Ca' Foscari
University
of Venice

PROFESSIONAL MASTER'S PROGRAMME (2ND LEVEL) IN SCIENCE AND MANAGEMENT OF CLIMATE CHANGE

SIXTH EDITION

A.A. 2023-2024

Presentation

Climate change is one of the main challenges posing major risks to the society at large, as well as to business and industries. According to the World Economic Forum, the failure to implement effective mitigation and adaptation policies is one of the top-five economic risks for the business world.

The Master of Research in Science and Management of Climate Change is a 1-year programme aimed at preparing professional leaders capable of managing the complex and multi-faceted risks posed by climate change, as well as the opportunities that might arise.

Objectives

- Provide high-level academic training about the scientific and socio-economic aspects of climate change in a Master's programme, integrated with the PhD in Science and Management of Climate Change.

- Prepare experts with a broad and thorough scientific background in environmental economics, climate science, valuation techniques, and with specific modelling skills.

- Prepare leaders who can understand, synthesize, and communicate the biophysical and socio-economic nature of climate change, evaluate the socio-economic implications of climate change risks, and design innovative policy solutions and risk management strategies.

- Prepare experts familiar with a suite of methodological, analytical, statistical and modelling tools that make it possible to i) explain the physical and economic nature of climate change and their uncertainty, ii) assess the socio-economic impacts of climate change, their costs and benefits, iii)

estimate and manage climate change risk, iv) analyze, evaluate, and design innovative climate policy solutions, v) conceive transformational pathways in the context of sustainable development.

Sixth edition 2023-2024

Students will follow 12 courses (72 CFU). Didactical activities will consist of frontal lectures, seminars, hands-on sessions, group activities, presentation of group/individual projects. Guest lectures and seminars from international experts will be offered throughout the year.

The first term will build the foundations and will be articulated into 6 common courses: *Mathematical modelling and programming*; *Statistics*; *Introduction to programming for statistics and machine learning*; *Introduction to climate dynamics*; *Environmental and climate economics*; *Climate of the past*.
In the second term students will choose one of the two streams articulated in 6 courses each:

1- **Climate Economics and Finance:** *Decision theory and multi-criteria analysis*; *CGE and integrated assessment modelling of CC impacts and policies*; *Applied environmental economics and policy evaluation*; *Domestic and international climate policies*; *Climate finance*; *Energy systems and technologies*.
2- **Climate Modelling and Impact Assessments:** *Chemodynamics*; *Climate change and environmental quality*; *Climate modelling and monitoring*; *Risk assessment and decision support system for environmental impacts of climate change*; *Adaptive management of natural resources and agricultural systems*; *Climate damage modelling and assessment*; *Energy systems and technologies*.

All students will be offered three labs, two on *Data, Tools and Methods for Earth Sciences* (introduction and practicals) and one about *Environmental Diplomacy* for a total of 60 hours.

Foundations

Mathematical Modelling and Programming (prof. Giove)

Understanding of dynamic systems and preliminary concepts such as linear algebra, eigenvalues, complex numbers. Introduction to mathematical instruments for dynamic systems and applications to environmental problems.
Lectures will focus on theory as well as on applications through hands-on sessions.

Statistics (prof. Prosdocimi)

The course introduces the statistical methods useful to quantify changes in climate variables and the impacts of climate change on human activities. Students will learn how to specify, fit and interpret a variety of statistical models, and how to use them to answer scientific questions about the climate. The material is introduced using numerous case studies. Hands-on sessions with the R statistical software will be an integral part of the course.

Introduction to Programming for Statistics

Hands-on sessions with the R statistical software. Lectures will focus on imparting data handling and analysis skills utilizing various commonly used scientific data formats (e.g. netCDF, ascii etc). Students will also be introduced to geo-spatial mapping routines in R to facilitate rapid spatiotemporal aggregation and mapping of environmental and socio-economic data.

Machine Learning (prof. Cosmo)

Introduction to the principles and elements of machine learning. Application of commonly used neural networks and other machine learning approaches with focus on climate science will be a central theme of the course. Lectures will include hands-on machine learning algorithms using Python programming language. Students will get an overview and experience in data science, a hot topic having wide-ranging applications in environmental studies.

Introduction to Climate Dynamics (prof. Zanchettin)

Introduction to climatology. Basic understanding of how Earth's climate operates and how it is investigated by contemporary and pioneering climate research, with focus on the physical components of climate. Students will become familiar with the main modern tools used for characterization, understanding and prediction of climate and learn fundamentals of anthropogenic climate change and natural climate variability. Lectures will be frontal.

Environmental and Climate Economics (prof. De Cian)

Market failures and environmental externalities. The role of climate policy in the broader context of sustainable development and planetary boundaries. Climate-economy tools to simulate and evaluate climate policy instruments. Lectures will focus on theory and applications through hands-on sessions, group discussion, and students' presentations. Students will learn to compare costs and benefits of climate

change, analyze, evaluate, and design climate policy solutions, conceive transformational pathways in the context of sustainable development.

Climate of the Past (prof. Barbante)

Introduction to paleo-climate, time scales of climate change, and climate in human history. Methods for detecting climate change, including proxies, ice cores, instrumental records, and time series analysis. Lectures will focus on the physical and chemical processes in climate, including primordial atmosphere, ozone chemistry, carbon and oxygen cycles, and heat and water budgets. Students will learn about the internal feedback mechanisms in earth's climate system, including ice, aerosols, water vapor, clouds, and ocean circulation.

Stream 1: Climate Economics and Finance Stream

Decision Theory and Multi-criteria Analysis

Methodological basis of Decision Theory under uncertainty, Utility Theory, Decision Tree, Group Decision, Weighted Averaging, Ordered Weighted Averaging. Methods for optimization problems, in particular Linear Programming approach and some extensions.
Lectures will focus on methods as well as hands-on exercises in R. Students will learn how to understand, specify, describe some problems in this field, and to implement a resolution strategy.

CGE and Integrated Assessment Modelling of CC Impacts and Policies (prof. Bosello)

Overview of macroeconomic approaches used to study the socio-economic impacts of climate change and the adaptation responses. Four topics related to different modelling aspects: discounting, impacts assessment, and mitigation and adaptation policy assessments. Focus on Computable General Equilibrium (CGE) models. Lectures will focus on theory as well as applications with hands-on sessions. Students will learn the theoretical foundations of those models and learn how to apply them for the analysis of the socio-economic impacts of climate change.

Applied Environmental Economics and Policy Evaluation (prof. Vona)

The objective of the course is to introduce students to the use of econometric methods to evaluate historical environmental and climate policies, with an empirical focus on their impacts on innovation and employment.

Domestic and International Climate Policies (prof. Carraro)

Recent history of international negotiations on climate change to identify the main factors that prevent countries to achieve a widespread and effective agreement. Lectures will focus on the economic theory of climate negotiations using a quantitative approach based on game theory. The course will also review the main climate policy instruments with particular emphasis on the design of emission permits schemes both nationally and internationally.

Climate Finance (prof. Battiston)

Climate risk differs from other sources of risk traditionally analysed in finance. The course focuses on the new scientific approaches required to describe and manage climate-related risk, a topic of increasing interest for practitioners of both public and private financial institutions. Student will learn: i) the main theoretical notions of climate financial risk (in class) and ii) practical know-how for the computation of metrics of climate financial risk on empirical data (hand-on sessions).

Energy Systems and Technologies (prof. Pasut)

This course will describe the basic energy principles and laws (thermodynamics principles), and provide an overview of the energy system, generation and conversion technologies, with particular attention to low-carbon and renewable technologies, as well as the relationship between climate change and the built environment.

Stream 2: Climate Modelling and Impact Assessments

Chemodynamics, Climate Change and Environmental Quality (prof. Marcomini)

Basic concepts of environmental chemistry and thermodynamics. Climate system under a chemical and thermodynamic perspective. Impacts of climate change on environmental chemical pollution. Environmental risk assessment by exposure to chemicals. Lectures will focus on the behavior of environmental pollutants having different lifespans, with emphasis of the feedback cycle under climate change. Students will learn of the overall framework of contaminants' management, and to estimate and manage climate change risk.

Climate Modelling and Monitoring

This course will further develop the topic of climate modelling and monitoring. It will also introduce the science of remote sensing, with a particular focus on its viability for recognition of environmental problems, as well as different applications to issues related to climate variability and its management. It will provide an overview of key aspects of climate modelling, including the numerical implementation of different physical and dynamical processes and the evaluation and assessment of simulation outputs. Particular attention will be given to international climate simulation activities, like CMIP6.

Risk Assessment and Decision Support System for Environmental Impacts of Climate Change (prof. Critto)

Tools, methods and skills required for assessing environmental hazards, vulnerability and risks posed by climate change in the context of global environmental changes. Decision Support System for climate change risk assessment and management. Lectures will focus on theory as well as on applications through hands-on sessions, students' presentations, and group discussion. Students will learn to define and implement environmental risk analysis, impacts and vulnerability assessment, and use related specific decision support systems.

Adaptive Management of Natural Resources and Agricultural Systems (prof. Giupponi)

Introduction to the principles of natural resources management. Lectures will focus on the interactions between natural and human elements of socio-ecosystems and agro-ecosystems in particular. Sustainability and sustainable development will be central themes of the course. System dynamics will be the most widely used approach. Spatial and temporal dynamics are explored with concrete examples and case studies. Students will be involved in individual and group case-studies and learn methods and tools for problem-solving approaches.

Climate Damage Modelling and Assessment (prof. Mysiak)

Theoretical and practical understanding of the methods and tools to assess climate change risk and the economic benefits of climate adaptation. Analysis of climate policies and management of risks deriving from climate change and variability.
Lecture will focus on methods as well as applications in R and QGIS. Students will learn to estimate and manage climate change risk utilizing current geospatial modelling tools and practices.

Energy Systems and Technologies (prof. Pasut)

This course will describe the basic energy principles and laws (thermodynamics principles), and provide an overview of the energy system, generation and conversion technologies, with particular attention to low-carbon and renewable technologies, as well as the relationship between climate change and the built environment.

Labs

Data, Tools and Methods for Earth Sciences

The course will introduce students to recent tools, methodologies, data repositories and advancements in computing infrastructures applicable in Earth Sciences, with special emphasis on climate impacts and risk assessment. Students will develop an understanding of various observational/model simulated data sources, scope and limitations of usage, and tools to access and process Earth Sciences' data on cloud computing infrastructures such as the Copernicus Data Store. The course will be articulated into two parts:

1. Introduction (15h);
2. Practicals (15h).

Environmental Diplomacy

The course examines: (i) the complexities of environmental problems; (ii) theory of conflict resolution and environmental diplomacy; and (iii) ways of resolving conflicts. The class is taught comparatively, that is, with constant reference to cases from around the world.
This course is designed to raise student awareness of the state of environmental conflicts globally and the need for more effective environmental governance. It builds on several case studies of environmental

conflicts in different parts of the world, while also helping students develop the negotiation and mediation skills they will need to resolve environmental disputes.

Duration and summary of didactic activities and university credits (CFU)

The Master's lasts for one year with 360 hours of didactic activities (72 CFU) and additional 60 hours of practical, hands-on sessions (optionals). A 250 hour internship (10 CFU) forms an integral part of the course and represents an excellent opportunity to enter the workplace. The internship is mandatory. For students already working professionally in the sector, the same activities, accompanied by the drafting of a project work, will be recognized as valid for the completion of the internship.
The final exam (2 CFU) consists of a short report on the internship activity.
Including individual study, the course requires an overall commitment of 610 hours, for a total of 84 CFU**.**

Qualification issued

Students attending the didactic activities, completing the internship and passing the intermediate verifications and final examination will be awarded the Professional Master's Diploma (2nd level) in Science and Management of Climate Change.

Course period

September 2023 – June 2024.

Teaching method

Frontal lectures, hands-on-sessions, discussion groups, labs, seminars, guest lectures from international experts.

Language

English.

Attendance

Attendance will be monitored by signing a register. Regular attendance in the classroom is obligatory to passing the individual modules. Absences must not in any case exceed 20% of teaching hours for each individual module. Credits are assigned with completion of the individual modules and internship/project work activities and passing of the final examination. Students employed in a professional activity coherent with the Master's course may ask for this to be recognized in calculating the credits allocated to internship and work placement activities.

Course location

Scientific Campus Via Torino, Mestre (VE) / Economic Campus San Giobbe, Venezia.

Ca' Foscari
University
of Venice

Admission requirements

SECOND LEVEL

To enroll in the Master's, candidates must be in possession of at least a second cycle, specialization or pre-reform (Italian Ministerial Decree no. 509/99) degree in a scientific or economic subject. At the discretion of the Master's teaching board, candidates with other degrees, or equivalent foreign university qualifications, may be considered on the basis of their previous education and training and in respect of current legislation. English language to proficiency level of at least level B2.

Admission application

Candidates must fill in the online admission application, the details of which are defined under article 3 of the University's Call for Applications. Only applications accompanied by all the required documentation will be considered. The Call for Applications and relative attachments can be downloaded from the Master's website.

Selection procedure

A specific Board will assess candidates based on their CVs, qualifications submitted and a personal interview (the date, time and place will be communicated by email with sufficient advance notice; on motivated request, the interview may take place by video-conference). The oral admission test, in English, will aim to ascertain the candidate's motivations, but also to verify the competencies already acquired in subjects necessary for quantitative analysis and mathematical and statistical modelling, as well as the candidate's ability to express themselves in English. The main factors considered for the purposes of selection will be: qualifications, motivation, relational skills, relevant former educational and professional experiences and a willingness to respect then necessary attendance requirements.

Applicants interested in the Deloitte scholarship need to explicitly mention that in the cover letter and will be interviewed by a company representative as well.

Graduate eligibility

Students about to graduate may also be admitted to the course, provided they qualify within one month from the start of the course. In this case, enrolment to the Master's programme may be finalized only after the valid qualification for admission has been awarded. Candidates without a degree may enroll as auditors and will be awarded a certificate of attendance.

Available places

Maximum number of available places: **15**

Course fees: € 6.000

1st instalment by 14/08/2023: € 3.016 (including € 16 stamp duty)*

2nd instalment by 10/01/2024: € 3.000

** Stamp duty is not refundable. Fees should be paid through PagoPA*

Ca' Foscari
University
of Venice

Study support

Loans are available from the University's partner banks (for more information: http://www.unive.it/pag/8560/).
A full scholarship, financed by the Master itself, will be granted to 1 student with the highest score based on the criteria used for the selection procedure.
Another full scholarship will be financed by the company Deloitte Climate & Sustainability; the student beneficiary must carry out the internship at the company within the Sustainability & Climate Change team in Italy.

Enrolment

ADMISSION APPLICATION SUBMISSION (online procedure, Call for Applications, art. 3)
by July 11 2023
SELECTION AND RESULT ANNOUNCEMENT
by August 1 2023
ENROLMENT COMPLETION (online procedure, Call for Applications, art. 6)
by August 11 2023
Beginning of courses: September 2022. See https://www.unive.it/data/37027/ for updates.

Course coordinator and deputy coordinator

Prof. Wilmer Pasut, prof.ssa Enrica De Cian.

Website

www.unive.it/climate

For information

On **enrolment procedures**, please contact:
The Post-lauream office, **e-mail:** postlauream@unive.it, **Tel**: (+39) 041 234 7575.

On **didactic activities, calendar** of lessons and **internships**, please contact:
e-mail: phd-climate-change@unive.it,
Tel: +39 041 234 7743.