# River restoration and soil bioengineering

## 30-31 January 1st Febrauary 2017. Sant Cugat del Vallès, Catalonia (Spain)

### Introduction

Water is an essential component for life. There is no life without water and human progress would be unthinkable without a regular supply of fresh water. Therefore, water availability and its use as a resource have shaped the history of mankind with many effects on the economy, society, environment, etc. All these aspects are linked together and, thus, for a sustainable water management we need an in deep and integrated analysis of all of them. In addition, it will become crucial to anticipate the undesired consequences of Climate Change that are supposed to have a negative impact on the world's climate with less annual rainfall in many areas, while others receiving more intense and torrential rains.

All these current and new conditions will have many significant implications for river ecology and for the ongoing river management in the years to come. Accordingly, this course is focused in some of these consequences and how to deal with them. The fluvial network is a key element in water management, both in a hydrological and hydraulic point of view, but also in other important aspects such as biogeochemistry.

The current trends in river management target, as a primary objective, to ecosystem restoration and river naturalisation, while a second objective especially in urban areas is an increase of water infiltration rates. We need to increase infiltration rates. And we also need to collect the runoff pollutant loads (the first flush) and decontaminate them. It should always be avoided the burial, the covering and the channelling of streams because these works can solve problems upstream but cause serious damages downstream. Furthermore, concrete channels and underground streams usually require high maintenance costs that should always be avoided. It is important to remember, and we will discuss about this during the course, that rivers have a liquid flow but also a solid flow volume. On that basis, one of the new tools we use for modern river management is known as soil and water bioengineering. Soil and water bioengineering is a discipline that combines technology and biology, making the use of plants and plant communities to help protect land uses and infrastructures, and contribute to landscape development; can be applied to effective river management and restoration.



Within the context and methods of bio-engineering we need to recover the ecosystem functionality of our rivers and streams and to improve water quality. Following the holistic approach of bio-engineering we have to work with the resources provided by natural systems, taking into account that almost a 60% of the water flowing within Catalan rivers comes from sewage treatment plants and knowing that this water mixed up with urban runoff contains diffuse pollutants (pharmaceutical waste products, nanoparticles, etc) harmful to man and the environment alike.

In such adverse and challenging situation Hypotrain is an Innovative Training Network (ITN) project financed by EU Marie Sklodowska-Curie Actions from the Horizon 2020 Programme.

Hypotrain Project aims to go beyond a good and necessary understanding of river natural systems, but also envisages a better comprehension of how these natural systems interact with the effluent and what can be done to improve it in such conditions.

In summary, Hypotrain project intends to go from “pure biology” or “pure science” to its practical application for a better future for our rivers and streams.

---

The project is led by the IGB Leibniz Institute of Freshwater Ecology and Inland Fisheries, from Berlin, and the following 9 partners from universities, research centres and a Catalan SME:

- ✓ Stockholms Universitet · Sweden
- ✓ Institute des Forschungsverbundes Berlin · Germany
- ✓ The University of Birmingham · UK
- ✓ KTH Royal Institute of Technology · Sweden
- ✓ Universität Bayreuth · Germany
- ✓ Swiss Federal Institute of Aquatic Science and Technology · Switzerland
- ✓ IWW-Water Center · Germany
- ✓ University of Roehampton · UK
- ✓ River Restoration Centre · UK
- ✓ NATURALEA CONSERVACIÓ · Catalunya-Espanya

This Project is supported and benefits from the active involvement of the University of Barcelona (Spain), University of Wien (Austria), Flinders University (Australia), Ben Gurion University of the Negev (Israel) and Stockholm Environment Institute (Sweden).

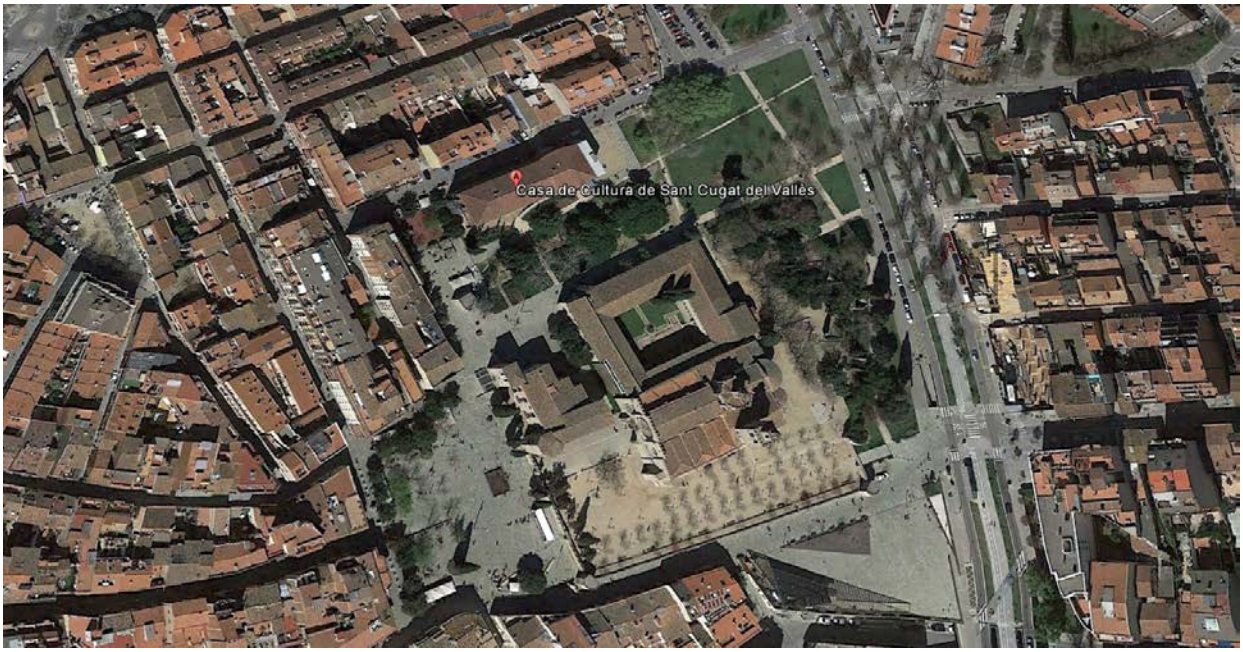
This project fits in the research area of the Urban River Lab framework, with the participation of the University of Barcelona, CEAB-CSIC and the Consortium for the Protection of the Besòs-Tordera River Network, and the SME Naturalea Conservació.

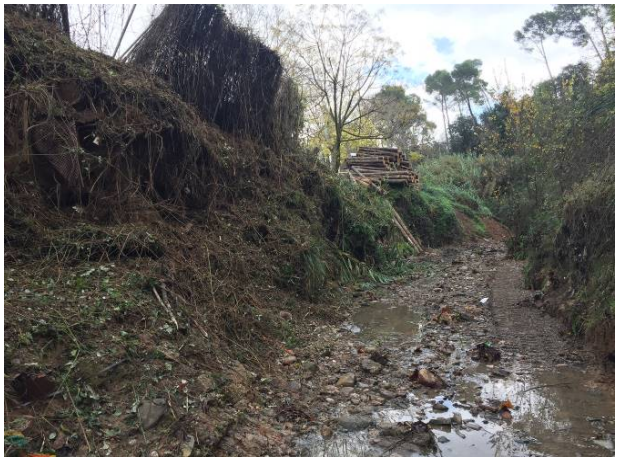
**Course location**:

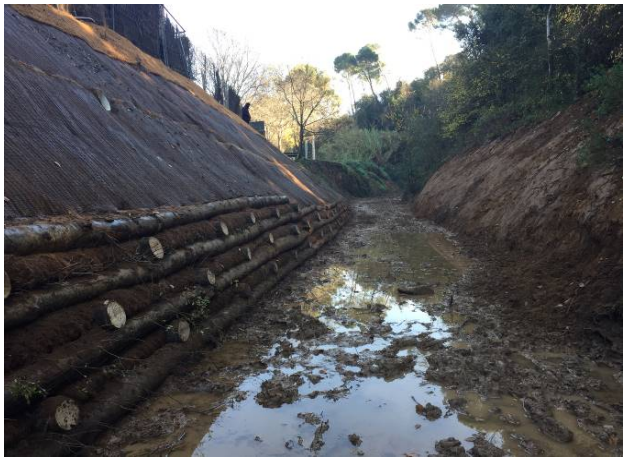
Casa de Cultura

Carrer de Castellví, 8 (Jardins del Monestir)

08173 Sant Cugat del Vallès, Spain





Sant Cugat del Vallès is one of the European cities committed to soil and water bioengineering techniques.

**PROGRAMME:**

**30th of January 2016**

**9:00-9:15h Opening address and welcome message.**

**9:15-10:00h Introduction: The management of river areas.** Albert Sorolla

**10:00-10:30h Coffee break.**

**10:30-12:30h Introduction to river engineering: Watercourse morphology and fundamentals of hydrodynamics.** Jesús Soler.

**12:30-14:00h Lunch. Field visit to bioengineering works in Can Cabassa stream (Sant Cugat del Vallès)**

**14:00-16:00h Fluvial ecosystems services: the role of Hyporheic zone and criteria to be considered in stream restoration.** Francesc Sabater.

**16:00-17:00h Biological characteristics of plants: resilience, regeneration, vegetative reproduction, water resistance.** Esperança Gacia

**17:00-17:30h General discussion**

**31th of January 2016**

**8:00-9:00h Introduction to soil bioengineering techniques.** Paola Sangalli

**9:00-10:00h Biotechnological characteristics of plants: tensile strength, shear strength, soil cohesion I.** Guillermo Tardio

**10:00-10:30h Coffee break**

**10:30-11:30h Biotechnological characteristics of plants: tensile strength, shear strength, soil cohesion II.** Guillermo Tardio

**11:30-12:30h Materials and techniques of soil bioengineering for river restoration I.** Albert Sorolla

**12:30-14:00h Lunch**

**14:00-15:00h Materials and techniques of soil bioengineering for river restoration II.** Albert Sorolla

**15:00-17:00h European case studies of river soil bioengineering.** Paola Sangalli

**17:00-17:30h General discussion and closing speech**

**1st of February 2016**

**Field visits**

**8:00 Meeting in Casa de Cultura**

**8:30-9:30 Visit 1. Urban River Lab.**

The URL is an outdoor laboratory consisting of channels with circulating water and wetlands designed to investigate new techniques to improve the water quality of highly modified streams and rivers. Feeding water comes from the effluent of a wastewater treatment plant.

Visit conducted by **Miquel Ribot**

**9:30-10:30 Travel and Coffee break**

**10:30-12:30 Visit 2. Cànoves stream.**

A restored area where we study the influence of the morpho-hydraulical changes in river channels on the self-purification capacity of nutrients in intermittent rivers. In particular, we tested different bioengineering techniques

**12:30-14:30 Travel and Lunch**

**14:30-16:15 Visit Artificial wetland in a storm water basin in Ca N'Alemany (Viladecans, Barcelona)**

**16:15-17:00 Travel to Sitges, next meeting place**

Stormwater basins are a necessary strategy in order to avoid flooding problems on new urbanized areas. The partial development Plan PPU-01 in the area of Ca N'Alemany in Viladecans (Barcelona) includes the construction of a stormwater basin, a water runoff pre-treatment, an in-situ runoff treatment and, finally, the creation of a wetland area.

The raft, with a capacity of more than 80.000 $m^3$ has an area of 15.269 $m^2$ of bottom surface from which 4.104,8 $m^2$ are free waters and the rest have been vegetated involving different communities present in Delta del Llobregat. The water level fluctuations involves alternating between aridity and flooding conditions. To facilitate the implementation and viability of the plants, there have been applied bioengineering techniques,basically those ones structured in natural fibres.

The excess water will go to a nearly horizontal stream on which, in order to improve biodiversity, we have made shrubby and macrophytes deflectors (vegetated coir logs and pre vegetated grasslands fibre).

**LECTURERS**

- **Esperanca Gacia**: Doctor in biology. Researcher in Continental Ecology at CEIB-CSIC
- **Paola Sangalli**: Biologist and Landscaper, President EFIB (European Federation for Soil Bioengineering), designer and lots of experience in these techniques. Technical Director of Sangalli Coronel y Asociados - AKIS SL.
- **Francesc Sabater**: Doctor in biology. Professor and researcher of the Department of Ecology at the University of Barcelona.
- **Jesus Soler** Hydraulic engineer. Communicator
- **Albert Sorolla**: Biologist, President of the AEIP, vice-president of the European Soil and Water Engineering Group .ESWEG. Technical Director of Naturalea.
- **Miquel Ribot**: Doctor in biology. Researcher in Continental Ecology at CEIB-CSIC. Technical manager of URL
- **Guillermo Tardio**: Forestry engineer, head of R & D AEIP.