



# The river and the geology

Module:

**Hydrogeological Risk**

**Total duration:** 6 hours

**Field work:** yes

**List of materials:**

- PC, beamer (IWB)
- Internet
- Geological map of the area
- Sieves (2 and 0.5 mm)
- Plastic bags
- Shovels
- Smartphones

**Worksheets:** 1 to be developed by students

**Students' age:** 16-18

**Use of apps/software:** Google Earth; Siftr

## Brief disciplinary introduction

The main activity of the river is transporting sediments from the highlands to the valley. The size of the elements transported gives indications about the energy of the flowing water. Moreover, the type of sediments gives indications on the geology of the landscape from which the river comes from. Sometimes the stones found along the river banks, are the same used for the construction of monuments and buildings in the town. Walking along the river and observing the sediments can be an important activity for understanding the territory. The river moves the sediment and it generates a landscape in continuous transformation. Time after time the morphology of the riverbed changes and often in a small river these changes can be observed. In this learning unit students will focus on their river by observing its water course on digital images (e.g. Google Earth) and investigating the water flow energy by the observation of the sediments in different locations along it. They will understand how much information can be gained from observing and analyzing the river sediment, and how covering the rivers causes a potential loss of information to the citizens.



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## Objective of the learning unit

To learn about

- ✓ Geological and geomorphological survey techniques
- ✓ Recognize the stones from the territory

To be able to

- ✓ Acquire skills about how observing the “river-scape” to understand the energy of the river.
- ✓ Work in group
- ✓ Discuss and collaborate in carrying out conclusions

## Introduction (orientation)

**Time estimated:** 10 minutes

**Where the activity takes place:** in the classroom

**Method (how the students have to work):** class brainstorming

**Instructions for teachers:**

- Show some photos or videos of the river in your town or area, or in general, of rivers in town or in areas with anthropogenic pressure.
- Then, ask students:
- *Do you know if the landscape has been always like this?*
- *What is the main modeling agent in your country?*
- *How familiar are you (students) with activities connected to rivers?*

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## Conceptualization

**Time estimated:** 30 minutes

**Where the activity takes place:** in the classroom/lab

**Method (how the students have to work):** group-work

**Instructions for teachers:**

Ask students:

- *What kind of information on the landscape come out from the observation of a watercourse?*
- *Are the stones important elements of the landscape?"*

Take some sediments and pebbles to show to the class and focus on those ones the students pay more attention on. To facilitate the discussion, ask students

- *How would you describe a pebble?*

In groups, the students prepare a list of descriptive aspects from observing the sediment or pebbles, in schematic form as in the example below:

Size	
Roundness	
Angularity	
Main color	
Presence of visible minerals	
....	

When students are ready, pose some questions, for instance

- *What do you think is the relationship between the characteristic of the sediments and river energy?*
- *How would you explore this?*

Starting from this first in-class experience, students define and prepare own worksheet that will be used to gather the information in an outdoor activity.

The students will use the worksheet in small groups, filling the proper fields according to what they have learned in this session.

## Investigation

**Time estimated:** 5 hours

**Where the activity takes place:** in the classroom and outdoor

**Method (how the students have to work):** group-work

**Instructions for teacher:**

In the classroom, the students are divided in groups.

### 1) Planning

- Open the free software *Google Earth*, where it is possible to give an overview about the river course, from the spring, across the mountain, along the valley and across the urban area, until its mouth. It can be useful to look at a geological map of the area and to an atlas of the rocks (or the science schoolbook) to understand what type of rocks you expect to see along the river banks.
- Students identify the most interesting "river locations" or "stops" to collect samples of sediments along the river banks. If in the area there is a hidden river, students should plan to take samples also after and before the covering of the river.
- Students plan the activities to run at each stop and list the useful materials, besides taking photos of the place where the samples are collected and of the landscape around. They prepare a worksheet for the characterization of the river and sediments, and list the materials (e.g. shovel, sieves, plastic freezer bags, notebooks and cameras, mobile phones - on this regard they can use app such as Siftr (see [www.siftr.org](http://www.siftr.org)) to collect simultaneously photos and notes).

The different groups and the teacher agree on the final worksheet and locations for the investigation of the river sediments.

### 2) Performing

Outdoor, at the chosen river location along the river.

- At each stop, each group of students analyze one square meter of terrain in the river bank and fill in the worksheet that they have prepared for the characterization of the

river and sediments. According to the type of sediments, they will perform different activities.

If there are mostly stones, each group:

- 1) Collect some small stones. It will be important to take a detailed photo of the area to verify that the sample is representative of the sediments in that stop.
- 2) Analyze the morphology and the nature of the stones with the worksheet.
- 3) Take a photo of each stone collected and analyzed. The students can bring at school only a few samples, the more interesting and representative.

If there are fine sediments, each group:

- 1) Take a photo of the square meter of terrain and collect around 500 gr of samples (to help this task it is possible to fill a plastic container of about half a liter capacity).
- 2) Separate the materials using two sieves for the particle size distribution (gravel/coarse-medium-fine sand/silt-clay) and put them in one plastic bag each.

Don't forget to take one extra sample (not separated nor filtered) to school for repeating the analysis if needed.

*"How students can inspect the particle size and texture of the sediments? and therefore understand the transport capacity?"*

*For the finer sediments, they can use one sieve (2 mm grid size) to separate the gravels from the finer particles (coarse sand). The coarse, medium and fine sand can be in turn sieved with a 0.5 mm grid size to separate from finer particles (silt and clay). The result of sieving will be the texture size composition of the river sediments. It will be enough to weigh the different bags (one with gravels, one with sands and one with silt and clay). Another method is to shake a jar with sediments and water and let sink the different particles for 48 hours. The stratification can be used to determine the soil texture with the triangle of soil textures.*

## Conclusion

**Time estimated:** 10 minutes

**Where the activity takes place:** in the classroom

**Method (how the students have to work):** group-work

**Instructions for teacher:**

Students should make the connection between the particle size classes of the sediments and the energy variation of the river flow along its course.



Looking at the images of the river from Google Earth, students can trace the water course and indicate for each stop the relevant characteristics and reflect about the flow energy on the base of the landscape characteristics and the river sediments.

## Discussion

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**Time estimated:** 10 minutes

**Where the activity takes place:** in the classrooms

**Method (how the students have to work):** class discussion

**Instructions for teacher:**

Ask students some questions to reflect about the whole investigation, such as:

- *How can the information from the observation of the river be useful for the citizens?"*
- *What about the river in your town?*