DAYLIGHTING RIVERS IN SPAIN, AN EXPERIENCE OF INQUIRY BASED LEARNING: EMBEDDING NEW LEARNING APPROACHES IN A HIGHLY REGULATED EDUCATION SYSTEM

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Civic ecology and inquiry based learning is not independent of its context

Murcia is in the Segura river basin (on the figure)

SE Spain is the driest area of Europe

So *rivers with water* are uncommon landscape features

Some basic data of Murcia surroundings

Annual rainfall < 290 mm, potenital evapotranspiration > 1200 mm. Ephemeral and seasonal wáter courses are the norm

Very intense rains. September 2019 300-500 mm in 24-48 h. To cover rivers is uncommon, not a good idea. But ephemeral rivers are converted in streets passing through the city

Main river (Segura) crosses the city but water quality now is good

Naturalized ('daylighted') channels for irrigation and drainage do exist on the floodplain since IXth cemtury

The *main* objective is to let students to know the different realities of water courses in urban and suburban areas of their hometwon. Using IBL as a tool to inspoire scientific vocation.

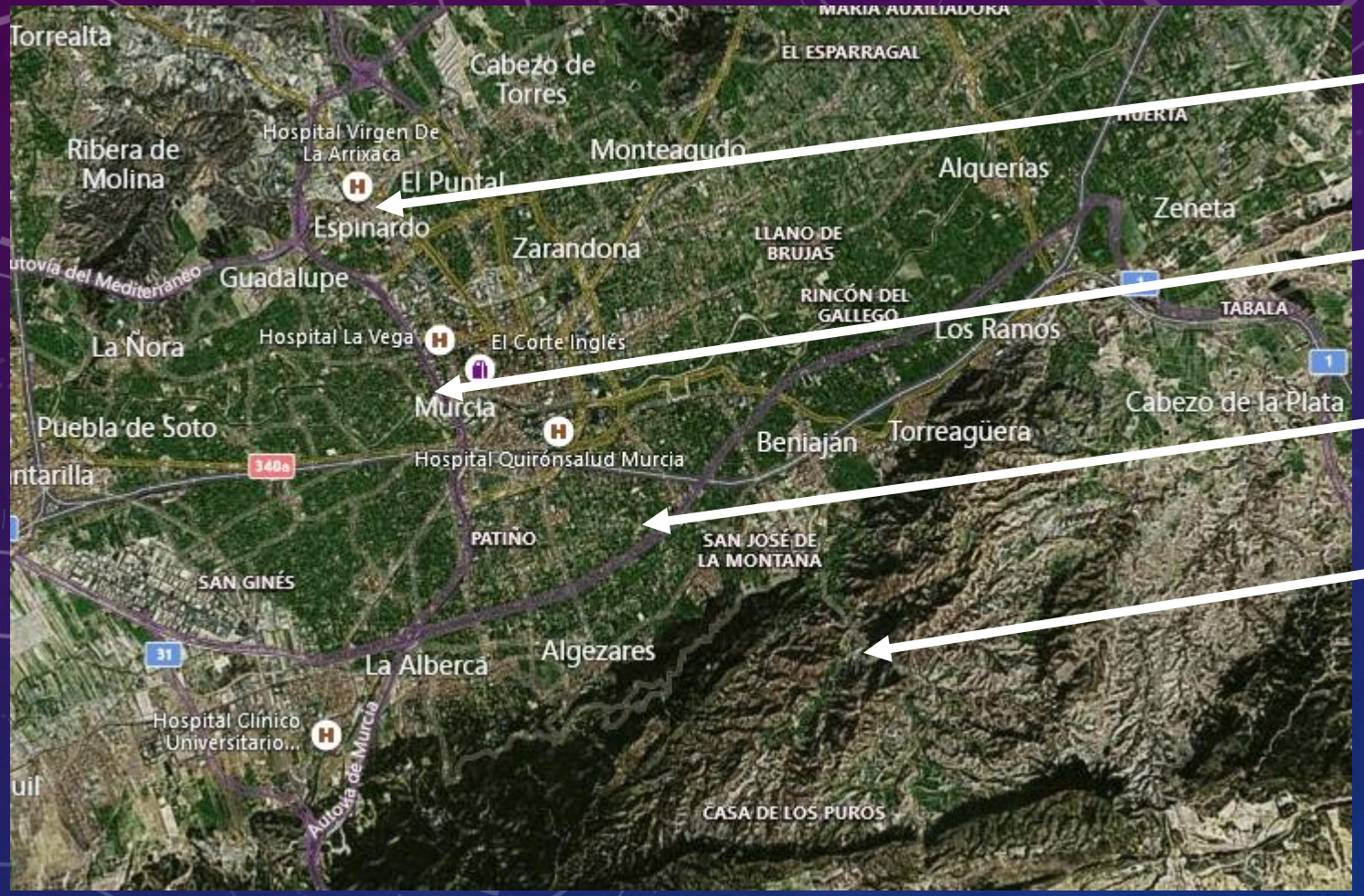
Fieldwork was essential and three field sites were selected. At the same time, as we will see, filedwork is not well matched to a highly regulated education environment.

Three field sites were selected:

Ephemeral water course (flow only after rain) with a heavily urbanized basin

Seasonal water course (flow ceasing in summer or longer periods in droughts), close to the city but surprisingly wild.

Traditdional irrigation system, in the floodplain surrounding the city



Ephemeral water course, heavily urbanized area

The high school is here, just in the city

Orchards in the floodplain

Seasonal water course, wild setting

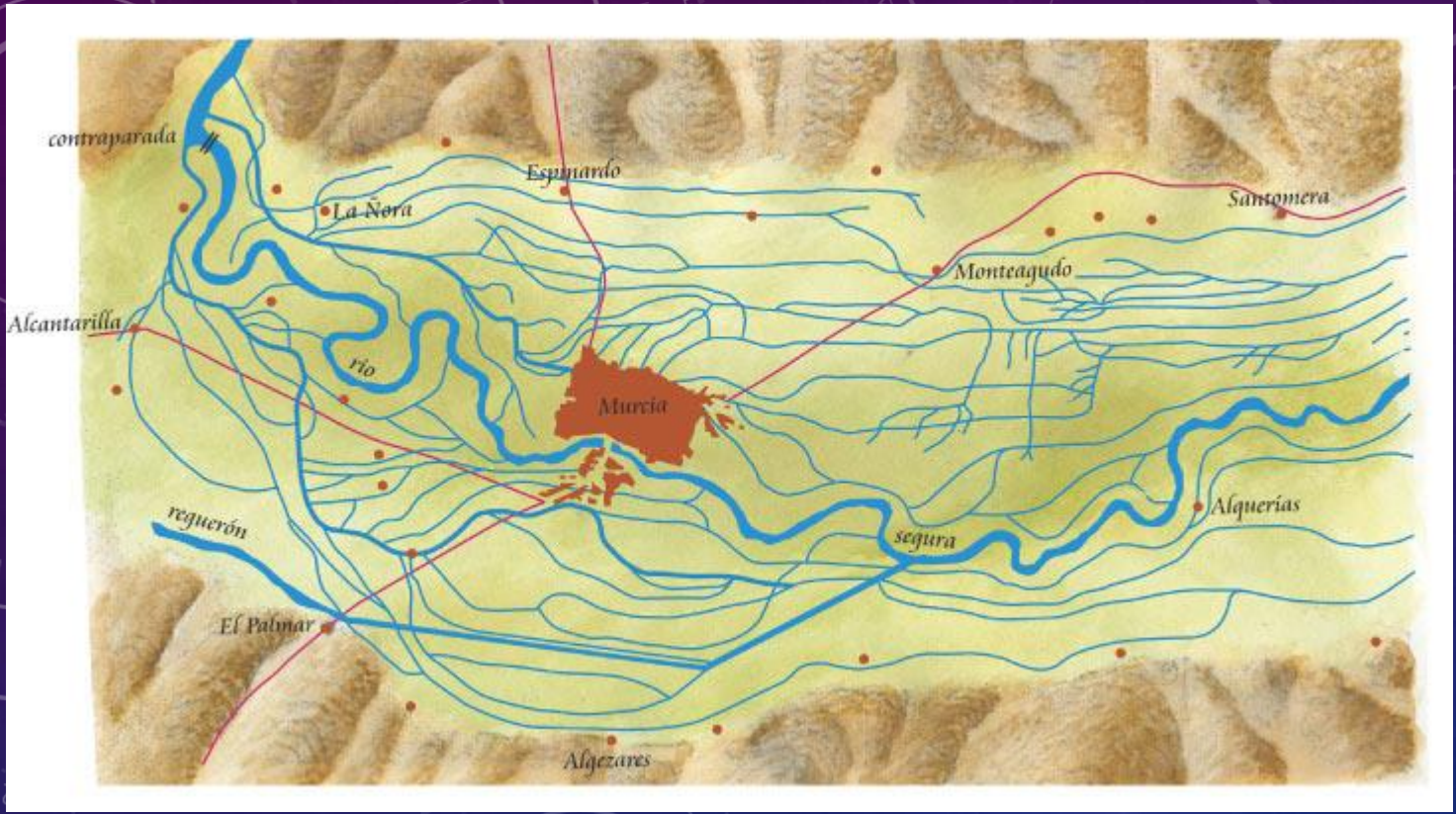
The basin of the Rambla de Espinardo is mostly covered by the impervious surfaces of University Campus.

Water flow is channeled in the campus just towards….

... the town of Espinardo downstream (figures taken from analyses carried out by the students)

Students learnt the impact of rain in the basin with an impervious upstream area and a downstream section converted just in a street.

Last, but not least. Epehemeral water courses are usual places for unregulated wáter disposal. They directly work about.



The network of irrigation and drainage cannel is very dense in the floodplain (in the figure only the backbone of the system).

This reality was mainly unknown to the students

There are sections of high naturalness

But this heritage is being destroyed

Students learnt the logic of the system (irrigation/drainage), its historical context (visiting museums), and the degradation processes

The third site is only some kilometers south of the city and the secondary school but its wild appearance and the diversity of features (geology, hydrology, geomorphpological processes, different sources of pollution, vegetation, fauna, etc.) made it the perfect place for IBL.

They studied how water expands and contracts in a Mediterranean seasonal river

Students learnt to use scientific equipment in the field and understood the physical principles of the measurement methods

They checked water quality and took samples for further lab analyses

And explored biological diversity patterns and the environmental factors controlling them. An *ad hoc* plant guide was created for the site

Hierba de cólico o salsona (*Limbarda crithmoides*)

Descripción: es una mata baja, de entre 50 y 80cm, con tallos rectos y poco ramificados. Hojas carnosas, con tres dientes al final. Flor amarilla compuesta, tipo "margarita".

Ciclo de vida: perenne, mantiene las hojas todo el año. Florece durante el verano.

Conoce sobre ella en estos enlaces:
http://www.regmurcia.com/servlet/s.Sl?sit=c,365,m,1309&r=ReP-27544-DETALLE_REPORTAJES
http://herbariovirtualbanyeres.blogspot.com/2013/08/inula-crithmoides-romero-marino-salsona.html
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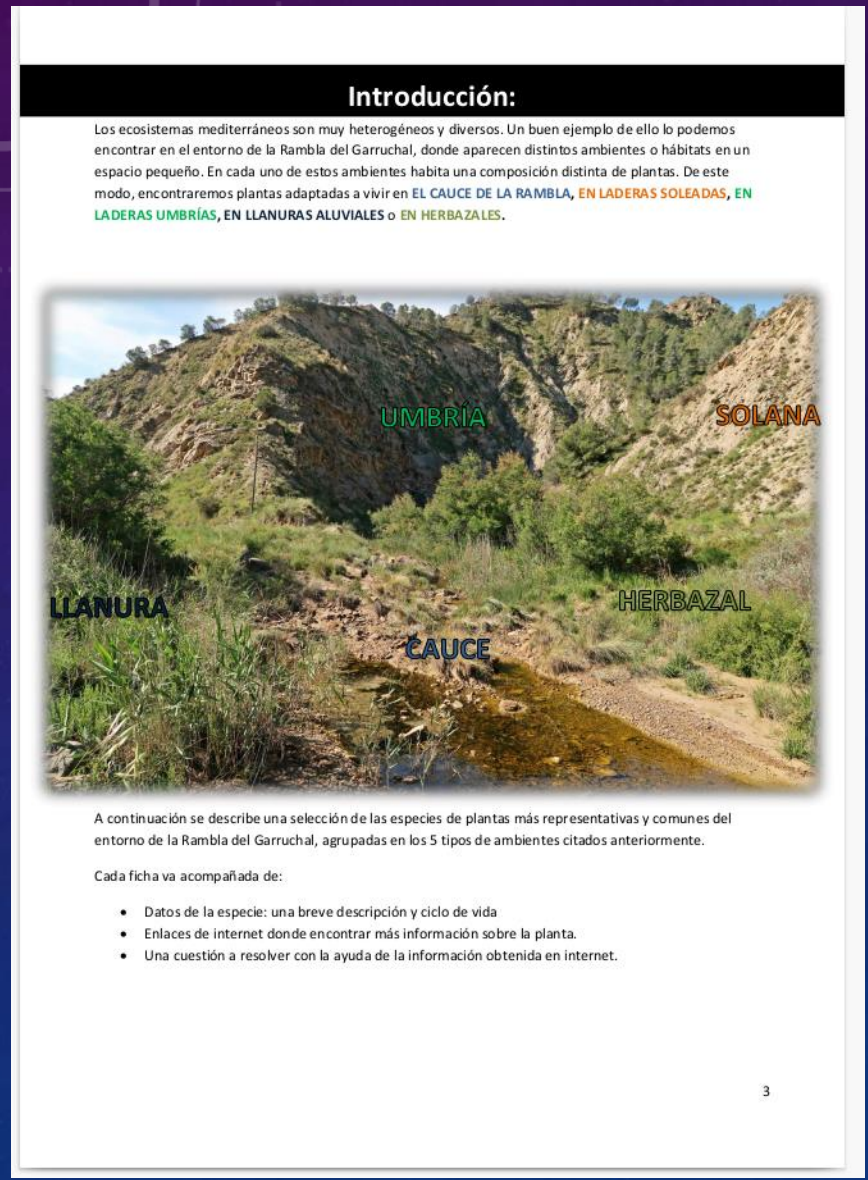
¿Qué peculiaridad presentan las raíces de esta planta? ¿Por qué pueden resultar de utilidad para nosotros?



Introducción:

Los ecosistemas mediterráneos son muy heterogéneos y diversos. Un buen ejemplo de ello lo podemos encontrar en el entorno de la Rambla del Garruchal, donde aparecen distintos ambientes o hábitats en un espacio pequeño. En cada uno de estos ambientes habita una composición distinta de plantas. De este modo, encontraremos plantas adaptadas a vivir en EL CAUCE DE LA RAMBLA, EN LADERAS SOLEADAS, EN LADERAS UMBRÍAS, EN LLANURAS ALUVIALES o EN HERBAZALES.

A continuación se describe una selección de las especies de plantas más representativas y comunes del entorno de la Rambla del Garruchal, agrupadas en los 5 tipos de ambientes citados anteriormente.

Cada ficha va acompañada de:

- Datos de la especie: una breve descripción y ciclo de vida
- Enlaces de internet donde encontrar más información sobre la planta.
- Una cuestión a resolver con la ayuda de la información obtenida en internet.

3

Students valued the experience but above at all the outdoor experience. Most of them had not too much experience walking and observing nature, and doing inquiries about what are the processes underlying the observed patterns.

BUT

What is operating IBL in a 'standard' learning environment?

The problems arising can be divided in *learning at the school* and *working in the field*

Learning at the school

About 30 students participated in the Project. However, they were splitted in several groups. Organizing the 'theoretical' (in classroom) activities was complicated:

1. Time schedule at the school is strict and available teaching time is hardly enough for the curriuclum. Additional topics are difficult to be embedded in the normal flow of teaching

2. 'Experimental' students were allocated in several groups and matching everything became a *sudoku*.

Working in the field

1. You need to find additional time for going out to the fields (a must in Daylighting rivers). Constrained to be within 'oficial' teaching times, it left not too much opportunities.

2. Logisitics, especially transport. You have to move the whole group. It was not posible to combine a full excursion with further visits by litle groups (not authorisation would be posible).

3. Managing a group of 40 people for field work is complicated and not effective.

4. Teachers are not easily available because their tighted time table

→ Implementing IBL in a 'standard' school is going to be difficult. At school some reorganization could alleviate the problema, however fieldwork is going to be a major problema because strict norms about security.

The Research curriculum in the high school in Murcia (Spain) and its compatibility to IBL

The basic law of education in Spain is frequently changed but it establishes as a basic skill to be achieved at high school the fundamentals of scientific research and methods and promote autonomous work.

In the Region of Murcia a *Research* curriculum was set one decade ago. High schools can apply to be qualified to teach this curriculum *but* it does not convert the school in a research high school but let to créate experimental groups of until 30 students to be in the research curriculum.

The research curiculum does not substitute the standard one but complement it. The basic difference is research curriculum basic methodology being the scientfic method. *That is obviously close to IBL aims*

The experience of Daylighting Rivers Project and the research curriculum in Murcia's high schools (1)

Research curriculum is organized around *specific* student groups, with dedicated teachers. This substantially different to embed IBL in the standard curriculum as: (i) there is not an additional burden to students and teachers; (ii) clases can be organized purposively to the method.

The inmediate question is:

Is it posible the implemetation of some IBL oriented topics embedded in a standard curriculum?

The experience of Daylighting Rivers Project and the research curriculum in Murcia's high schools (2)

From our experience its seems not very advisable simply embed some IBL within the standard curriculum. It could be a good approach if the school organization was not so rigid and constrained.

The most singular aspect of research curriculum is that students have to develop a research work along the academic year. In the learning untis of *Daylighting Rivers* project students have to do a mini-research Project, but they were organized in groups carrying out specific tasks more than carrying out a whole research project.

Changing the school to the research curriculum is not posible as law only let experimental groups within the high school. Note also, that even in the public school, it is going probably that most of the students of the experimental groups will come from wealthier families.

In the region, the research curriculum is not thought to change the learning system but to offer additional opportunities to predisposed students probably with good academic achievments.

The experience of Daylighting Rivers Project and the research curriculum in Murcia's high schools (3)

Could we facilitate the embedding of IBL approach into the 'standard' learning?

Instead of implementing the IBL learning unit in a continuous way distribute it along the year. It will be possible to find more 'spare' time and give more time to students to mature the mini research project participating in all the flow more than in particular tasks. It would reduce burden of extra time and smooth constrains

'Redress' learning units. Instead creating them from the scratch do aggregate contents of several related units within the compulsory curriculum. In such away the IBL learning unit *does not add* over the standard curriculum but *complement* it-

Fulfilling this principles may let students developing mini research projects linked to the IBL learning unit

The experience of Daylighting Rivers Project and the research curriculum in Murcia's high schools (4)

Research curriculum in Murcia make emphasis in three ideas: (i) search of information; (ii) experimental work in labs *but* not on fieldwork.

Searching information is easier tan ever before, but labs in the high schools are not so well equipped as necessary and we saw how difficult is implementing fieldwork.

So even with the proposed changes resources and school organization may yet be limiting to a succesfull implementation of IBL approach at the school within the standard curriculum.

Thank you