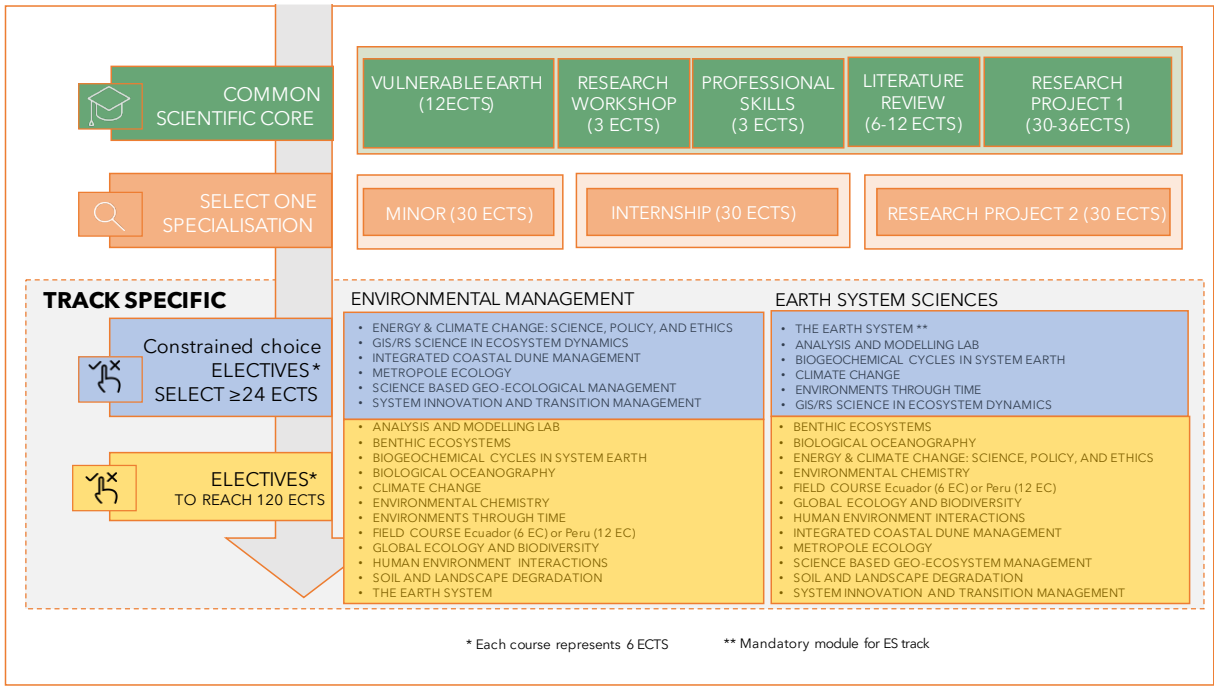
UNIVERSITY OF AMSTERDAM
Faculty of Science

MSc Earth Sciences at the University of Amsterdam

The MSC Earth Sciences has two tracks: Earth System Science (ESS) and Environmental Management (EM). The ESS track is aimed at understanding fundamental processes of Earth system functioning and interactions with the biotic world, and the EM track focuses on heavily managed environments, in which diverse groups with sometimes conflicting needs and interests compete for space and ecosystem services. For both tracks, students will gain comprehensive knowledge and skill sets through the integration of course work and lectures, field- and laboratory work, and data analysis.

The Modules



Our Master Earth Sciences has a common scientific core that all students will follow (green). The Master consist of two tracks Environmental Management (EM) and Earth System Science (ESS). For EM track students the internship with a private or governmental organisation is mandatory. For ESS track students, the course The Earth System is mandatory. After choosing a track, students choose at least 24 EC from the mandatory elective modules (blue block). To reach 120 EC students can add additional courses from the yellow field. All students can choose to do an internship, a minor, and/or a MSc thesis (small or large).

Common scientific core (green)

Vulnerable Earth (coordinator Dr Harry Seijmonsbergen)
Earth systems are vulnerable to natural and human disturbances, such as climate change, natural hazards and the impact of land use and land cover changes. In this course you will combine theoretical concepts and state-of-the-art literature, collect data during a 10-days fieldwork on Tenerife, analyze field samples in the laboratory and run spatial analyses to evaluate water scarcity, land abandonment, soil degradation and ecological responses on a volcanic island. You will practice a wide array of skills, such as team collaboration, field- and lab methods, peer review, presenting, discussing and writing a technical data report and a research proposal.

Research Workshop (coordinator: Dr Thijs de Boer)
The Research Workshop is a platform where students present their research proposal and discuss their research results with teachers and fellow students. Students may also present what they have learned during their internship that forms part of the Environmental Management track. Or present insights that were obtained in a Literature Review.

Professional skills courses (choose at least 2, ≥3 ECTS)
The Professional Skills modular trajectory consists of over ten modules of 1,5EC. All modules focus on transferable professional skills that students need for a career inside and outside the academic world. Some of the modules that are offered: Scientific writing, Explore your options- from study to career, Project management, Effective communication and presentation, Data management and visualization, Entrepreneurial basics, Consultancy, Policy making, Science communication, Scientific Ethics.

Literature review (coordinator: Dr Carina Hoorn)
During this course the students are trained in writing a competent and informative literature review that presents a timely and appropriate research question, cites and discusses relevant literature, makes a point, and is written in an engaging and well-argued manner. The training consists of studying existing review papers, writing practice, and discussion and presentations on the progress of the review with course coordinator and peers. The students will choose an Earth sciences topic and specialist supervisor (IBED staff or external) and the individual reviews will range from c. 4000 words based on c. 35 well-researched references (6 EC) or 7500 words and c. 50 references (12 EC).

Research Projects 1 (coordinator: Dr Carina Hoorn)
The research projects are carried out within one of the departments of IBED, with research contributing to the domain of Earth Sciences and Ecosystem Sciences. The Master thesis research should comply with the research themes of the research institutions involved in the MSc Earth Sciences. The research projects begin with choosing a topic and a literature research followed by the design of methodology and planning of project timeline. The practical work, such as laboratory experiments, fieldwork or computer simulations, can then be started and will make up most of the time devoted to the research projects. Each research project should be completed with a written report and an oral presentation at the Research Workshop.

Specialisation (orange)

Research Projects 2
See research project one

Internship* (coordinator Dr Albert Tietema)
The module “Internship” offers students the possibility to participate in a job environment in a direction of their choice. It can be a scientific environment, of a management environment, depending on the track and the interest of the student. The Internship has to have a research component, at the level of a MSc Earth Sciences.
*mandatory for Environmental Management students

Majors and minors
At the UvA you can choose to do your Master's programme with a major (60 EC) or minor (30 EC) that focuses on other skills than doing research. In case of a major you will follow the programme of your chosen scientific discipline during the first year of your Master's, and the major during the second year. Majors we offer are Science in Society, Science Communication and Education. Minors we offer are Science for Sustainability (SfS) and the Tesla minor. In the SfS minor, the sustainability combines technological and agroecological solutions with on policy and economic aspects, system innovation and transition management, and futures-thinking. The Tesla Minor is designed for students who want to implement disciplinary knowledge and develop competencies necessary to integrate elements of business, science and society.

Electives (≥24 ECTS blue and yellow)

The Earth System**
We learn to analyse how the Earth system function on various spatial and temporal scales, from global to local, from deep evolutionary time scales (more than millions of years) to ecological time scales (months to years). This course will follow the path of sediments from source to sink, from mountains to low-land coastal systems, and focus on Earth system processes from the lithosphere (rock), hydrosphere (water), pedosphere (soils), and atmosphere, and assess how they interact and are influenced by humans. Key aims of the module to assess Earth system natural baseline rates on deep time scales from millions to thousands of years; and asses how human actions since the Anthropocene are exceeding these baseline rates and affecting the Earth's spheres. The course consists of a several (guest)lectures, a group project assignment, and concludes with a mini symposium or workshop organised by the students for all IBED staff and students.
** mandatory for ESS students

Analysis and Modelling Lab (coordinator Dr Eldar Rakhimberdiev)
Timely science supporting our future planet requires well developed data handling, analysis and modelling skills. In this build to order course you will create your own learning trajectory by selecting four (out of ten) analysis topics and will go through them on a week by week basis. Modules range from introduction to programming and descriptive statistics to individual based models and machine learning.

Benthic Ecosystems (coordinator Dr Jasper De Goeij)
Below each body of water—from deep oceans to mountain lakes—there are ecosystems consisting of benthic (bottom-dwelling) organisms that form complex food-web structures depending on their physical environment. Factors such as light, temperature, salinity, substrate-type and water-flow are important drivers for the structure of each of these dynamic systems. Interactions between organisms at different trophic levels are unraveled by an interdisciplinary approach of biology, geology and chemistry, biogeochemistry in short. Ultimately, this module aims to understand how benthic ecosystems function, impact their environment and even predict their dynamics in a changing world. The course is organized in lectures, excursions and the writing of a research proposal.

Biogeochemical Cycles in System Earth (coordinator Dr Boris Jansen)
In this course you will study the important biogeochemical cycles of our planet within the context of urgent present day societal challenges. Examples include the dynamics of soil carbon in relation to climate change and land degradation, the nitrogen cycle as linked to soil acidification and biodiversity loss, and the fate of emerging pollutants in terrestrial ecosystems.

Biological Oceanography (coordinator Dr Katja Peijnenburg)
The oceans have a critical function for the supply of food and raw materials, and marine ecosystems are crucial in the regulation of Earth's climate and biogeochemical cycles. Our understanding of the ocean and the life it supports is, however, far from complete. Biological oceanography improves our understanding of the principles underlying marine ecosystem organization, and the processes that govern spatial and temporal distribution, dynamics, biodiversity and evolution of auto-, hetero- and mixo-trophic organisms as well as trophic interactions. This course will give an in-depth insight in the current knowledge of life in the ocean from viruses and plankton to marine fish and mammals, and from production to burial. The knowledge will be largely framed within the complex suite of processes that are involved in the transformation and transfer of fixed organic carbon (particulate and dissolved) from the surface to the deep ocean (collectively referred to as the 'biological pump').

Climate Change (coordinator Dr Cynthia Maan)
In this course we will study the IPCC reports (the scientific basis and summary for policymakers) to learn about the scientific basics and the environmental and societal implications of climate change. We will also get into systems thinking to better understand the vulnerabilities of natural systems as well as the challenges of systems change.

Energy and Climate Change: Science, Policy and Ethics (coordinator Dr Colin Hickey):
In this course (through a series of lectures/seminar discussions, readings, short papers, and a group project) we investigate the relationship between climate change, the design of our energy systems, policy tools and obstacles for creating a decarbonized world, and the moral values that should inform a just energy transition.

Environmental Chemistry (coordinator dr Antonia Praetorius)
In this course students will learn fundamentals of environmental chemistry, more specifically the major sources and emission pathways of chemical pollutants, the mechanisms governing their transport and fate in different environmental compartments (with a focus on organic pollutants) as well as approaches to chemical risk assessment and management. Students will learn about the different classes of chemical pollutants and how their environmental behavior is driven by their underlying chemical structure and properties. The course will consist of interactive (online) classes with exercises, group projects and a computer practical.

Environments through Time (coordinator Prof Will Gosling)
Landscape, societies and climates evolve over timescales of decades to millennia, and on spatial scales of tens to thousands of kilometers. To obtain insight into how environments have changed beyond the documentary record, we must turn to the sedimentary record for information. Indicators preserved within sedimentary records allow us to reconstruct many aspects of past environments, such as climates, vegetation, and human history, but to make these directly comparable with observed and projected changes a clear understanding of timescales is required. In this course we will consider how information on past environmental change can be obtained from the sedimentary record, assess uncertainty within these records, and explore patterns of environmental change through time.

Field Course Geo-ecological Systems (coordinator Dr Erik Cammeraat)

Thorough field knowledge of landscape elements and their mutual relationship is vital to the understanding of geo-ecosystem functioning. This course deals with integrated geo-ecosystem analysis and includes the state factors geology and climate, which affect the distribution of water, light and nutrients and geomorphological processes in the landscape, as well as the development of soil and vegetation. The course is centered on a research project carried out in the field using various field techniques including coring, water sampling and erosion mapping. The fieldwork will take around 3-4 weeks. Fieldwork will take place either in mountain or lowland settings in South America (e.g. Ecuador, Peru) or Europe (e.g. Luxemburg, Alps).

Field Course Ecuador (coordinator: Dr Crystal McMichael)
Information will follow later

GIS/RS Science in Ecosystem Dynamics (Dr Harry Seijmonsbergen)
Geographical Information Systems (GIS) and Remote Sensing (RS) include a powerful set of computational techniques and methods for storing, retrieving and the analysis of spatial data. We offers topics for students with and without previous GIS/RS experience. You will select self-tuition assignments in which GIS tools such as weighting and ranking, suitability analyses, raster-based analysis, least-cost pathways, web-services, model building, hydrological tools, python scripting are applied to real-world challenges. The remote sensing techniques include supervised classification, land use and land cover change analyses, object-based image segmentation and classification, band-ratio analysis, image pre-processing and computing vegetation indices. The data and imagery that you will use are Digital Terrain Models (DEMs) such as LiDAR data, Landsat, SPOT and Sentinel-derived spectral bands, orthophotos and digital geological, soil, geomorphological and census data.

Global Ecology and Biodiversity (coordinator Dr Daniel Kissling)
Biodiversity contributes to ecosystem functioning and is of fundamental importance for human well-being. Moreover, knowledge about biodiversity and its spatial (global, regional and national) distribution is essential for understanding the origin of biodiversity, for reporting about biodiversity change, and for conservation management and spatial planning. Mapping and analysing biodiversity and environmental data also contributes to the vision that biodiversity is valued, conserved, restored and wisely used, that ecosystem services are maintained, and that we can sustain a healthy planet and deliver benefits essential for all people. With this course, we want to contribute to educating a new generation of ecologists who are equipped with the quantitative skills to address questions in global ecology, biodiversity and conservation science. We particularly focus on handling large biodiversity and environmental datasets, analysing spatial ecological data, and modelling of biodiversity and species distributions.

Human-Environment Interactions (coordinator Dr Elisabeth Krueger)
The goal of this course is to make students understand the complex human-environment interactions that lead to social-ecological development in space and over time. It will include an interdisciplinary analysis of the historical evolution of key life support systems, such as food, water and energy, and how they are connected to specific contexts, places and processes. Students will work on specific case studies and elicit the social, ecological and technological dimensions of the evolution of these case studies whilst acquiring and applying mixed methods research skills. We will address questions such as how Amsterdam's food system evolved over time, with a specific focus on the development of local farms, the mapping of local food production, as well as the identification and analysis of involved actors and governance institutions.

Integrated Coastal Dune Management (coordinator: Dr Annemieke Kooijman)

The Dutch coastal dunes are important for sea defence, but also for its ecological and economical values. Due to the wide variety in ecosystem services, a multidisciplinary approach towards balanced management and policies is needed. In the course, we combine different work forms, such as guest lectures by professionals and experts working in the coastal dunes, excursions to different dune areas, evaluation of the concept of Resilience Thinking, and a case study on ecology and management of a particular coastal dune area somewhere in the world.

Metropole Ecology (coordinator Prof Judy Shamoun)
Urban and peri-urban areas are dynamic ecosystems harbouring over half of the human global population. We use an interdisciplinary approach to learn about diverse challenges and opportunities in metropoles for biodiversity, ecosystem functioning, and people. The course combines lectures, discussions, excursions, quantitative analysis, and a final project on a mega-city of choice. Join us to discuss the current and future state of metropole ecosystems around the world.
Field excursion Periphery Amsterdam

Science-based Geo-ecological Management (coordinator Prof Astrid Groot)
This course aims to give insights in the geo-ecological processes that should be considered to come to science-based management. Through lectures, an excursion, a practical and interviews with managers, organized by the students, you will develop your own adaptive management plan for an area of your choice, which includes defining objectives, developing predictions and experiments, monitoring to test assumptions and learn from the outcomes with which plans can be adjusted.
Field visit Oostvaardersplassen

System Innovation and Transition Management (coordinator Prof John Grin)
Opinions about the desirable pathways towards sustainability vary widely. In this course we address the issue on how to understand the dynamics and governance of the second transition dynamics in order to ensure sustainable development and long-term transformative change. In this module transition thinking will be put into practice in various domains, including those concerned with Climate Change, Energy and Agriculture. In our course, we will draw from these concrete practices to learn more about transformative change and system innovation in real life.