Syllabus

Course Description

Course Title	Management of mountain rivers
Course Code	47056
Course Title Additional	
Scientific-Disciplinary Sector	
Language	English
Degree Course	Master in Environmental Management of Mountain Areas
Other Degree Courses (Loaned)	
Lecturers	Dr. Andrea Andreoli, Andrea.Andreoli@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35911 Prof. Maurizio Righetti, Maurizio.Righetti@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33740
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	6
Teaching Hours	40
Lab Hours	20
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	The course aims at teaching theoretical and applied aspects of river management, in particular related to mountain channels, which must combine the conservation/enhancement of environmental quality with a certain level of flood risk mitigation. By the end of the course, the student is expected to have acquired: 1) the most updated scientific knowledge on river

	hydromorphology and on flood mitigation strategies; 2) the capacity to predict the possible interactions across the different spatial and temporal scales in river systems; 3) the capacity to assess the hydromorphological alterations induced by human activities in mountain rivers; 4) the capability to identify and design the most adequate measures to mitigate flood risk as well as to favor the natural morphological processes; 5) the capacity to establish river management plans.
Course Topics	- Basics of river hydraulics and sediment transport - Scales in river morphology - Classification of river types and geomorphic units - Assessment of rivers' morphological quality
Keywords	Fluvial dynamics, River morphology, Channel trajectory, Sediment transport, Flood protection, Structural and non structural measures
Recommended Prerequisites	knowledge of the principles of hydraulics, knowledge of formulas derived from physics and mathematics to analyse the behaviour of fluids in motion
Propaedeutic Courses	No
Teaching Format	In this course the theoretical concepts are presented in the class by the Professor whereas field excursions are led by the Professor with the teaching assistant. Power Point presentations of the lectures will be made available on TEAMS, along with links to external resources and exercises. Additional material will be provided on selected topics.
Mandatory Attendance	No
Specific Educational Objectives and Learning Outcomes	Ability to apply knowledge and understanding --> Knowledge and learning abilities are achieved through course attendance, practical activities both in the field and in the laboratory and through personal study. The achievement of the learning objectives will be tested through oral and/or written examinations, as well as through the guided preparation of seminars on topics specific to the Master's degree. In addition to having acquired a solid scientific-technological basis, the graduate of the Master's degree in "Environmental Management of Mountain Areas" acquires the ability to tackle and solve new problems. Thanks to a technical-scientific education, integrated with technological-managerial subjects, he or she is able

	to analyse, design, plan and manage the mountain territory and its specificities, vulnerabilities and characteristics. The graduate must also be able to coordinate interdisciplinary teams in the fields of ecology, restoration and functional maintenance of mountain ecosystems, agro-forestry management and socio-economic development. The tests (written and oral examinations, reports) and exercises involve the performance of specific tasks in which the student demonstrates mastery of tools, methodologies and critical autonomy. The final thesis will play a central role in assessing the students' ability to design, plan, and manage forest ecosystems, with particular reference to the mountain environment. Autonomy of judgement --> A fundamental means of developing independence and critical awareness is through the drafting of the final thesis, in which the student must demonstrate that he or she has acquired autonomy of choice and design skills. Communication skills --> Graduates will be able to work professionally and scientifically in one or more foreign languages, since in addition to English (the official language of the course) in which all compulsory and part of the optional courses are offered, they will be able to follow optional courses offered in Italian or German. The Language Centre of the Free University of Bozen/Bolzano also offers students, in accordance with the policy for trilingualism that characterises the profile of the Free University of Bozen/Bolzano, the possibility of taking extracurricular courses at level (A1-C1) in Italian and German. Finally, the graduate will be able to effectively communicate what he or she has learnt to the different professional categories with which he or she works and has the ability, given the international nature of the degree course, to share projects with foreign interlocutors. Written and oral communication skills are developed in seminars, tutorials and training activities, which also include the preparation of written reports and documents and the oral presentation of these, compulsorily in English and possibly in Italian and German

	for optional courses. The acquisition and assessment/verification of the achievement of communication skills is also envisaged through the writing of the final dissertation and its discussion in English. The Master's degree course promotes the acquisition of additional language skills (Italian/German), which are also aimed at increasing the ability of graduates to effectively market themselves on the labour market in part of the Alpine region (Austria-Switzerland-Italy-Germany). Learning capacity --> The graduate will have the ability to learn by synthesising the notions learnt in the course of studies, in order to address complex design issues, by expanding and updating the knowledge and technical skills acquired by using analysis, design and management tools appropriate to the situations in which the graduate operates. The graduate will be able to manage the different information networks in order to be able to continue to learn and thus to update himself/herself for his/her own cultural improvement and professional advancement. In addition, the graduate will be able to identify the appropriate training tools and paths for the development of their own cultural and specialist knowledge. Learning skills are attained during all phases of the course of study. The Master's degree course enables students to consolidate their self-study skills, especially when they carry out group work on proposed topics; again, this ability is enhanced during a compulsory course, which involves group work, and subsequently in the preparation of the final thesis of an experimental nature. In particular, this practical course requires students to work in small groups (3-5) on a project (e.g., rural development plan for a mountainous area, rehabilitation project for a degraded terrestrial or river ecosystem) from its initial stages (identification of objectives, conceptual development of actions, collection of available data) through to interaction with the various stakeholders and communication activities towards society. The projects will take place under the supervision of two or more professors from the two universities involved, but also by having the students interact with professional firms and/or public technical offices that have already expressed interest and willingness to do so. Learning ability is assessed through continuous forms of verification during the training activities and during the conduct of

	the activity related to the final examination.
Specific Educational Objectives and Learning Outcomes (additional info.)	Knowledge and understanding of i) basic and applied aspects and methodologies in river management science; ii) river functioning as well as human impacts on their processes; iii) main geomorphological processes typical of mountain channels and of their possible management strategies; iv) pros and cons of different river management strategies. Applying knowledge and understanding to i) the hydromorphological analysis of mountain channels and to ii) river management, including restoration actions and risk mitigation; Making judgements on river dynamics, on human impacts on fluvial processes, on flood hazard type and magnitude, as well as on management options through the personal interpretation of the study areas visited during the field trips Communication skills to present basic and applied aspects of river processes and management strategies to stakeholders and scientists clearly and unambiguously with pertinent and adequate technical terminology Learning skills to autonomously deepen and update the knowledge acquired during the course seeking relevant information on scientific and technical literature, for their future professional and/or academic studies
Assessment	For each module, an written examination (3 open questions) for the theoretical aspects and an individual report about the computer-based exercise activities; for the second module oral examination is required
Evaluation Criteria	The final grade for the course will be calculated as the average of the final grades obtained in the two modules. The mark for both modules will be assigned based on the written and oral exam (80%) and the individual report (20%). Relevant for the assessment of student reports: ability to analyze correctly the context of the study cases, skills in critical thinking, ability to summarize. Relevant for the written exam assessment are correctness and clarity of answers, mastery of the technical language, capability to

	establish relationships between different topics. relevant for the oral examination: ability to present arguments, respond to questions in a reasoned manner, interact and demonstrate in-depth understanding. Analyze, comment on and rework information in a personal way, demonstrating critical thinking skills and not just a repetition of concepts
Required Readings	Course slides, scientific papers and selected book chapters posted on TEAMS platform
Supplementary Readings	Fryirs, KA, Brierley, G.J (2012) Geomorphic Analysis of River Systems: An Approach to Reading the Landscape. Wiley, 360 pp, ISBN: 978-1-405-19274-3 Wohl, EE (2013) Mountain Rivers Revisited. Water Resources Monograph AGU, ISBN 9780875903231 Rinaldi M., Surian N., Comiti F., Bussettini M. (2012), Guidebook for the evaluation of stream morphological conditions by the Morphological Quality Index (MQI), ISPRA, Roma, 90 pp (available online) Conesa-Garcia M., Lenzi M.A. (2010) Check Dams, Morphological Adjustments and Erosion Control in Torrential Streams. Nova Publisher, ISBN: 978-1-60876-146-3. Armanini, A. (2018) Principles of river hydraulics ISBN 978-3-319-68099-6
Further Information	one field trip is planned to to torrents control works, in SudTirol, with Bevolgerungsschuty technicians
Sustainable Development Goals (SDGs)	Responsible consumption and production, Life on land, Climate action

Course Constituent Title	Hydromorphology of mountain rivers
Course Code	47056A
Scientific-Disciplinary Sector	AGR/08
Language	English
Lecturers	Dr. Andrea Andreoli, Andrea.Andreoli@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35911
Teaching Assistant	
Semester	Second semester
CP	3
Responsible Lecturer	
Teaching Hours	20
Lab Hours	10
Individual Study Hours	45
Planned Office Hours	9
Contents Summary	The module provides an introduction to the hydromorphology of mountain rivers, focusing on fundamental processes and methods for analyzing river form and dynamics. Students will first acquire basic concepts in fluvial hydromorphology and an understanding of spatial and temporal scales in fluvial geomorphology. The course then explores the characterization of streams and the structure of the fluvial system, with particular attention to channel patterns, channel changes, and river trajectory through the classification of river types and geomorphic units. Finally, students will learn approaches to assess the morphological quality of rivers, with applications to mountain river environments.
Course Topics	- Basics concepts in fluvial hydromorphology ; - Scales in fluvial geomorphology; - Characterization of streams - The fluvial system - Channel patterns - Channel changes - Classification of river types and geomorphic units - Assessment of rivers' morphological quality
Teaching Format	In this module the theoretical concepts are presented in the class

	by the Professor , exercises are led by the Professor and the teaching assistant in the classroom with the use of PC and GIS software. Field excursions are envisaged to apply the practical case developed during the exercises. Power Point presentations of the lectures will be made available on TEAMS, along with links to external resources and exercises. Additional material will be provided on selected topics.
Required Readings	• Lectures handouts (on TEAMS); • Scientific papers posted on TEAMS.
Supplementary Readings	• Fryirs, KA, Brierley, G.J (2012) Geomorphic Analysis of River Systems: An Approach to Reading the Landscape. Wiley, 360 pp, ISBN: 978-1-405-19274-3 (available online); • Wohl, EE (2013) Mountain Rivers Revisited. Water Resources Monograph AGU, ISBN 9780875903231 (available online); • Rinaldi M., Surian N., Comiti F., Bussettini M. (2012), Guidebook for the evaluation of stream morphological conditions by the Morphological Quality Index (MQI), Istituto Superiore per la Protezione e la Ricerca Ambientale, Roma, 90 pp (available online); • Conesa-Garcia M., Lenzi M.A. (2010) Check Dams, Morphological Adjustments and Erosion Control in Torrential Streams. Nova Publisher, ISBN: 978-1-60876-146-3.

Course Module

Course Constituent Title	Flood risk mitigation in mountain rivers
Course Code	47056B
Scientific-Disciplinary Sector	AGR/08
Language	English
Lecturers	Prof. Maurizio Righetti, Maurizio.Righetti@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33740 Dr. Andrea Andreoli, Andrea.Andreoli@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35911
Teaching Assistant	

Semester	Second semester
CP	3
Responsible Lecturer	
Teaching Hours	20
Lab Hours	10
Individual Study Hours	45
Planned Office Hours	9
Contents Summary	- Basics of river hydraulics and sediment transport - Scales in river morphology - Classification of river types and geomorphic units - Assessment of rivers' morphological quality
Course Topics	Flood risk mitigation measures in mountain basins Principles of river hydraulics Introduction to Sediment transport Fluvial systems in alpine environment Structural and non structural interventions for flood risk mitigation Transversal structures Consolidation and retention heck dams Longitudinal structures levees, rip-rap bioengineering techniques, retention basins Integrated river management interventions
Teaching Format	The theoretical concepts are presented in the class by the Professor, who also leads the field excursions (along with local river managers) Power Point presentations of the lectures will be made available on TEAMS, along with links to external resources and exercises. Additional material will be provided on selected topics.
Required Readings	Armanini Principles of river hydraulics didactic material uploaded by the lecturer
Supplementary Readings	Ellen Wohl, Stuart N. Lane, and Andrew C. Wilcox, 2921. The science and practice of river restoration.

	https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2014WR016874