



River ecosystems: plant biodiversity

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Module:

**Impacts of human intervention
on river ecosystem**

Total duration: 9 hours

Field work: Yes

List of materials:

Materials for collecting plants
Cameras/Smartphones
Vegetation guides
Plastic bags
Meter

Worksheets: 6

Students' age: 15-18

Use of apps/software: Google
maps/Siftr

Brief disciplinary introduction

The biodiversity is indispensable to support the correct functioning of the system formed by the living beings with the environment they inhabit. In the ecosystems linked to water the nutrient cycle, the water cycle, the soil genesis and soil retention, the resistance to invasive species, the climate regulation and the pollution are aspects highly influenced by the living beings. To know the number of present species in an area, as well as which species are more abundant is indispensable to understand the functioning of the ecosystems linked to the water currents and to value them.

Keywords: acequia (irrigation channel), azarbe (draining channel), rambla (ephemeral and intermittent stream), biodiversity, vegetation cover, functional group, vertical structure, erosion.



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Objective of the learning unit

To learn about:

- ✓ Plan and carry out a research project following the steps of the scientific method
- ✓ Evaluate the plant diversity on studied ecosystems
- ✓ Influence of the presence of open water channels on the plant diversity on the surrounding zones.

To be able to:

- ✓ Quantitatively estimate the vegetation biodiversity in natural and agricultural and urbanized areas.

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Introduction (orientation)

Time estimated: 25 minutes

Where the activity takes place: in the classroom

Method (how the students have to work): work-groups

Instructions for the teacher:

Collect some pictures, photographs of a specific type of water stream, for instance a rambla (ephemeral and intermittent stream).

After an introduction by the teacher, the students meet in groups. They are asked to observe a series of photographs of some characteristic species of the ramblas (ephemeral and intermittent streams), and they are asked to answer the following questions.

Afterwards, the answers will be shared among the groups.

“Do you know some ramblas (ephemeral and intermittent streams)?”

“Could you describe the characteristic landscape of the ramblas?”

“What kind of plants and animals do you think live in the ramblas?”

“Do you know the term biodiversity? What its meaning is?”

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Conceptualization

Time estimated: 10 minutes

Where the activity takes place: in the classroom/lab

Method (how the students have to work): work-groups

Instructions for the teacher:

After the orientation about biodiversity in the ecosystems linked to the ramblas the students have to elaborate one or several hypotheses to be tested along the research.

The hypothesis have to be related to the plant biodiversity and the variables could influence it.

Investigation

Time estimated: 75 minutes in the classroom and one day field trip

Where the activity takes place: in the classroom, field work by the river

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

Instructions for the teacher:

In the classroom, the students are divided in groups for starting *“Studying the plant biodiversity on ramblas (ephemeral and intermittent streams) and acequias and azarbes (irrigation and draining channels)”*

1) Planning

Duration: 75 minutes

In Planning, students should arise the following questions:

1. *Where will we be studying the plant biodiversity?*

With the support with tools as Google Maps or Siftr the students have to locate several points along the rambla or the acequias and azarbes for sampling. Although this is not an essential task, it is adequate to plan the completion of a simple handmade map as well as photographs of the zone. This help us to have a global vision of the study area

2. *How do we measure the plant biodiversity?*

The students will decide the sampling method to be used to quantitatively measure the plant biodiversity. They can be informed about different methods (use of quadrats, line transects with a rope, etc.) as well as different techniques to random choosing the sampling points.

In any case it will be emphasized the importance of an adequate planning, the rigorous work on the sampling as well as the importance of replication to obtain valid data useful for statistical analyses.

3. *How do we estimate the vertical structure of the vegetation?*

Besides to estimate the number of different species and their frequency in an area, it is important to classify the sampled species by their functional groups, to see which are the dominant functional groups. (trees, shrubs, chamaephytes, etc.)

4. *What materials do we need to measure the biodiversity and to collect plant samples in the field?*

The students have to list the necessary material to estimate the plant biodiversity and to collect and to conserve in good conditions the specimens found in the field (pruning shears, field notebook, tables for data collection, newspapers, photographic camera, maps, quadrats, rope, ...)

5. *What method will we select to collect and conserve the specimens?*

It is convenient to know all the steps to a good sample collection (to collect specimens with leaves, flowers, fruits...; to photograph the specimen and of the environment; as well as prepare a field sheet to annotate date, geographical coordinates and name of the person collecting each specimen).

6. *How to identify the plant samples?*

As a full taxonomical classification requires a long expertise out of reach for a learning unit it will be proposed the use of a photographic guide of the zone elaborated by a botanist.

7. How to elaborate information sheets about the observed plants?

Students will be supplied with files containing information taxonomy, habitat and characteristics of the species, with a photograph. The information about habitat will include its classification depending of soil humidity (dry, middle, wet, very wet, saturated).

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2) Performing

Duration: one day

Organization: In the field (ramblas), each group (of 5 students) will work in a concrete zone. It is better in spring (March to May) to find most of the species with flowers and/or fruits.

Materials: The materials proposed by the students for the collection and conservation of plant specimens.

3) Data analysis

Duration: two sessions of 55 minutes each one.

Organization: In the classroom and/or home, in groups of 5.

Materials: the material and the data collected on the fieldwork, computers, photographic guide and field sheets.

Once the specimens are identified and after searching information on Internet the students will elaborate information sheets of the most important species found. Students will be reported of adequate internet directions for the task as well as consultation literature.

On the other hand, with the data collected on the field sheets they will proceed to calculate Simpson's biodiversity index.

$$D = \frac{\sum n(n-1)}{N(N-1)}$$

Where n = number of individuals/cover per species and N = total number of individuals/cover in the community.

The values of D range from 0 to 1, 0 is an infinite biodiversity while 1 is a one species community. As lower is D higher is biodiversity.

After calculating biodiversity per sampling point, the total average and conclusions will be reached in relation with the soil conditions in relation to the water course.



Conclusion

Time estimated: 3 hours

Where the activity takes place: in the classroom

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

Instructions for the teacher:

Part 1. Draft the conclusions of the experimentation

Duration: One session of 55 minutes

Materials: the map of the study area, the sheets elaborated by the different groups, the notes taken on the field and the results obtained by the biodiversity index calculation.

The groups provide their conclusions. They compare the plant biodiversity found in the different points and try to answer the questions asked in the conceptualization phase, testing their hypotheses.

Later students will write a report including:

- The identified species by them on the study area
- The vertical structure of the vegetation (relative abundance of trees, shrubs, subshrubs and herbs)
- The conclusions about the plant biodiversity
- Valuation of the importance of the species appearing in the zone (usefulness, protected species, ...)

The conclusions should determine plant richness and diversity of these ecosystems including the presence of endangered and protected species and the influence of some factors as the distance to the watercourse as well as the presence of pollution point sources on the plant biodiversity. Also, they should include a valuation of the *ramblas* and other water courses as biodiversity refuges and hotspots in their area.

Part 2. Development of the presentation:

Duration: 2 hours

Organization: In the PC room and at home.

Materials: computers with presentations software (Powerpoint; Prezzi)

Each group will prepare a presentation on Power-point or Prezzi explaining steps on the research process and the obtained results.

Discussion and communication

Time estimated: 30 minutes, each group

Where the activity takes place: in the classroom, or in a public event (Multipurpose Classroom, Cultural Week, meeting with parents, etc.)

Method (how the students have to work): group-work or with the whole group

Instructions for the teacher:



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Students can prepare their presentation with software for presentations (Power-point; Prezzi). Also the can be prepared posters about the research and information sheets. The students will be available for the rest of the education community for solving questions and to explain concrete aspects of their work.