

Maîtrise universitaire ès Sciences en sciences de l'environnement Master of Science (MSc) in Environmental Science

Faculty of Geosciences and Environment University of Lausanne



This translation is for information purpose only. Only the orginal version in French is binding

Master of Science (MSc) in Environmental Science Maîtrise universitaire ès Sciences en sciences de l'environnement

2023 - 2024

Study Plan

In this document, the masculine form is used generically, all titles and functions apply equally to women and men.

The Master of Sciences (MSc) in Environmental Science [hereinafter Master of Science in Environmental Sciences] is organized by the Faculty of Geosciences and the Environment of the University of Lausanne.

At the 2nd cycle level, This is a 2nd cycle level course of 120 ECTS credits. It is planned for a duration of 4 semesters. The compulsory lessons are given in English. If and when English is used, the teacher concerned will ensure compliance with Directive 3.4 of the University Management.



General framework

The Study Plan for the Master of Science in Environmental Sciences has four parts:

First year:

Part 1: a common core of 30 ECTS, composed of two modules

Module 1 "Foundations in environmental science" (10 ECTS credits)

Module 2 "Environmental data and systems analysis" (20 ECTS credits)

Part 2 : an orientation part of 30 ECTS composed of one module each

Orientation A « Aquatic science » (30 ECTS)

Orientation B « Natural hazards and risk » (30 ECTS)

Orientation C « Earth surface processes in mountain environments » (30 ECTS)

Second Year:

Part 3: an optional teaching module (20 ECTS credits) in which the student can carry out an internship in a company or in administration (from 5 to 20 ECTS).

Part 4: a master's thesis (40 ECTS credits)

The assessment of each course can be done in one of the following forms:

- written exam (between 2 and 4 hours, during an exam session)
- oral exam (between 15 and 30 minutes, during an exam session)
- validation: continuous assessment (at least two validations), practice (report, seminar, etc.) provided as part of the studies

Prerequisites: The courses indicated as prerequisites are considered to be the basis for following courses in the Master of Science program in environmental sciences.

Part-time studies: Students enrolled in the part-time study course (see Management Directive 3.12) must comply with the indications relating to the semester and year in which each course must be taken. These recommendations appear in the last column of the tables detailing the Study Plan (SA = autumn semester, SP = spring semester, followed by a number indicating the semester number).

Legend of the teaching plan

- 1. Teachers: N.N. = teacher to be designated
- 2. **Type of teaching**: C = ex cathedra course, T = field (terrain), TP = practical work (travaux Practicals), S = seminars
- 3. **Hours**: the total actual hours corresponding to the duration of the lessons; jb (jour-bloc) = teaching given in block days; djb (demi-journée-bloc) = half-day-block
- 4. ECTS credits: one ECTS credit is equivalent to 25-30 hours of actual work

5. **Assessment**: each course is assessed by means of a written or oral examination or validation (continuous assessment, practice, etc.). The exams are organized during the exam sessions, the validations take place during the semester.

Part 1: Common core (30 ECTS)

The lessons of the common core concern all students enrolled in the course. The core part is divided into two modules. For students carrying out the part-time course, it is requested that the common modules be completed at the end of the second year (SP4).

Module 1 « Foundations in environmental science »

		Semester			
Courses	Teachers	- Number of hours	Assessment	Credits ECTS	Part time
Masters Project Preparation	P. de Anna (coord) G. Mariethoz	Autumn 20 C,TP Spring 10 C,TP	Validation	4	SA1 SP4
Applications of environmental science seminar series	N. Chèvre (Coord) N. Linde MH. Derron J. Hunziker Lecturers	Autumn 12 S	Practical	1	SA1
Statistical Analysis in Environmental Sciences	X. Dupla O. Broennimann	Spring 27, C,TP	Oral	3	SP2
Introduction to Scientific Programming with Python	T. Beucler	Autumn 16, C/TP	Pratical	2	SA3
Total credits required for this module			Total	10	

Assessment:

The module is passed and the ECTS credits granted when the average grade, weighted by the ECTS credits of all the lessons planned for in the module, is equal to or greater than 4.00.

Module 2 « Environmental data and systems analysis »

The student chooses four courses among the seven offered.

	Semester				
Courses	Teachers	- Number of hours	Assessment	Credits ECTS	Part time
Model parameter estimation and uncertainty quantification	N. Linde (resp.) J. Hunziker	Spring 48 C,TP	Practical	5	SP2
Environmental time-series analysis	J. Irving	Autumn 48 C,TP	Practical and written	5	SA1
Remote sensing of Earth systems	G. Mariethoz G. Antoniazza	Autumn 48 C,TP	Practical	5	SA1
Machine Learning for Environmental Science and Engineering (will take place in the second year)	T. Beucler	Autumn 48 C,TP	Practical	5	SP4
Watershed and river network modelling	N. Peleg	Autumn 48 C,TP	Practical	5	SP4
Scientific computing	Y. Podladchikov	Autumn 48 C,TP	Practical	5	SA3
Weather and climate dynamics	D. Domeisen	Spring 27 C,TP	Practical	3	SP4
Mountain ecosystems; ecology and evolution Terrain (course mandatory to be able to go to the field trip)	A. Guisan	Spring 52 T	continuous assessment	4	SP2 SP4
Advanced Geospatial Data Analysis – practical concepts and environmental applications	M. Tonini	Autumn 24 C, TP	Practical	3	SA3
Principle of scientific data acquisition	C. Schmidt	Automne 24 C, TP	Practical	3	SA3
Total des crédits offerts pour ce module				46	
Total credits required for this module			Total	20	

Assessment:

The module is passed and the ECTS credits granted when the average grade, weighted by the ECTS credits of the four courses chosen for in the module, is equal to or greater than 4.00.

Part 2: Orientation (30 ECTS)

The student chooses one orientation from the three offered. Each orientation is made up of one module.

Orientation A « Aquatic science» (30 ECTS)

The "Aquatic Sciences" orientation aims to provide multidisciplinary skills on issues relating to inland waters. It was created and built with a global perspective integrating the typical aquatic continuum of the Swiss landscape for which the mountains literally play the role of "water tower". This formation explicitly integrates the hydrological link between glaciers and high altitude environments, and soils and subsoil, to rivers and lakes in Piedmont. Such a perspective, unique in the landscape of university education in Switzerland, makes it possible to tackle issues relating to surface and subsurface water at the watershed scale, which is the unit of both environmental management and management. fundamental understanding of human impacts on water quantity and quality.

At the end of the Master, students should be able to:

- 1. Master the basic tools for studying water flows, tracing their origin and their residence time in the soil, rivers and lakes, studying their chemical and biological quality, both in the laboratory and in the field.
- 2. Approach the issues related to the availability and quality of surface and subsurface water in a multidisciplinary manner.
- 3. Integrate the notions of the different scales of space and time nested in the issues of water.
- 4. Build and conduct data collection programs related to these issues, including their digital analysis.
- 5. Identify governance issues and public policies on water in Switzerland.

Module 3A « Orientation Aquatic science »

	Semester				
Courses	Teachers	- Number of hours	Assessment	Credits ECTS	Part time
Fluid flow and transport in the subsurface	P. de Anna	Autumn 50 C,TP	Practical and oral exam	6	SA3
Environmental toxicology	N. Chèvre	Autumn 30 C,TP	Practical	3	SA1
Soil and Water Chemistry	M. Keiluweit	Autumn 40 C, TP	Written	3	SA1
Aquatic ecosystems: glaciers, rivers, and lakes	ME. Perga S. Lane G. Antoniazza	Spring 48 C,TP	Practical	5	SP2
Tracing biogeochemical processes and fluxes using isotope analysis	T. Vennemann	Autumn 20 C,TP	Practical	2	SA1
Field and laboratory methods (I): The UNIL campus as a microcosm	J. Berg (resp) N. Chèvre T. Vennemann	Spring 60 C, TP	Practical	5	SP2
Field and laboratory methods (II): Alpine catchments (<i>Field trip taking place outside of class periods</i>)	ME. Perga S. Lane	Spring Autumn 50 T,C	Practical	5	SP4
Total credits required for this module			Total	30	

Assessment:

The module is passed and the ECTS credits granted when the average grade, weighted by the ECTS credits of all the lessons planned for in the module, is equal to or greater than 4.00.

Orientation B « Natural hazards and risk » (30 ECTS)

The "Natural hazards and risk" orientation offers training in natural risk analysis, from the study of physical processes to their management, including the quantification of their probability of occurrence (hazard).

The main components of this orientation are:

- Study of physical processes: acquisition and analysis of basic data, mapping, analysis and modeling of mechanisms, monitoring techniques. In this part, the emphasis is on gravity hazards (landslides, landslides, floods, avalanches, etc.).

- Estimation of the risk and its different components (hazards, vulnerability, resilience, "quantitive risk assessment: QRA",...).

- Risk management, warning systems, development and Assessment of reduction strategies.

- Risk communication ...

This orientation includes field activities, laboratory and numerical modeling. It also includes stakeholders from practice in risk management.

At the end of the Master, students should be able to:

- 1. Understand the processes at the origin of the main natural hazards. Acquire and analyze data relating to these phenomena in the field and in the laboratory.
- 2. Build the conceptual model of a hazard. Master the basic tools of numerical modeling of the phenomena concerned.
- Carry out a quantitative risk analysis for natural phenomena.
 Propose risk reduction measures
- 5. Identify more broadly the issues related to risk management and its communication

Module 3B « Orientation Natural hazards and risk »

		Semester			
Courses	Teachers	- Number of hours	Assessment	Credits ECTS	Part time
Communication on environmental risks	M. Jaboyedoff	Autumn 32 C,TP	Practical	3	SA1
Advanced quantitative risk and vulnerability	M. Jaboyedoff	Autumn 40 C,TP	Oral	3	SA1
Risk quantification and insurance	M. Jaboyedoff (resp) L. Marescot	Spring 20 C, TP	Practical	2	SP4
Risk management (monitoring, early warning, post-disaster preparedness)	M. Jaboyedoff & Lecturers	Spring 20 C, TP, T	Practical and oral exam	2	SP2
Erosion and slope movements	M. Jaboyedoff (resp) A. Abellan	Spring 48 C,TP	Practical and oral exam	5	SP2
Monitoring techniques for slope dynamics	MH. Derron	Autumn 48 C,TP	Practical	5	SA3
Hazards and risks of slope mass movements: field camp	MH. Derron M. Jaboyedoff	Spring 80 T	Practical	5	SP2
Flood risk modeling	G. Antoniazza Intervenants	Spring 48 C,TP	Practical	5	SP4
Total credits required for this module			Total	30	

Assessment:

The module is passed and the ECTS credits granted when the average grade, weighted by the ECTS credits of all the lessons planned for in the module, is equal to or greater than 4.00.

Orientation C « Earth Surface Processes in Mountain Environments » (30 ECTS)

The orientation "Earth surface processes in mountain environments" aims to train students in the analysis of active surface processes in mountainous environments. Emphasis is placed on process characterization, data processing and analysis, learning study methods and process modeling. Training is given in the form of courses, practical work and field measurements

At the end of the master's degree, students should be able to:

- 1. Describe and analyze the natural processes in mountain regions using the appropriate methodological tools.
- 2. Master the practical use of different analytical methods (field, modeling, laboratory, mapping and remote sensing).
- 3. Collect, process and analyze information and field data.
- 4. Critically apprehend the complexity of mountain surface processes and the challenges of mountain region development.
- 5. Communicate the results of research in the analysis of mountain surface processes orally and in writing to diverse audiences.

Module 3C « Earth surface processes in mountain Environments »

	Semester				
Courses	Teachers	- Number of hours	Assessment	Credits ECTS	Part time
Alpine periglacial environments	C. Lambiel	Autumn 40 C,TP,T	Practical	4	SA1 SA3
Monitoring techniques for slope dynamics	MH. Derron	Autumn 48 C,TP	Practical	5	SA3
Aquatic ecosystems: glaciers, rivers, and lakes	ME. Perga S. Lane G. Antoniazza	Spring 48 C, TP	Practical	5	SP2 SP4
GIS-based analysis for mountain geomorphology	C. Lambiel	Spring 28 C,TP	Practical	3	SP2 SP4
Mountain streams; sediment management ("Aquatic ecosystems: glaciers, rivers, and lakes" est un prérequis obligtoire pour cet enseignemetn	S. Lane	Autumn 40 T	Practical	4	SA3 SA5
Erosion and slope movements	M. Jaboyedoff (resp) A. Abellan	Spring 48 C,TP	Practical and oral	5	SP2
Dates and rates of Mountain evolution	G. King	Autumn 40 C,TP,T	Practical	4	SA3
Total credits required for this module			Total	30	

Assessment:

The module is passed and the ECTS credits granted when the average grade, weighted by the ECTS credits of all the lessons planned for in the module, is equal to or greater than 4.00.

Part 3: Free-choice courses (20 credits ECTS)

Students complete their academic course with free-choice courses. The student can choose master's courses given either within the Faculty or UNIL, or in science courses at Swiss Higher Schools or abroad, in agreement with their thesis director. Each year, the scientific committee provides students with a list of suggested courses to help them in their selection..

After having made his choice of courses, the student must complete the "**Free choice courses form**", submit it to the thesis director for **validation** and signature, then send it to the Master's secretariat.

Bachelor level courses can be chosen for a maximum of 6 ECTS credits. "Tutorials" can be recognized up to 5 ECTS credits. It is also possible to register an internship in this module, as long as it has been previously approved by the scientific committee of the Master. The number of credits allocated to the internship depends on the duration of the internship carried out, with a maximum of 20 ECTS for an internship carried out over the entire semester. The internship Assessment includes writing a report and a letter of appreciation from the supervisor in the host structure, as well as an oral presentation for internships of 10 ECTS or more.

Assessment:

The free-choice module is passed and the 20 ECTS credits are granted when each assessment is passed individually.

Part 4: Master's thesis (40 crédits ECTS)

The last part is reserved for personal research work, the thesis, allowing the acquisition of 40 ECTS credits. The thesis is to be completed in principle at the end of the 4th semester. It is the logical continuation of the teaching modules. The thesis must be completed according to the chosen orientation. A teacher for compulsory courses in the first year is in principle appointed thesis director. A teacher from the Faculty can also direct a thesis, with the agreement of the Scientific Committee, which appoints one of its members as rapporteur.

The thesis module is passed and the 40 ECTS credits are granted if the grade reflecting the quality of the research, the writing quality of the thesis and the defense is equal to or greater than 4.00.

Adopted during the Faculty Council of April 5, 2023

Addendum

IMPORTANT INFORMATION

The pandemic has shown us that circumstances beyond our control may lead us to have to make the following adaptations to study plans during the semester:

- possibility of switching from one teaching mode to another (face-to-face <--> distance, synchronous <--> asynchronous, transition to co-modal teaching where it was not initially planned).
- modification of the evaluation methods, without inducing a derogation from the Study Regulations (oral <--> written, examination <--> validation, individual work <--> group work, practical work <--> theoretical work, evaluation in the presence <--> online assessment, etc.
- alternative or time-staggered modalities for teaching, internships, practical work, fieldwork and camps which could not take place or teaching which could no longer take place in the form initially planned.

Reserve adopted by the directorate of the University of Lausanne, on July 1, 2022