonial studies and epistemologies of the South show familiarities and differences in the focus they lay on capitalism, colonialism, and patriarchy. How can epistemologies of the South reappraise the relationships, that pre-existed colonization, between the indigenous and the ecological? How can an anglophone lens contribute to discourses of the environment that must necessarily incorporate an awareness of other-than-anglophone and other-than-western perspectives?

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### **Research team and environment**



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

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

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

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU4 - Theories, Institutions and Cultures*

## **Understanding sustainable development between institutional arrangements and market regulation. A comparative law perspective.**

**Reference Person:** Velliscig Lydia (lydia.velliscig@iusspavia.it)

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

**Research Keywords:** Comparative Law

Economic Analysis of Law

Law and policy of risk management and financing

**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

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

Mitigating climate change and supporting sustainable development are a common commitment and priority. In this context, the development of initiatives aimed at identifying effective public-private partnerships for elaborating innovative forms of protection against climate change-related risks appears to be critical for financing sustainable development. Strengthening the legal, regulatory and institutional environment is an effective way for public institutions to mobilize public resources and encourage capital market development. More generally, a cooperation between public and private sectors enables better align private incentives with public goals and creates a policy framework that encourages market development in these areas. The candidate will critically examine, from the perspective of comparative law and economics, legal and institutional responses implemented in different legal systems to manage and govern risks that arise from climate change and that must be addressed in view of sustainable development. Particular attention will be reserved to how risks are regulated, to liability and incentive mechanisms, to the identification of risk financing strategies based on insurance, reinsurance and other financing tools, including capital market instruments, also in order to identify critical points and possible areas of improvement.



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### **Research team and environment**

Research activities at IUSS are carried out with a highly innovative and multidisciplinary approach and the candidate will have the opportunity to join a stimulating academic environment. Specifically, the candidate will join the Legal Science Research Group, which focuses its activities on examining, from a comparative law and economics standpoint, the main legal, economic, institutional and policy profiles relating to the management of large-scale risks and emerging risks both at national and international level.

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

Legal background (Law Degree), preferably a good background in comparative law; openness to transdisciplinary research; intellectual curiosity; team-working skills.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU5 - Agriculture and Forestry*

## **Holistic strategies to contrast climate change impact in maize value chain**

**Reference Person:** Battilani Paola (paola.battilani@unicatt.it)

**Host University/Institute:** Università Cattolica del Sacro Cuore / Dipartimento di Scienze delle Produzioni Vegetali Sostenibili - DIPROVES

**Research Keywords:** Mycotoxins contamination in maize

Genetic and biological control

Food safety

**Reference ERCs:** LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

LS9\_9 Plant pathology and pest resistance

PE6\_11 Machine learning, statistical data processing and applications using signal processing (e.g. speech, image, video)

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 3: Good Health and Well-being, GOAL 13: Climate Action

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

Maize is a very versatile crop, growing in all sorts of edaphic, altitudinal and fertility conditions, which explains its global adaptability and many types of varieties. This crop has become the most important raw material for animal feed and for several industrial processes.

The impact of climate change (CC) has been identified as an emerging issue for food and feed safety and many changing patterns in mycotoxin contamination in maize due to CC were identified as a potential emerging hazard. Maize hosts several mycotoxin producing fungi with *Aspergillus flavus* and *Fusarium verticillioides* as the most relevant species and aflatoxins and fumonisins as crucial toxins.

The research project will investigate new methods to prevent the contamination in the field. New sustainable technologies will be developed to monitor toxigenic fungi, analyze and prevent the mycotoxin contamination risk. Research efforts will consider the impact of CC with focus on: (i) the identification of accurate techniques for phenotyping ear rot and mycotoxin contamination and the identification of novel host germplasm sources and resistance traits for marker-assisted selection programs, (ii) the application of biological control agents to reduce/compete with the toxigenic fungi, (iii) the improvement of predictive models for mycotoxin contamination during the growing season, (iv) machine learning application to optimize the support from all data available in mycotoxin mitigation.



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### **Research team and environment**

The Department of Sustainable Crop Production is to find sustainable solution to support crop value chains. The team involved in this project has expertise in plant-pathogen interaction, focus on mycotoxin producing fungi, predictive modelling, biocontrol, breeding for resistance, mainly in maize (molecular biology, molecular markers and QTL analysis). The research team includes P. Battilani and M. Camardo Leggieri Plant Pathologist, A. Marocco and A. Lanubile Plant Genetists. Significant infrastructures are the laboratories of plant pathology and genetics fully equipped, the experimental farm "Cezoo" of 50 ha, greenhouses and growth chambers.

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

Applicants will need to have a MSc in a field related to genetics and plant pathology and a strong aptitude for programming and data analysis. Applicants will need proof of written and spoken English language competence.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU5 – Agriculture and Forestry*

## **State and regional legislative power on agroenergy in light of the fight against the climate crisis**

**Reference Person:** Di Salvatore Enzo (edisalvatore@unite.it)

**Host University/Institute:** Università degli Studi di Teramo / Dipartimento di Giurisprudenza

**Research Keywords:** Agroenergy  
Agricultural energy  
Climate Change

**Reference ERCs:** SH2\_1 Political systems, governance  
SH2\_4 Legal studies, constitutions, human rights, comparative law  
SH1\_15 Public economics; political economics; law and economics

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 9: Industry, Innovation and Infrastructure, GOAL 13: Climate Action

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

As pointed out by FAO, energy, agriculture and the climate crisis are strictly linked. Agricultural food systems currently massively rely on fossil fuels to operate. The increasing use of fossil energy in agriculture leads to increasing greenhouse gas (GHG) emissions from the agricultural sector, which in turn has an impact on agricultural production. One of the ways to overcome the mentioned problems is to increase the use of renewable energy in agriculture, including sustainable bioenergy from agri-food systems. The regulation of agroenergy in light of the fight against the climate crisis intersects crucial fields: 1) agriculture; 2) energy; 3) protection of the environment, which are entrusted to different levels of government (agriculture: regional exclusive competence, art. 117.4 Constitution / energy: State-regions shared competence, art. 117.3 Constitution / protection of the environment: central State competence, art. 117.2 Constitution). In light of the above, the objective of this research project is to understand and clarify who (central State, Regions or both) has the right to adopt legislation aimed at promoting the production and use of renewable energy in agriculture and how this competence should be exercised as a way of contributing to climate change mitigation.

### **Research team and environment**





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The research team is made up of 3 researchers: 1 Associate professor in Constitutional and Environmental Law, 1 Research Fellow in Constitutional Law with special expertise in Agroenergy, 1 PhD candidate in Economic and Social Sciences, with expertise in Constitutional Law and protection of marine environment

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**Suggested skills for this research topic**

Ability to work in team

Strong legal background, with a focus on Constitutional and Environmental Law

Good command of Italian and English. Good command of other languages is a plus.

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at EURAC Research

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*Curriculum: CU5 - Agriculture and Forestry*

## **Modeling for climate change adaptation**

**Reference Person:** Donatella Spano Donatella Spano (spano@uniss.it)

**Host University/Institute:** Università degli Studi di Sassari / Dipartimento di Agraria

**Research Keywords:** adaptation  
ecosystem management  
management model

**Reference ERCs:** LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

**Reference SDGs:** GOAL 13: Climate Action, GOAL 15: Life on Land

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

Estimate the resilience of natural ecosystems to climate change, predicting their future changes in different possible future paths, and identify adaptation strategies. Models of management scenarios and best practices, as well as different interactions with territories, will also be developed to support the integration of climate change adaptation concepts into landscape programming and planning.

### **Research team and environment**

The team has experience in monitoring and modeling ecosystems processes and plant status, climate change impacts and risks, adaptation and mitigation strategies for sustainable land management, landscape planning and actions to preserve, maintain and valorize ecosystems biodiversity and resilience. The team coordinator, Donatella Spano is specialized in biometeorology. Dr. Marras and Dr. Sirca (agrometeorologists and ecophysiologicalists) will be pivotal for monitoring and studying biodiversity, assessing ecosystem services, and identifying adaptation strategies for improving ecosystems resilience.

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

Some knowledge of agricultural and forest ecosystems, use of IT tools for monitoring and adaptation models

### **Source of fundings**

Host University's fundings

### **Period of research abroad**

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



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### **Internship**

For this scholarship it is not planned a period of intership

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*Curriculum: CU5 - Agriculture and Forestry*

## **Climate adaptation and environmental sustainability of tropical fruit crops in Mediterranean area.**

**Reference Person:** Farina Vittorio (vittorio.farina@unipa.it)

**Host University/Institute:** Università degli Studi di Palermo / Dipartimento di Scienze Agrarie, Alimentari e Forestali (SAAF)

**Research Keywords:** Tropical plants phenology and climate changing

Fruit yield and quality

Sustainable farming

**Reference ERCs:** LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

LS8\_14 Ecophysiology, from organisms to ecosystems

LS8\_10 Ecology and evolution of species interactions

**Reference SDGs:** GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

Climate change is modifying the way we farm and produce food. The rise in global temperatures has led to an increase in the number of plant species that can be cultivated in areas with a Mediterranean climate, with the introduction of tropical species, such as Mango, Papaya and Avocado. The fruits of these species are among the most demanded by European consumers, but European production is not enough to meet the request. The supply chain related to the shipping of these products from producing countries in other continents is responsible for an increasing impact on the environment, in terms of resources consumption, carbon emissions and social and political issues in the producing areas. The PhD idea is based on the possibility of improving production chains of tropical fruit in the Mediterranean ensuring high environmental sustainability by 1) applying innovative cultivation management models, based on the elaboration and application of phenoclimatic models and on sensory-based agroclimatic surveys in the field (precision farming); 2) to reduce food waste identifying the best time to harvest the produce (tree ripe) using complex maturity indexes; 3) developing intelligent logistics and eco-friendly packaging systems and technologies capable of guaranteeing a 'zero km' product with low environmental impact and high added value also in terms of human nutrition and diet.

### **Research team and environment**



The research team consists of a principal investigator, who will act as a tutor to the PhD student, two PhD who will supervise the research and eld activities, and a PhD student who has experience in tropical crops. The working area consists of 10 farms where experimental elds and a network of weather stations are located to measure environmental variables. Laboratory activities can be carried out in the Department's pomology, ecophysiology, food chemistry and post-harvest units. The programme can be enriched by the numerous collaborations with research organisations and Italian and foreign universities with which the research team has active partnerships and student exchanges.

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

The ideal candidate has a good knowledge of the subject of horticulture and the best agronomic practices necessary to improve fruit yield while preserving the environment and agro-biodiversity. S/he is interested in the impact of agriculture on the territories and the communities that make a living out of it. Fundamental skills that will be needed in the research activity are knowledge of research protocols and experimental designs, experience in the collection of vegetative activity and fruit quality data. International experience and knowledge of foreign languages are a plus.

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU5 – Agriculture and Forestry*

## **Combining crop models and seasonal forecasts for a climate-resilient farming system**

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|-----------------------------------|--|
| <b>Reference Person:</b>          | Ferrise Roberto (roberto.ferrise@unifi.it)   |
| <b>Host University/Institute:</b> | Università degli Studi di Firenze / Scienze e Tecnologie Agrarie, Alimentari, Ambientali e Forestali |
| <b>Research Keywords:</b>         | Climate smart agriculture<br>Precision farming<br>Climate change adaptation                          |
| <b>Reference ERCs:</b>            | LS9_8 Applied plant sciences, plant breeding, agroecology and soil biology                           |
| <b>Reference SDGs:</b>            | GOAL 2: Zero Hunger, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action        |

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

Crop growth and development are impacted by weather, which is a main contributor to year-to-year variability in crop yield. Farmers minimize the economic risk of yield variability through empirical knowledge of seasonal trends and their land, but this limits their ability to take advantage of favorable weather conditions. Accurate and reliable methods for in-season estimation of crop yield are important for agri-food decision-makers and farmers to maximize yield, reduce losses, and limit the environmental impact of agriculture. Crop simulation models (CSMs) coupled with seasonal climate forecasts (SCFs) are gaining interest for in-season yield estimates, especially in areas with strong climate signals like the United States, Africa, and Australia. However, SCFs are less reliable in Mediterranean environments due to the complex interplay between orography, atmospheric variability, and large-scale climatic phenomena.

This proposal aims to explore the potential of coupling SCFs and CSMs for in-season crop yield estimates in Mediterranean environments to develop a tool for timely crop input resource management. This will aid in designing climate-resilient farming systems and promoting sustainable agro-ecological practices, including precision agriculture and smart irrigation, in the context of the green and digital “twin” transition.

### **Research team and environment**

The research team is involved in projects to study the impact of climate change on agro-ecosystems and develop adaptation and mitigation strategies. Their expertise is on innovative tools and approaches, such as crop models, climate projections, weather generators, GIS, and remote sensing, to monitor and predict agro-system responses to



environment. The department provides the PhD student with access to databases, equipped laboratories, and technical support needed for research activities. Additionally, the student can benefit from a network of collaborations, which offers opportunities to engage with international scholars and experts to improve their knowledge and skills.

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

The ideal candidate should be highly organized, capable of working independently and in a team environment, and possess interpersonal and written communication skills. Additionally, they should have a good command of English, above-average interest in academic studies, and an analytical mind. A doctoral program requires a research-oriented approach, and the candidate should enjoy exploring a subject in-depth, differentiating between primary and secondary issues, and connecting data and insights as they pursue their research. Moreover, the candidate should have basics of plant ecophysiology, and crop modelling.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU5 – Agriculture and Forestry*

## **Forest ecosystem services under climate change**

**Reference Person:** Freppaz Michele (michele.freppaz@unito.it)

**Host University/Institute:** Università di Torino / Dipartimento di Scienze Agrarie, Forestali e Alimentari

**Research Keywords:** Forest ecosystems  
Sustainable forest management  
Soil degradation

**Reference ERCs:** LS9\_11 Biomass production and utilisation, biofuels  
PE10\_12 Sedimentology, soil science, palaeontology, earth evolution  
PE10\_4 Terrestrial ecology, land cover change

**Reference SDGs:** GOAL 13: Climate Action, GOAL 15: Life on Land

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

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

The PhD candidate will investigate both the influence of climate variability on forest ecosystem functioning (e.g. soil nutrient cycling, tree reproduction, mortality, soil properties and threats) and adaptation to climate change by sustainable forest management practices (e.g. economically viable silvicultural systems which prevent or mitigate drought, fire and storm impacts). The research will deepen how climate, disturbances, land-use changes and competition influence long-term forest demography and interact to control change in forests, and will develop and test innovative forest management strategies to adapt to changing disturbance regimes and maintain key ecosystem services in mountain forests (e.g. protection from rock-falls, avalanches, and water erosion; carbon sink; sustainable wood production).

### **Research team and environment**

The DISAFA is a leading academic institution that undertakes strategic research at the forefront in agricultural, forest and food systems. The campus includes cutting-edge research labs and greenhouses equipped with advanced instruments for the analysis of





complex and structured matrices for specific topics (e.g. dendrochronology, physiology and plant genetics, plant pathology, soil biogeochemistry, wood technology, economy). A network of experimental farms and forests, and field research sites, complement campus facilities. The DISAFA research environment attracts leading international scientists and collaborations with EU and global research institutes.

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

Candidates should preferentially have the following skills:

- brightness with a good dose of common sense for teamwork in a research group
  - passion and intellectual curiosity for natural ecosystem dynamics and processes
  - ability in organizing and planning the work and meeting deadlines
  - writing and language skills and the ability to express and organize ideas in English
  - data analysis with tools for statistical computing and graphics (e.g. R)
  - have strong work ethics, discipline, focus, efficiency and professionalism
  - being ambitious, show leadership qualities and being not afraid to take responsibility
  - perseverance and commitment
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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU5 – Agriculture and Forestry*

## **Impacts of climate change and its uncertainty on agriculture**

**Reference Person:** Monteleone Beatrice (beatrice.monteleone@iusspavia.it)

**Host University/Institute:** Scuola Univeritaria Superiore IUSS Pavia / Classe di Scienze Umane e della Vita

**Research Keywords:** Climate change uncertainties  
Impact models  
High resolution climate models

**Reference ERCs:** PE10\_3 Climatology and climate change  
PE1\_19 Scientific computing and data processing  
PE10\_21 Earth system modelling and interactions

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

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

As highlighted by the UN development goals and the European Climate Law, climate change is a reality to which society needs to adapt. The possibility to address the adaptation issue lies on our ability to include climate change into impact studies.

Until recently, climate modellers did not have the capability to generate long-term projections at a spatial and temporal resolution useful for impact studies as risk assessment for agriculture. The advent of kilometer-scale atmospheric models (convection-permitting models, CPMs), with a spatial resolution closer to what modellers in the field of agriculture need, enables those impact studies.

Climate model ensembles are used to evaluate the uncertainties related with the climate change signal. An open question remains on how climate change uncertainties will propagate into impact models such as the ones used to estimate the effects of climate on agriculture. When using climate model as input, the weight of climate projection uncertainties affects the output of the impact model.

This research aims to investigate the impact of using high-resolution climate model into models applied to estimate agricultural productivity to learn how to deal with uncertainties to provide examples of good practice, storylines and a clear message to stakeholders and policymakers. The study will rely on climate data accessible from the EU Copernicus project (the global ERA-5 reanalysis, CPM data created under the CORDEX Flagship Pilot Study).

### **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 and he/she 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.

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

The ideal candidate will have experience with impact assessment models, statistical analysis, large climate dataset. Specific skills in the field of climate science will be considered a plus. Moreover, the candidate should be strongly motivated to work in a multi-disciplinary environment, collaborating with the STEM and social scientists of the CARISMA research centre and beyond.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU5 – Agriculture and Forestry*

## **Hyperspectral detection of plant diseases to support global food security and safety**

**Reference Person:** Nali Cristina (cristina.nali@unipi.it)

**Host University/Institute:** Università di Pisa / Dipartimento di Scienze Agrarie, Alimentari e Agro-ambientali

**Research Keywords:** Plant Pathology  
Vegetation spectroscopy  
Machine learning

**Reference ERCs:** LS9\_9 Plant pathology and pest resistance  
LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology  
PE10\_14 Earth observations from space/remote sensing

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 3: Good Health and Well-being, GOAL 13: Climate Action

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

Ensuring a food-secure/safe future dictates changes in agriculture to cope with numerous plant diseases. Understanding how to achieve greater crop yield and quality, with minimized environmental footprint, requires advancements in high-throughput techniques to early and accurately detect and monitor the effects of plant diseases, as well as the effectiveness of plant protection strategies. Vegetation spectroscopy has emerged as a promising tool, being a non-destructive, rapid, and relatively low-cost technique to monitor vegetation status, but plant disease spectroscopy has remained underdeveloped. The research aims to (1) design and develop a protocol to extensively acquire hyperspectral data collected from leaf to UAV to space levels, both in field and controlled conditions, to create a huge hyperspectral plant disease dataset; (2) massively develop vegetation spectral indices sensitive to plant diseases, hyperspectral models to rapidly and non-destructively assess plant traits commonly investigated because affected by plant diseases, and hyperspectral classifications of plant diseases; and (3) design and develop a cloud-based open source hyperspectral library associated with plant diseases and metadata to be shared with the scientific community.

### **Research team and environment**

The Plant Pathology group of the Department of Agriculture, Food and Environment of the University of Pisa led by Prof. Cristina Nali, also includes an Associate Professor, a



Researcher, four PhD students, and six technicians. Major research interests of the group 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 Plant Pathology approaches and background in plants are 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**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU5 - Agriculture and Forestry*

## **Central Italy Emmer wheat types: healthy foods from sustainable agriculture**

**Reference Person:** Sacchetti Giampiero (gsacchetti@unite.it)

**Host University/Institute:** Università degli Studi di Teramo / Bioscienze e Tecnologie Agro-Alimentari e Ambientali

**Research Keywords:** Biodiversity preservation

Sustainable agriculture

Food quality

**Reference ERCs:** LS9\_5 Food biotechnology and bioengineering

LS8\_2 Biodiversity

LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

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

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

Emmer (*Triticum turgidum* subsp. *dicoccum*) is a cereal grown in mountainous and marginal areas of central and southern Italy with low environmental impact because it is a rustic species that adapts to cold climates, soils with low fertility and limited water availability.

Emmer is a product that meets health and naturalness requirements (low environmental impact) but has poor technological performance due to a low, and low quality, gluten content, which compromises the dough making ability of the flours and severely limits their use.

The project implies the investigation of the qualitative properties and the technological functionality of native glassy emmer ecotypes of central Italy for the development of food products with peculiar sensory and functional characteristics. In particular, the rheological characteristics of the doughs will be evaluated in relation to the pasta-making and bread-making processes and the quality of the final products. Quality will be evaluated through instrumental and sensory analysis and finally the products will be analysed for their content in bioactive compounds, their digestibility and their glycemic and insulin index.

### **Research team and environment**

The research team in Food Technology is composed by 6 Professors, two Researchers, one Technician, one Post-doc and 6 PhD students.



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The labs are part of the Department of Bioscience and Technology for Food, Agriculture and Environment of the University of Teramo (Teramo, Italy) and are composed by Food Chemistry and Preparation, Food processing, Food Physics, and Sensory analysis labs.

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**Suggested skills for this research topic**

Food Science and Technology knowledge

Agricultural Science knowledge

Basic ICT knowledge

Chemical laboratory practice

Sensory lab practice

Spreadsheet management

Statistical analysis skills

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU5 – Agriculture and Forestry*

## **Management of dairy farm sustainability**

**Reference Person:** Atzori Alberto (asatzori@uniss.it)

**Host University/Institute:** Università di Sassari / Dipartimento di Agraria

**Research Keywords:** feeding economics,  
indicators  
nutrient use efficiency

**Reference ERCs:** LS9\_10 Veterinary and applied animal sciences  
SH1\_10 Management; strategy; organisational behaviour  
PE1\_20 Control theory, optimisation and operational research

**Reference SDGs:** GOAL 1: No Poverty, GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action

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

The management of dairy farms requires a multidisciplinary competence that integrates animal science background and skills that belong to economic or engineering domains. The standards of sustainability and technical-economic efficiency required of companies to achieve adequate levels of profitability are increasingly high. Dairy farm management have high responsibilities to reduce environmental impact of dairy production systems. High opportunities for dairy management has been emerging especially if farm data are used to predict animal requirements and farm performances over time in order to support farmer decisions.

The research topic will focus on the use of farm available data (nutrition, milking , dynamics and reproduction softwares, meteo, etc) to study the main areas of farm management especially focusing on feed efficiency and economic efficiency. The main output of the research will advance dairy farm models to increase the awareness of farmers and improve farm management in terms of sustainable and resilient productions.

The Ph.D. Is designed to foster multidisciplinary interaction of biological and livestock expertise, physics for thermoregulation modeling and data analysis, economics, and mechanical and management engineering for optimization of farm production processes and climate change adaptation impact assessment.

### **Research team and environment**





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The research team will involve one associate professor of animal nutrition and management, two postdoc specialized in modeling, 2 PhD in animal science, collaboration with economists and engineers

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**Suggested skills for this research topic**

Aptitude to model and work with spreadsheet and data management, background in animal science ruminant preferred, aptitude to work with economics and management.

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU5 - Agriculture and Forestry*

## **Exploring new ways of monitoring good agricultural practices also with the support of EO products**

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

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

**Research Keywords:** Copernicus  
Common Agricultural Policy  
Space Economy

**Reference ERCs:** PE10\_14 Earth observations from space/remote sensing  
LS9\_5 Agriculture related to crop production, soil biology and cultivation, applied plant biology  
LS9\_7 Forestry, biomass production

**Reference SDGs:** GOAL 9: Industry, Innovation and Infrastructure, GOAL 15: Life on Land

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

Air quality issue is increasing attention from institutions and citizens. In 2022, the European Commission presented its proposal to revise Directive 2008/50/EC on ambient air quality and cleaner air for Europe. This new version, in line with the World Health Organisation, will contribute to achieve the environmental and climate objectives set out in the 2030 Agenda, as reducing the levels of atmospheric pollutants. The agricultural sector contributes 94% of total national ammonia emissions to the atmosphere (IIR 2018, ISPRA). Ammonia is a precursor to PM2.5 and PM10, with consequent harmful implications for both human health and aspects of everyday life.

The PhD should investigate the limitations and shortcomings of monitoring in terms of assessing the efficacy of adopted agricultural practices and progress from an environmental perspective also in relation to EEA objectives. To reach this goal the PhD should explore the choice of agricultural practices and their impact on ammonia emissions, especially in the soil fertilisation phase. The outcomes will include the feasibility of a model for continuous, reliable and systematic observation, tracking and evaluation of agricultural activities for the PNRR implementation. The PhD will explore the application of EO products in a complementary way with existing in situ data concerning the classification of different types of crops and tracking their phenological status.



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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 in the fields of Science, Technology, Engineering and Mathematics (STEM), and Human, Social and Life Sciences. At IUSS, PhD candidates will find an open multidisciplinary environment offering real opportunities for developing academic and professional tools for facing the challenges arising from increasing complexity and fast changes in the society and the environment. IUSS is always and actively committed towards internationalisation, inclusion and diversity. The selected candidate will join the research centre on Climate change impAct studies for RiSk Management (CARISMA). The CARISMA team is composed by STEM and Social scientists working in the prism of climate change on data analysis including Copenricus and modelling of Earth System and economic system processes; impact assessment of extreme natural events and anthropogenic activities on human and natural environments; risk assessment and management of natural and anthropogenic hazards; formulation and proposal of new economic, political and legal models of sustainable development. The research activity will be carried out in collaboration with the Space Unit and Data Unit of the Italian Institute for Environmental Protection and Research (ISPRA) and may include stays at the ISPRA Research Centre (Rome).

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

- Knowledge of artificial intelligence approaches (fuzzy logic, Bayesian systems) applied to determine the response of ecosystems both agriculture and forestry to climate change;
- Experience in the implementation of integrated decision support systems for the innovative tool in forestry and agriculltre domain;
- Experience in using the European Earth Observation Program (Copernicus).

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### **Source of fundings**

DM118/2023 - 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**

For this scholarhip it is mandatory a period of Min 6 months - Max 12 months at European Environment Agency - EEA - Copenhagen



*Curriculum: CU5 - Agriculture and Forestry*

## **A polyamine metabolism-based strategy to improve stress tolerance of crops**

**Reference Person:** Tavladoraki Paraskevi (paraskevi.tavladoraki@uniroma3.it)

**Host University/Institute:** Università Roma Tre / Dipartimento di Scienze

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**Research Keywords:** Crops with Improved stress tolerance

Polyamine metabolism

Crops with improved yield and nutritional value

**Reference ERCs:** LS8\_5 Biological aspects of environmental change, including climate change

LS9\_2 Applied genetics, gene editing and transgenic organisms

LS1\_9 Molecular mechanisms of signalling processes

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 13: Climate Action, GOAL 15: Life on Land

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

This project aims to investigate the contribution of polyamines (PAs) and their metabolism to plant stress responses and to assess whether genetic manipulation of PA metabolism may provide crops with improved stress tolerance, yield and nutritional value.

The project is based on experimental evidence from Arabidopsis and tomato plants, which highlighted the important role of PAs in plant growth and stress responses. Arabidopsis polyamine oxidase 5 (AtPAO5), which is involved in PA catabolism, interferes with PA homeostasis, plant development, and stress defence mechanisms. In tomato, three AtPAO5 homologs are present (SlPAO2, SlPAO3, SlPAO4) and preliminary data indicate that slpao3 mutants, obtained through the innovative Genome Editing technology, exhibit improved tolerance to water stress compared to parental lines.

The project proposes to:

- Characterize tomato plants with altered expression levels of genes involved in PA metabolism, such as mutants for PA catabolic (e.g., SlPAO2, SlPAO3 and SlPAO4) and biosynthetic genes, for growth, yield and nutritional value under normal and environmental stress conditions.

- Screen a number of important, traditional and modern, Italian tomato varieties and identify those with optimal PA levels for high stress tolerance, yield and nutritional value.

- Develop new formulations of PA-based bio-fertilizers.



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This study will provide genetic resources and molecular tools to breeders and plant growers for crop improvement.

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### **Research team and environment**

The research team of the Laboratory of Plant Biotechnology of University 'Roma Tre' coordinated by Paraskevi Tavladoraki takes part of the integrated Laboratory of Plant Physiology, Biochemistry and Biotechnology which involves a Full Professor, two Associate Professors, two Researchers and two Doctorate students. The Laboratory of Plant Biotechnology is well equipped with a plant growth chamber, microscopy and facilities for tissue culture, molecular analyses and physiological studies. Furthermore, this laboratory has a strong expertise in polyamine metabolism, plant developmental, hormone signalling and defence mechanisms, and techniques of genetic engineering and plant transformation.

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

Experimental and theoretical skills in gene expression studies, in basic molecular biology and biochemistry techniques, and in plant morphological, histological, anatomical and metabolic analyses.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU5 - Agriculture and Forestry*

## **Study of mass and energy exchanges between ecosystems and the atmosphere in the Alpine region**

**Reference Person:** Vendrame Nadia (nadia.vendrame@unitn.it)

**Host University/Institute:** Università di Trento / Centro Agricoltura Alimenti Ambiente (C3A)

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**Research Keywords:** Vegetation-atmosphere interactions

Ecosystem carbon and water budget

Eddy covariance method

**Reference ERCs:** LS8\_5 Biological aspects of environmental change, including climate change

PE10\_2 Meteorology, atmospheric physics and dynamics

LS8\_14 Ecophysiology, from organisms to ecosystems

**Reference SDGs:** GOAL 2: Zero Hunger, GOAL 13: Climate Action, GOAL 15: Life on Land

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

The Earth surface is continuously exchanging mass and energy with the lower atmosphere, influencing its characteristics. Vegetation, in particular, plays a fundamental role in global biogeochemical cycles, actively exchanging carbon (photosynthesis and respiration) and water (evapotranspiration) with the surrounding atmosphere. Indeed, vegetated ecosystems, are estimated to uptake every year about 30% of anthropogenic CO<sub>2</sub> emissions, but the role played by different ecosystems and their response to a changing climate are still unclear. In this context, the long-term monitoring of fluxes at the field scale, applying the eddy covariance (EC) method, is essential to increase the understanding of plant-atmosphere interactions. The PhD candidate will be involved in the management and operation of an EC station located in an agricultural area (vineyards) in the Adige Valley, which was deployed in the framework of the Euregio project INTERFACE. She/he will analyze data collected at this and other EC sites, to assess the carbon and water budgets of ecosystems in the Alpine area of Trentino-South Tyrol, studying the variability between sites and the dependence on meteorological drivers, but also addressing issues related to the application of EC in complex terrain. Results will be useful to quantify the role of agricultural and forest ecosystems in the global carbon budget and increase the efficiency of water management in agriculture in a changing climate.

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### **Research team and environment**



The PhD student will be part of the Atmospheric Physics Group of the University of Trento. Research interests are mainly on the dynamics of the atmosphere and climate over mountainous regions, including the use of numerical weather prediction models and atmospheric measurement systems, and the analysis of collected data. The results of research are applied in various fields (e.g. air quality, evaluation of renewable energy resources, support to agriculture). The candidate will be enrolled at the Center Agriculture, Food, Environment (C3A), that conducts teaching and research activities in the areas of agriculture, food products and the environment, including climate change impacts on these.

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

The candidate should be interested in understanding the biophysical processes at the base of ecosystem functioning in relation to environmental drivers, including turbulent transport of mass and energy in the lower atmosphere. The study of plant-atmosphere interactions is a multidisciplinary topic, so the background of the candidate could be either in atmospheric, environmental, agricultural, or forest science. Good knowledge of either plant physiology, micrometeorology, or agrometeorology is desirable, as well as basic skills in the analysis of large datasets with a programming language (e.g. R, Python).

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at Agenzia Provinciale per la Protezione dell'Ambiente (APPA)

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*Curriculum: CU6 - Health and Ecosystems*

## **Identification of preclinical candidates for the treatment of waterborne parasites**

**Reference Person:** Angelucci Francesco (francesco.angelucci@univaq.it)

**Host University/Institute:** Università degli studi dell'Aquila / Dipartimento di Medicina Clinica, Sanità pubblica, Scienze della vita e dell'ambiente

**Research Keywords:** waterborne pathogens  
infectious diseases  
structure-based drug discovery

**Reference ERCs:** LS1\_8 Structural biology  
LS1\_13 Early translational research and drug design  
LS1\_2 Biochemistry

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 6: Clean Water and Sanitation, GOAL 10: Reduced Inequality

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

Waterborne schistosome parasites are spreading in Africa and China and recently are appearing also in Europe. Rising water temperatures and altered precipitation associated with climate changes can considerably alter the distribution and abundance of the parasite intermediate host, a snail, resulting in a shift in disease dynamics and transmission to people, as already observed in Corsica (FR) where several tourists were infected by the parasite in 2014. Schistosomes infect 200 million people, resulting in significant morbidity and more than 200,000 deaths annually. Female genital schistosomiasis is a common complication of *S. haematobium* infections, occurring in approximately half of infected females, roughly 40 million girls and women, making it one of the most common gynecologic conditions in Africa. Schistosomiasis control strategies rely almost exclusively on praziquantel, administered to 40 millions people every year, with no new drugs in the clinical pipeline. We identified a highly promising drug target: the worm selenocysteine-containing enzyme thioredoxin glutathione reductase (TGR). We established that TGR is a central and essential mediator of antioxidant defenses in the worm. Our studies have elucidated an inhibitory mechanism that is completely novel for this family of proteins. We hypothesize that it will be possible to optimize our novel TGR inhibitors for potency for TGR inhibition for the development of novel schistosomicidal therapeutics.

### **Research team and environment**





At present there are 1 assistant professor, one technician, 1 Ph.D student and 3 master students, which assure a young and active scientific environment in the lab.

The group of Prof. Angelucci 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**

Suggested skills:

- heterologous expression of protein and their purification
- biocrystallography
- enzymology
- protein-ligand binding

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Genomic and transcriptomic response to environmental changes in aquatic animal species**

**Reference Person:** Biscotti Maria Assunta (m.a.biscotti@univpm.it)

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

**Research Keywords:** Mobilome  
Adaptation to climate changes  
Biodiversity conservation

**Reference ERCs:** LS8\_5 Biological aspects of environmental change, including climate change  
LS8\_3 Conservation biology  
LS2\_5 Genomics

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

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

Environments are changing rapidly and organisms must adapt to new climatic conditions that affect their biology both at individual, population, and species scale. Understanding how organisms cope with global change stressors is central to characterize and predict the effect of climate change on natural populations on a short-term timeline. It is generally accepted that the adaptation to environmental changes has a polygenic basis. In this view, transposable elements (TEs) are among the best candidates to generate genetic and epigenetic variability that allows responding to stressful environmental changes. TEs represent a significant fraction of eukaryotic genomes referred to as "mobilome". Although the exact function of TEs is still largely unknown, they are environment-sensitive molecular elements whose activity can be triggered by numerous environmental stressors (as climate changes, toxicants, and pests). TEs can cause chromosome rearrangements, increase mutation rates, or influence the expression of nearby genes, triggering the rapid adaptation of organisms to new conditions. The aim of this research proposal is to evaluate the genomic and transcriptomic response through molecular and bioinformatics approaches in aquatic animal species to environmental changes and investigate the role of TEs in species adaptation. The findings will be useful to improve management strategies.

### **Research team and environment**

The project will be carried out at the Department of Life and Environmental Sciences of the Polytechnic University of Marche (DISVA). DISVA includes interdisciplinary laboratories such



as molecular phylogenetics, biological physics, cell and molecular biology, genetics, biochemistry, chemistry, microbiology, physiology, reproductive biology, marine ecotoxicology, and oceanography. <http://www.disva.univpm.it/> The DISVA offers the possibility to use the Actea Mobile Laboratory to sampling activities and hosts the "Aquarium" Laboratory representing a unique infrastructure at National level.

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

Candidates are expected to have a background in genomics and transcriptomics with particular focus on molecular adaptation to environmental changes. Preferred skills reflect the ability to process biological samples using modern molecular biology techniques, genetics, and bioinformatics.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU6 - Health and Ecosystems*

## **Neuro-organoids and assembloids for a sustainable and personalized medicine**

**Reference Person:** Boido Marina (marina.boido@unito.it)

**Host University/Institute:** Università degli Studi di Torino / Dipartimento di Neuroscienze "Rita Levi Montalcini"

**Research Keywords:** Precision medicine for neurodegenerative diseases

3D cell cultures

Biological twin

**Reference ERCs:** LS5\_11 Neurological and neurodegenerative disorders

LS5\_18 Innovative methods and tools for neuroscience

LS7\_2 Medical technologies and tools (including genetic tools and biomarkers) for prevention, diagnosis, monitoring and treatment of diseases

**Reference SDGs:** GOAL 3: Good Health and Well-being

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

Neurodegenerative diseases (from Alzheimer to neuromuscular diseases) affect millions of people worldwide and in the majority of cases do not yet have a cure. Therefore, the research in the field must be boosted. Two-dimensional (2D) cultured cell lines have been the main in vitro research tool for the past decades, but in the era of "personalized medicine" they are poorly attractive. Instead, iPSC-derived 3D cultured organoids are a powerful research tool to preserve genetic, phenotypic and behavioral traits of in vivo organs from patients.

This project will aim at developing neuro-organoids and assembloids i) to understand developmental deficits in case of disease, ii) to preliminarily and efficiently screen drugs in the perspective of an increasingly effective precision medicine, and/or iii) to identify by histological and molecular analyses early cellular changes and alterations, that could represent valid and predictive biomarkers.

The project will not only contribute to the SDG 3 (Good health and well-being), but will also help in reducing the use of experimental animals by promoting stem cell-derived cell cultures that can be used in their place, making the research important for sustainable development.

### **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, Neuroscience or Biomedical Engineering.

The ideal candidate should be skilled in the fields of cellular and molecular biology. Technical competences should include cell cultures, immunocytochemistry, 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**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU6 - Health and Ecosystems*

## **Neuro-cognitive evidence on the assessment and treatment of climate change anxiety**

**Reference Person:** Canessa Nicola (nicola.canessa@iusspavia.it)

**Host University/Institute:** Scuola Univeritaria Superiore IUSS Pavia / Classe di Scienze Umane e della Vita

**Research Keywords:** Climate change anxiety  
Treatment for climate change anxiety  
Neuro-cognitive metrics of treatment efficacy

**Reference ERCs:** SH4\_3 Clinical and health psychology  
LS7\_11 Environmental health, occupational medicine  
LS5\_8 Neural basis of behaviour

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

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

While media attention is focused on the direct effects of climate change, there is growing concern about its indirect consequences on mental health, even in individuals not directly affected by weather-related events. The awareness of the projected impact of climate change is known to elicit negative emotional reactions (ranging from common reactions to abnormal events up to chronic conditions such as post-traumatic stress disorder), well summarized by the notion of "climate change anxiety". Such concerns, alongside those generated by other recent dramatic events, reinforce a feeling of "permacrisis" that reflects a dramatic increase in the prevalence of mental health disorders worldwide, leading to a substantial economic burden on the healthcare system. This project aims to investigate the neural bases of climate change anxiety, and to assess the effect of "exposure" protocols for cognitive-behavioral treatments using clinical and neural measures.

### **Research team and environment**

This project is promoted by a multi-disciplinary team providing complementary and integrated skills in cognitive neuroscience and cognitive-behavioral therapy, in collaboration with the Climate Change Anxiety association.

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

- Degree in Psychology, Medicine or related disciplines
- Previous experience in neuropsychological or clinical psychological assessments



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- Previous experience in collection and/or analysis of EEG data and/or neurophysiological measures

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU6 - Health and Ecosystems*

## **Sustainable integrated nanostructured analytical platforms for on-site analysis and bioresearch**

**Reference Person:** Compagnone Dario (dcompagnone@unite.it)

**Host University/Institute:** Università degli Studi di Teramo / Dipartimento di Bioscienze e Tecnologie Agro-Alimentari e Ambientali

**Research Keywords:** Sustainable substrates and nanomaterials  
Low-cost (bio)analytical device manufacturing  
(bio)sensing and cell sensing

**Reference ERCs:** PE4\_5 Analytical chemistry  
PE4\_9 Method development in chemistry  
LS7\_2 Medical technologies and tools (including genetic tools and biomarkers) for prevention, diagnosis, monitoring and treatment of diseases

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 9: Industry, Innovation and Infrastructure, GOAL 12: Responsible Consumption and Production

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

Recently, the demand for sustainable analytical (bio)devices dramatically increased; notably, electrochemical sensors equipped with functional nanomaterials (NMs) offer the possibility to produce miniaturized and portable analytical tools, suitable for on-site analysis/diagnostics and bioresearch applied to emerging health issues.

In this project, flexible recycled plastics and cellulosic substrates will be used for (bio)analytical device development. Emerging low-environmental impact benchtop technologies for the development of lab-made integrated (bio)devices as xurography, wax-printing, laser-molding, thermal-assembling, and stencil-printing will be employed. To improve the performance and ensure communication with the biological elements, green-produced/derived NMs will be produced (i) via water-phase sonochemical exfoliation assisted by naturally-derived dispersant agents and (ii) using laser photo-thermal (LPT) solvent-free production strategies. Graphene, 2D-heterostructures, and biochar from industrial waste will be investigated. Using benchtop technologies, the more appropriate NMs will be integrated in all-in-one devices (lab-on-strip/paper) and sensors array. The nano-platforms will be employed for the determination of molecules of bio-functional interest and assessing the metabolic status of cell populations; the nanoplatforms ability to induce different metabolic pathways/differentiation in stem cells will be also investigated.





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### **Research team and environment**

UNITE Analytical Chemistry Team is composed of 3 professors, 3 researchers, 2 postdocs, 7 PhD students, and 1 lab technician (seven are women). The group has a renowned experience in nanomaterials and (bio)sensors and was evaluated second at the national level by ANVUR (VQR 2015-2019) in the analytical chemistry field (CHIM/01). The group has 3 labs equipped with benchtop and portable potentiostats, LC-MS/MS, spectrophotometers/ELISA plate readers, probe sonicator (600W), refrigerated centrifuges, craft-cutting and CO2 laser-plotter, wax-printer, presses, automatic thermal rollers, stations for manufacturing of microdevices, equipment to handle biological matrices, cells, and stem cells.

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

The PhD candidate can be a biotechnologist, a chemist, a material scientist, or a graduate in equivalent technical and scientific subjects. He/she should have a fundamental knowledge of sensors, biosensors, analytical chemistry, biology, and spectroscopical and or electrochemical fundamentals. Have skills in good laboratory practice and the ability to use basic computer programs. He/she should have a propensity for teamwork, and the willingness to get involved for explore new analytical techniques and challenging applications.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **ASTRA - Antimicrobial solutions for extraterrestrial human explorations**

**Reference Person:** Esposito Maria Antonietta (mariaantonietta.esposito@unifi.it)

**Host University/Institute:** Università degli Studi di Firenze / Architettura

**Research Keywords:** Space Exploration  
Human extraterrestrial settlements  
Antimicrobial solutions

**Reference ERCs:** PE8\_1 Aerospace engineering  
PE8\_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics  
PE11\_2 Engineering of metals and alloys

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

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

Extra-terrestrial space exploration is a set of strategic activities for the future boosting the technological progress and the transition of economic systems. The ongoing PNPR is targeted to empower systems of observation and to prepare the exploration of extra-terrestrial space habitats (SH). The research of the PE 15 will take part within the team of the: WP3 Mission concepts and architectures for sustainable human exploration of the solar system; Task 3.1 Design tools for SH. T3.1 will deal with the development of methods, tools and processes to support the design of future human-tended SH. Milestones: M3.1: Parametric design robust methods definition based on validated processes by the adopted technologies (e.g. distributed ledger). Task T3.1 Design tools for SH; WP4 Design of infrastructures for implementation and operations of sustainable exploration architecture; Task 4.3 Design of space infrastructures for the human exploration. T4.2 will investigate the design of crew stations (e.g., Moon, Mars), habitation means (e.g., Moon, Mars) and novel logistic modules (e.g., storage hangars, power generation). Milestones: M4.3: Digital modeling of project design concepts for extraterrestrial spaceports and sustainable settlements based as much as possible on available extraterrestrial resources; Project design concepts options generation and performances' parametric simulation; Project design details of specific human centered solutions.

### **Research team and environment**



The research team is led by the hub based at the Department of Mechanical and Aerospace Engineering Politecnico di Torino with University of Florence and other universities and research institutions of primary relevance within the space interdisciplinary associated with research the Italian Space Industry cutting edge Companies. The research environment is widely multidisciplinary one offers an excellence training for and ambitious competitive researchers. The project must end in 2026.

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

Engineering and architecture skills coupled with wish to go beyond the disciplinary boundaries may be the basis to start and successfully compete a challenging scholarly research in space activities. Computational skills will also be very welcome to model the complex problems to be solved within the research gap. Collaborative soft skills and curiosity are also expected by the candidate with international languages ability (French and German as first and also East and Far East ones will be very welcome).

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of internship

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*Curriculum: CU6 - Health and Ecosystems*

## **Conserving the evolutionary potential of endemic species under global changes**

**Reference Person:** Ficetola Gentile Francesco (raoul.manenti@unimi.it)

**Host University/Institute:** Università degli Studi di Milano / Scienze e Politiche ambientali

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**Research Keywords:** biodiversity  
climate change  
molecular ecology

**Reference ERCs:** LS8\_2 Biodiversity  
LS8\_1 Ecosystem and community ecology, macroecology

**Reference SDGs:** GOAL 13: Climate Action, GOAL 14: Life Below Water, GOAL 15: Life on Land

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

Italy is among the European countries with the largest number of endemic species. Endemic amphibians and stenoendemic cave invertebrates will be used as models, because of their vulnerability to climatic and habitat changes, and because they are particularly suitable for both modelling and genetic analyses.

The aims of the project are:

- 1) measuring genetic diversity in representative amphibian and endemic subterranean invertebrate species using genetic markers covering the whole genome (e.g. rad-SEQ).
- 2) linking genetic variation with present-day environmental variation (e.g. along climatic gradients). This allows to identify local adaptations that are expected to better persist under climate change scenarios.
- 3) integrating information on intra-specific variation with species distribution models (SDM). Integrating information on intra-specific diversity into SDM will improve our understanding and prediction of the impact of environmental changes on biodiversity. The improved models will consider the role of genetic diversity on species tolerance, and will also take into account the possibility of evolutionary adaptations of populations.

This project will produce unprecedented information on the response of endemic species to fast environmental changes.

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### **Research team and environment**



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The teams involves multiple qualified scientists from researcher with strong zoological and managerial background to postdoc researchers with strong expertise in molecular sciences and modelling

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**Suggested skills for this research topic**

The candidate should possess a background on evolutionary and ecological thematic and a general knowledge of molecular sciences basis. A certain knowledge of amphibian biology and on subterranean biology could be useful, but it is not mandatory. English language is recommended

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**Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Climate Change 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

**Research Keywords:** Permafrost degradation

GHG Emission

Ground disturbance

**Reference ERCs:** PE10\_18 Cryosphere, dynamics of snow and ice cover, sea ice, permafrosts and ice sheets

PE10\_13 Physical geography, geomorphology

PE10\_4 Terrestrial ecology, land cover change

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

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

The research will be focused on the impacts of the climate change on permafrost environments and the related ecosystems in polar areas and alpine mountains. Here 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 could be developed in Alaska where Insubria has a base and in the Italian Alps. This comparison will be important because both the areas are suffering the more intense warming in the planet. The research fits with the PNR 2021-27 within the general topic of Climate, Energy and Sustainable Mobility and more in particular with the frame of 5.5.2 Climate Change, Mitigation and Adaptation. In detail the research here proposed can contribute to several subtopics ("articolazioni") like: 5.5.2.1 because the research will try to investigate potential sources of GHG like CO<sub>2</sub> or CH<sub>4</sub> from degrading permafrost and 5.5.2.2 because it will contribute to the monitoring and to the understanding of the relationships between Climate and Earth System. Moreover the research can contribute also to the 5.5.2.4 because the analysis of the risks related to the permafrost degradation especially in the alpine environment or in the coastal polar environment can contribute to the improvement of the modelling of the future scenarios of impacts on the infrastructure and on the populations and economy at local scale.

### **Research team and environment**



This PhD will be part of Climate Change Research Center of Insubria University where it will be possible work in a multidisciplinary team iwithin the CRyosphere Lab (Pl. M. Guglielmin) with a Researcher (S. Ponti, expert in remote sensing), one Post Doc (A. Longhi, expert in soils) and twp PhD S. Picone (expert in debris flows and permafrost hydrology) and V. Chaturvedy. (expert of CH<sub>4</sub> emissions modelling and remote sensing). This group interacts with the Botany and Climate Change Lab (Resp. N. Cannone) where other experts of vegetation and terrestrial ecology of alpine and polar areas are working. The team interacts with the University of Alaska and other international institutions.

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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. Basic knowledge on geophysics is also welcome. The candidates should be ready to work in a dynamic, international context with an important field work activity in polar and alpine environment.

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Monitoring of the T-related infections by Photobacterium damsela piscicida in farmed sea bass**

**Reference Person:** Iaria Carmelo (ciaria@unime.it)

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

**Research Keywords:** Infectious diseases

Global warming

Fish

**Reference ERCs:** LS9\_10 Veterinary and applied animal sciences

LS8\_13 Marine biology and ecology

LS6\_6 Infectious diseases

**Reference SDGs:** GOAL 12: Responsible Consumption and Production, GOAL 13: Climate Action, GOAL 14: Life Below Water

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

#### **SCOPE AND RESEARCH QUESTION**

Considering the continuous increase in temperature caused by climate change, the main scope of this research is monitoring and checking the incidence and the pathogenesis of Photobacteriosis (Photobacterium damsela subsp. piscicida) especially during the summer. The PhD student will study the differences of impact and progression of the pathology between vaccinated and non-vaccinated farms. In this way, the PhD student will also study the efficacy of vaccination to prevent this pathology. The characteristics of the farming systems, the water parameters and general immunological status of the fish, as well as the follow up of infections will also be evaluated.

#### **METHODOLOGY**

During the sampling on field, from the beginning of the symptoms, some estimates on mortality rate and histological analysis on different target organs, such as liver, spleen, kidney and heart, to detect the typical lesion will be made. Also immunohistochemical (IHC) and molecular analyses (PCR) that are really useful to understand and to confirm the death cause, will be performed.

#### **EXPECTED RESULTS AND IMPACTS**

The main expected result is to know how the global warming can affect the management of fish farms and all those prophylactic measures to be applied to prevent possible outbreaks of





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common and new unusual disease. Moreover the differences in the pathogenesis of infection related to the high temperature will be also clarified.

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### **Research team and environment**

The Research team of Veterinary and Comparative Pathology of UNIME runs the Institute for Experimental, Comparative, Forensic and Aquatic Pathology, a facility for experimental aquatic in vivo models kept in recirculating aquaculture systems (RAS), performing histological, immunohistochemical and molecular analysis for diagnosis in aquaculture and experimental research.

Our role in the project is the evaluation of the epidemiological effects of *Photobacterium damsela* subsp. *piscicida* in aquaculture farms following the global warming.

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

Biological basis of diseases and disorders of aquatic organisms, theoretical and practical experience in marine biology and aquaculture research and particularly in fish pathology. Good knowledge of Italian and English languages.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Green and blu infrastructures and impacts on soil health and human health**

**Reference Person:** Marmiroli Nelson (nelson.marmiroli@unipr.it)

**Host University/Institute:** Università degli Studi di Parma / Dip. Scienze Chimiche, della Vita e della Sostenibilità Ambientale

**Research Keywords:** Ecosystem services from blue-green infrastructures

**Reference ERCs:** LS9\_7 Environmental biotechnology and bioengineering  
LS9\_8 Applied plant sciences, plant breeding, agroecology and soil biology

**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 aims to promote the use of green and blue infrastructure through a series of actions that support the development of easily accessible green and blue areas as multifunctional spaces that aid sociality and community cohesion. Central to these actions is the development of a participatory knowledge of all stakeholders to promote the good use of these areas and fully understand their benefits for mental and physical well-being, with special emphasis on the most vulnerable population groups such as the elderly and children.

Special attention will be given to promoting the proper management of urban green to prevent the loss of biodiversity, possible introduction of alien species, overproduction of pollen. One objective will be the integration of available information on the presence, characteristics and main ecosystem services provided by green and blue spaces.

- Mapping regulations and policies on green and blue spaces
- Mapping available evidence on the relationship between green and blue areas and health
- Acquisition and consultation of available information on the presence of green and blue spaces in Italian urban areas
- Construction of an atlas of plant species and their characteristics useful for a multifunctionality of green and blue spaces
- Evaluation of the contribution of green and blue spaces in mitigation and adaptation to climate changes, and in promotion of health and wellness particularly for vulnerable citizens

### **Research team and environment**



The research team has an international reputation in the field of sustainable agriculture and application of environmental biotechnologies, with extended reputation for innovation for phytoremediation, and circular economy.

Fully furnished laboratories will be available in the University of Parma. The labs share plant growth facilities (incubators, greenhouse) and microscopy facilities, atomic adsorption spectrometer, and essential laboratory equipment, shaking incubators, conventional PCR machines, quantitative PCR cyclers, UV/VIS spectrophotometer, laminar-flow cabinets, autoclaves. The Interdepartment Centers also provide access to Environmental Scanning Electron Microscopes (ESEM).

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

Knowledge of English

Expertise in laboratory work - biology, biotechnology, chemistry or similar field

Interest in environmental applications of biotechnologies

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Element speciation in a changing environment**

**Reference Person:** Monticelli Damiano (damiano.monticelli@uninsubria.it)

**Host University/Institute:** Università degli Studi dell'Insubria / Dipartimento di Scienza e Alta Tecnologia

**Research Keywords:** Trace element speciation analysis

Global biogeochemical cycles and global change

High throughput analytical methods

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

PE4\_18 Environment chemistry

PE10\_9 Biogeochemistry, biogeochemical cycles, environmental chemistry

**Reference SDGs:** GOAL 4: Good Quality Education, GOAL 6: Clean Water and Sanitation, GOAL 14: Life Below Water

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

Understanding the effects of climatic stressors on element biogeochemical cycles is a challenging task as the increase of atmospheric CO<sub>2</sub> and its consequences modify element cycling with possible far fetching outcomes. Nevertheless, minor attention was given to the effects on the speciation of the elements, which determines their behavior in the environment (mobility, phase transfer, etc.) and their interaction with biota (bioavailability, biomagnification of pollutants, etc.). As an example, methylmercury, the most toxic form of mercury, may be increasingly produced due to several factors (permafrost thawing and rising temperatures) and accumulated at a higher rate in marine and freshwater biota, possibly increasing the health risk associated to seafood consumption. The picture may be even more complicated for elements inducing positive or negative climate feedback: iron supply limits primary productivity in oceanic waters, but may induce phytoplankton growth, CO<sub>2</sub> sequestration and negative feedback only if it is present in a bioavailable form. The quality and the number of observations constrain at present our understanding of the links between element speciation and the changing environment: the present research aims at providing the scientific community with reliable and high throughput analytical methods to determine element species in environmental matrices. Connection to PNR: area 5.6.5, articolazione 1; connection to PNRR: misura M2C4, ambito di intervento 4.

### **Research team and environment**



The research team lead by prof. Monticelli includes postdoc fellows, PhD students and undergraduate students. It achieved a great expertise in speciation techniques and the related clean procedures. Experimental activities are supported by clean laboratories equipped with electrochemical and mass spectrometry facilities, including an ICPMS and a high-resolution mass spectrometer. The research team is a part of the analytical chemistry group at the University of Insubria. Cooperations include the Climate Change Research Center (CCRC, prof. M. Guglielmin), the Water Ecology and Ecotoxicology Lab (prof. R. Bettinetti) and the research group of prof. K. Buck at the Oregon State University, US.

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

The successful candidate is a highly motivated student with a strong background in analytical chemistry. Previous experience in the field of trace element speciation analysis is strongly suggested. Knowledge of biogeochemical cycles and their interaction with climate stressors will be positively valued. The candidate is expected to work in a multidisciplinary and international research including seconding in international institutions.

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### **Source of fundings**

Host University's fundings

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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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Bioproducts 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:** Ecosystems protection  
Bioactive compounds  
environment decontamination

**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**

Bioproducts from natural resources implies environmental exploitation that leads to loss of biodiversity, food insecurity and climate changes (10.1016/j.jenvman.2017.12.048). Natural resources exploitation can be avoided by finding alternative sources of bioproducts.

Marine organisms living in extreme environments have capacity in biosynthesizing novel bioactive compounds, which are potentially useful for pharmaceutical, cosmeceutical, and biotechnological applications (doi: 10.3390/md18120657).

The goal of this PhD project is to obtain sustainable bioproducts from bacteria. New Antarctic bacterial strains are available in the laboratory of the Reference person. Some metabolic features of these Antarctic microorganisms are already known:

- these bacteria can be used in bioremediation (granted patent n. PCT/EP2020/071193).
- these bacteria can produce siderophores, biosurfactants (granted patent n. PCT/EP2020/071193) and biocellulose from waste (patents PCT/EP2021/086747 and PCT/EP2021/086800).

The PhD candidate will work on: 1- characterization of the enzymes involved in bioproduct synthesis; 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 recycle of food waste.



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### **Research team and environment**

Sandra Pucciarelli is a Senior researcher (with habilitation) in the field of environmental adaptation, molecular biology and biotechnology.

The team is composed by young researchers with skills in microbiology and bioinformatics.

The research group can also rely on international collaborators: Prof Pietro Liò (University of Cambridge) and prof. Ilidio Correia (Universidade da Beira Interior).

The research group is operating at the School of Bioscience and Veterinary Medicine of the University of Camerino (UNICAM). The University has a strong commitment to doctoral training and internationalization.

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

Basic skills in microbiology, molecular biology, biotechnology, and biochemistry.

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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*Curriculum: CU6 - Health and Ecosystems*

## **The relationship between the exposome, the socioeconomical context and health**

**Reference Person:** Richiardi Lorenzo (lorenzo.richiardi@unito.it)

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

**Research Keywords:** Environmental exposures

Socioeconomical factors

Life-course epidemiology

**Reference ERCs:** LS7\_9 Public health and epidemiology

LS7\_11 Environmental health, occupational medicine

**Reference SDGs:** GOAL 3: Good Health and Well-being, GOAL 10: Reduced Inequality, GOAL 11: Sustainable Cities and Communities

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

It is acknowledged that climate change and environmental exposures threaten human health. However, not all human beings are equally exposed, and some groups, typically the socially and economically disadvantaged ones, experience much higher risks. The overall aim of the project is to explore environmental justice and its relationship with health impact in highly anthropized areas of high income countries using a life-course perspective. Exposures will be assessed prospectively and repeatedly over time starting from the first 1000 days of life. Information on health outcomes, including cardiometabolic and respiratory health, and neurocognitive development will be available from registries, questionnaires and/or biological samples. They will be studied as single or joint outcomes. The project will draw on a network of Italian birth cohorts collaborating to a project funded by the Italian Ministry of Health under a call on Health, Environment, Biodiversity and Climate. Collaborations with international cohorts are foreseen.

Methodological aspects will involve geospatial methods for exposure assessment, statistical methods to deal with multiple environmental exposures data, social epidemiology concepts, and causal inference approaches to explore pathways linking social and physical environment to health outcomes. Lastly, the project will evaluate the impact of different policies and mitigation strategies entailing both health and environmental benefits.

### **Research team and environment**

The research team includes a multidisciplinary group working on environmental, life-course, molecular and cancer epidemiology and includes, epidemiologists, biostatisticians, and





molecular biologists. The team collaborates with a national network of birth cohort researchers and is member of the Italian Network for Environmental Health. It has access to birth cohorts, including NINFEA ([www.progettoninfea.it](http://www.progettoninfea.it)) and Piccolipiu ([www.piccolipiu.it](http://www.piccolipiu.it)). It is based at the Department of Medical Science, University of Turin, that is a large multi-disciplinary department with research interests that span from basic biological research through clinical application, encompassing 16 medical disciplines.

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

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

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Microplastics and climate change: potential threat to human health**

**Reference Person:** Savoca Serena (ssavoca@unime.it)

**Host University/Institute:** Università degli Studi di Messina / Dipartimento di Scienze Biomediche, Odontoiatriche e delle Immagini Morfologiche e Funzionali

**Research Keywords:** Microplastics  
Climate changes  
Ecosystem service

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

### **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



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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**

DM118/2023 - 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**

For this scholarship it is not planned a period of intership

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*Curriculum: CU6 - Health and Ecosystems*

## **Enzyme-based bio-devices for CO<sub>2</sub> conversion to chemicals and biofuels**

**Reference Person:** Valetti Francesca (francesca.valetti@unito.it)

**Host University/Institute:** Università di Torino / Dipartimento di Scienze della Vita e Biologia dei Sistemi

**Research Keywords:** Biocatalysts,  
CO<sub>2</sub> bioconversion,  
Bio-hybrid and photo-activated devices

**Reference ERCs:** LS1\_2 Biochemistry  
LS9\_7 Environmental biotechnology and bioengineering  
LS1\_7 Molecular biophysics, biomechanics, bioenergetics

**Reference SDGs:** GOAL 7: Affordable and Clean Energy, GOAL 9: Industry, Innovation and Infrastructure, GOAL 13: Climate Action

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

The research aims to exploit biocatalysts such as bacterial enzymes (hydrogenase and formate dehydrogenase) for GHG effect mitigation via CO<sub>2</sub> conversion to chemicals and biofuels. In this perspective it is in line with the curriculum-specific topic concerning the identification and evaluation of possible bio-based climate change adaptation and mitigation strategies, focusing on biotechnological approaches for GHG abatement and recycling.

The biocatalysts will be directly interfaced with photo-activated semiconductors such as titanium and zinc oxides and will be used to develop bio-cathodes that allow the production of bio-hydrogen and the conversion of CO<sub>2</sub> to formate by exploiting electrons carried by the semiconductor.

The system works either coupled to an anode capable of generating electrons or via direct solar photo-activation. The coupling of hydrogenase to TiO<sub>2</sub> has already been demonstrated and published by our research group. The advantage of using enzymes is a very low over-potential compared to inorganic catalysts as well as high turnover frequency and mild operating conditions.

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



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### **Research team and environment**

The DBIOS biochemistry group, led by prof. Gianfranco Gilardi (<https://www.Biochemistry-scienze.Unito.It/>), is providing expertise in enzyme-based and microbial biocatalysts and industrial biotechnology processes. The research has a strong drive to exploitation for industrial competitiveness and improving society. Facilities: molecular biology and protein expression (2 x10 L fermenters, shakers) and purification (Akta and LC chromatography), 2D electrophoresis, HPLC, gas-chromatography, UV-vis and fluorescence spectroscopy, circular dichroism, 3 glove-boxes, diode array stopped flow, electrochemistry, Grazing angle FT-IR, contact angle, GPC-UV.

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

Background in biochemistry, chemistry, material sciences and an interest in the interdisciplinary field of combining inorganic and photo-active or electro-active material with proteins. The candidate should be prepared to be challenged with learning different techniques spanning from biology to chemistry and technological application.

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

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### **Source of fundings**

DM118/2023 - 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**

For this scholarship it is mandatory a period of Min 6 months - Max 12 months at an institution that will be determined during the course of the doctorate

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# PhD SDC

SUSTAINABLE DEVELOPMENT  
AND CLIMATE CHANGE

## CONTATTI



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