ENV-418

River eco-morphodynamics and bioengineering

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Cursus	Sem.	Type
Civil Engineering	MA1, MA3	Opt.
Environmental Sciences and Engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course deals with the interactions between hydraulics, solid transport by hauling and the watercourse space at the origin of the morphology and richness of habitats. Regime theory is presented and the quality of a stream's habitat is assessed.

Content

- **River corrections**

- Objectives and historical examples
- Problems of of river corrctions without taking morphology into account
- Interaction between solid transport and morphology

- **River revitalization**

- Classification of natural watercourses
- Watercourses as corridors linking biotopes
- Assessing the ecological status of a watercourse
- Constraints on revitalization
- Technical measures to reduce ecological deficits
- River revitalization and flood protection - a contradiction?

- **River dynamics**

- Transient flows and solid transport
- Alluvial dynamics
- Disruption of the natural regime by hydraulic engineering: problems of residual flow, tidal range and bed clogging. Solutions for mitgating adverse effects.
- Cleaning up hydropeaking
- Restoration of bed load

- **Bedforms and flow resistance**

- Dynamic bedforms
- Vertical and horizontal morphologies
- Bed and bank resistance

- **Natural morphological regimes**

- Regime theory (width, slope, depth)
- Meanders and braided beds
- Local widening

• **Interaction between morphology and habitat quality for aquatic species**

- Fish ecology and habitats
- Habitat modeling
- Longitudinal and lateral connectivity: fish migration

Keywords

River revitalization, river development, river space, river morphology, regime theory, habitat diversity, connectivity and fish migration

Learning Prerequisites

Recommended courses

Mécanique des fluides, Hydrologie de l'ingénieur, Ouvrages et aménagements hydrauliques

Learning Outcomes

By the end of the course, the student must be able to:

- Assess / Evaluate the ecological status of a river
- Apply regime theory
- Identify bedform formation
- Plan and carry out a field measurement campaign
- Recognize critical points for river revitalization

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.
- Take responsibility for environmental impacts of her/ his actions and decisions.
- Access and evaluate appropriate sources of information.
- Make an oral presentation.
- Write a literature review which assesses the state of the art.
- Summarize an article or a technical report.
- Write a scientific or technical report.

Teaching methods

Ex cathedra and exercises, fieldwork, literature analysis

Assessment methods

Written test on semester course material

(individual grade = 50% of final grade)

Exercise and practical work during the semester (Practical work: Assessment of the ecological status of a watercourse, report and oral presentation; Review of the literature establishing the state of the art on a subject covered in the course, with oral presentation)

(average of group marks = 50% of final mark)

Supervision

Office hours	Yes
Assistant.e.s	Yes

Resources

Notes/Handbook

Eco-morphologie fluviale par J.-L. Boillat, 2009

Moodle Link

- https://go.epfl.ch/ENV-418