

KNOW YOUR STREAM!



Notebook with contents and activities

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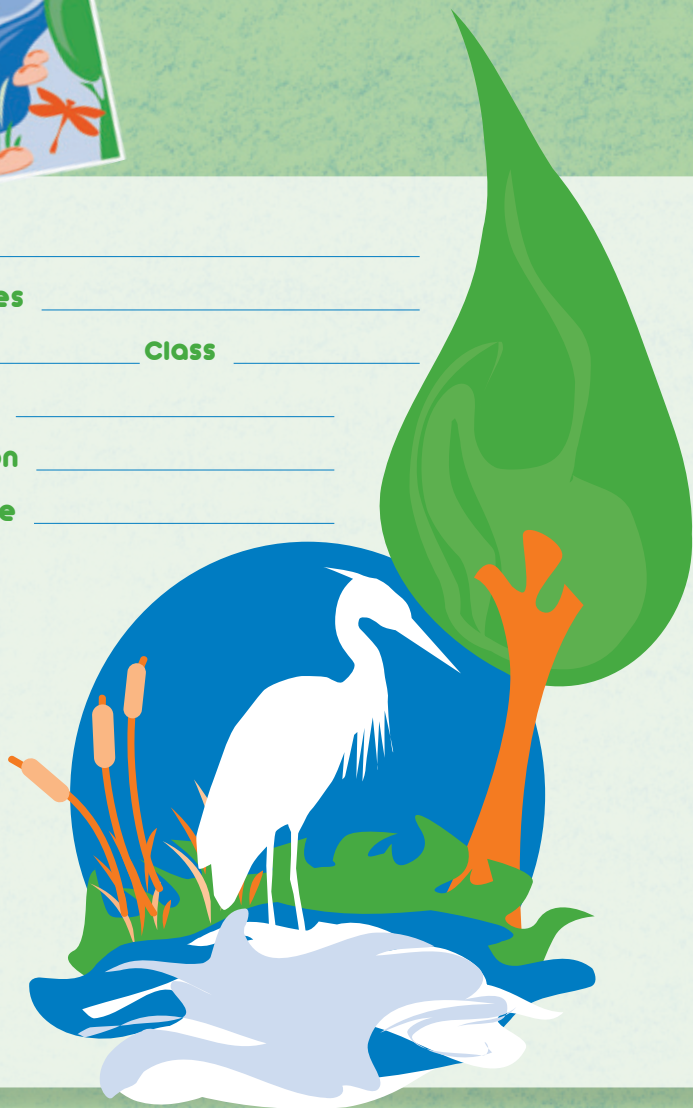
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GOBIERNO
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Y MEDIO AMBIENTE

CONFEDERACIÓN
HIDROGRÁFICA
DEL DUERO



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Adecagua (pages 18 and 24 bottom of page); Hydra (pages 10 and 22)

© Edited by: Duero River Basin Authority

C/ Muro, 5

47004 Valladolid

www.chduero.es



Publications Catalogue of the General State Administration: <http://publicacionesoficiales.boe.es/>

Design and layout: Europa Agroforestal, S.L.

Printing and binding: Gráficas CELARAYN, S.A.

First Edition: January 2016

NIPO (Official publication identification number): xxxxxx (paper copy)

NIPO (Official publication identification number): xxxxxx (on-line)

Legal deposit: VA- xxx

Technical data:

Format: DIN A5 (vertical)

Text box: 12 x 18 cm

Layout: 1 column

Typography: Geosans Light size 10 and Dunkin Sans size 18 and 12

Binding: Saddled stitch with wire staples

Cover page: CYCLUS PRINT, 200 g/m² paper

Inside paper: CYCLUS PRINT, 115 g/m² paper

Inks: Four colour printing on front, four colour printing on back

KNOW YOUR STREAM!

Notebook with contents and activities

Duero River Basin Authority
Environmental Education Programme





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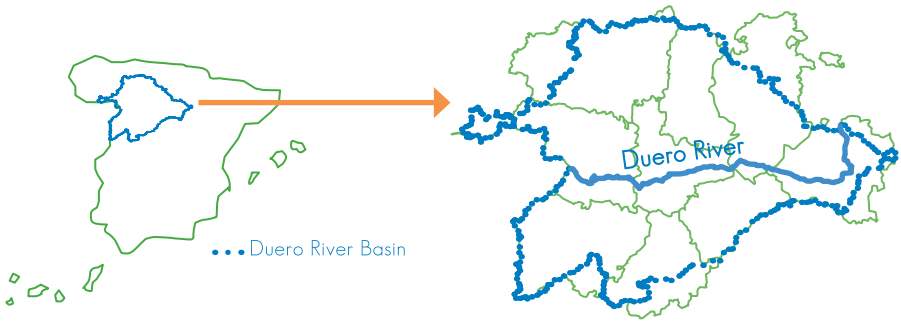
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CONTENTS



1 WHERE ARE WE? IN THE DUERO RIVER BASIN



Your stream is in the **Duero River Basin**. Its main characteristics are ...

... it extends through 2 countries: Spain and Portugal, being the largest basin in the Iberian peninsula.

... its surface area is 78,859 km².

... it extends through 8 Autonomous Communities: Castile-Leon, Galicia, Cantabria, Rioja, Madrid, Castile-La Mancha, Extremadura and Asturias.

... it borrows its name from the Duero River.

Duero River

- The headwaters of the river are in the Urbion Mountains, in Duruelo de la Sierra (province of Soria).
- Its outlet is located in Oporto (Portugal).
- It flows through the capitals of the provinces of Soria and Zamora.
- Its main tributaries are the Pisuerga, Valderaduey and Esla on the right margin, and the Duratón, Adaja and Tormes on the left one.

● It has natural spaces which are specially valuable due to their vegetation, fauna and relief; many of them are associated with the Duero tributaries.

REMEMBER THAT...

...a **river basin** is the land area where precipitation waters (rainfall, snow, etc.) drain to a common point, which can be a river, a lake,

or the sea. The boundaries of the basin or **drainage divide** are natural boundaries and correspond with the highest parts of a river.

2 WHAT IS AN ECOSYSTEM?

An ecosystem is a **set of elements** or pieces (as in a puzzle) **which are interrelated and from which they all derive a benefit**, such that if one of those pieces is removed or deteriorates, the set is no longer complete. These elements are:

- **Living organisms** (animals and plants).
- The **physical environment** where those living organisms live, or which sustains them (the soil, water, and air).

There are many ecosystems on planet Earth, but the main ones are:

- **Terrestrial ecosystems:** forests, prairies and deserts.
- **Aquatic ecosystems:**
 - Streams, brooks and freshwater ponds.
 - Seas and oceans.

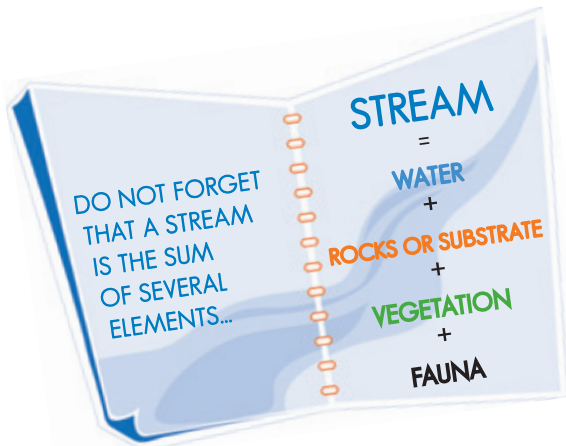
The **stream ecosystem**, where you are now, is made up of the following elements:

- Water.
- Substrate.
- Flora, trees, shrubs and aquatic plants.
- Riparian fauna, in particular the birds that live in the trees and also fish and microorganisms that live in the ground, trees and water.



3 KNOW YOUR STREAM

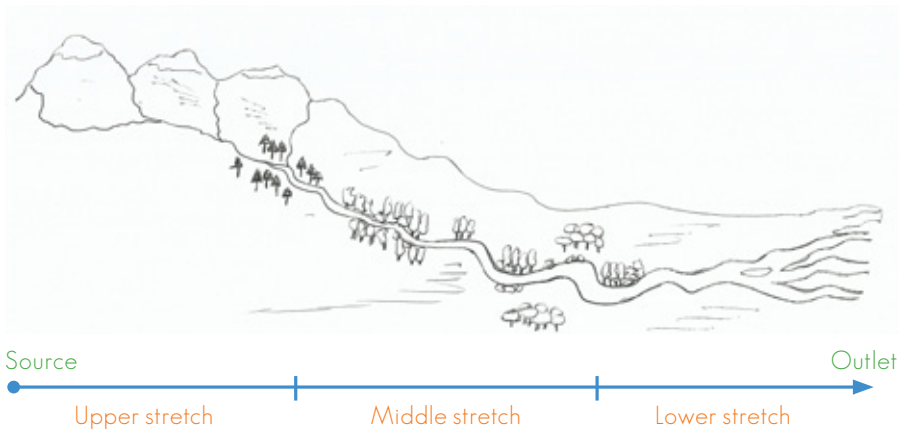
We are going to learn about each of these elements.



3.A How do we divide a stream lengthwise?

Streams can be divided into **three stretches** along their course from the headwaters or source to the outlet into another stream or into the sea:

- **Upper stretch:** it has **fast flowing waters**, fauna and flora are not very abundant, and there are large size stones and rocks on the bed.
- **Middle stretch:** the current is **slower** and there is a large variety of fauna and flora; the bed has cobbles and pebbles, gravel and coarse sand.
- **Lower stretch:** with **slow flowing waters** and scarce fauna and flora; the bed has fine sand and silt.



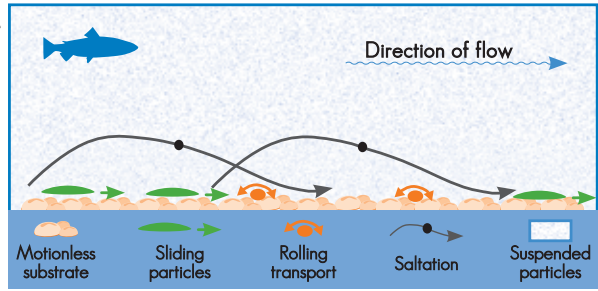
Depending on the stretch of the stream where we are, the substrate or bed materials vary in terms of size, and thus we can find the following differences:

Type of substrate	Grain diameter (en mm)
Boulders	200 mm (larger than a basketball)
Pebbles and cobbles	20-200 mm (between a basketball and a large marble)
Gravel	2-20 mm (between a large marble and a grain of rice)
Sand	0.063-2 mm (between a grain of rice and the head of a pin)
Silt	0.0002-0.063 mm (smaller than the head of a pin)

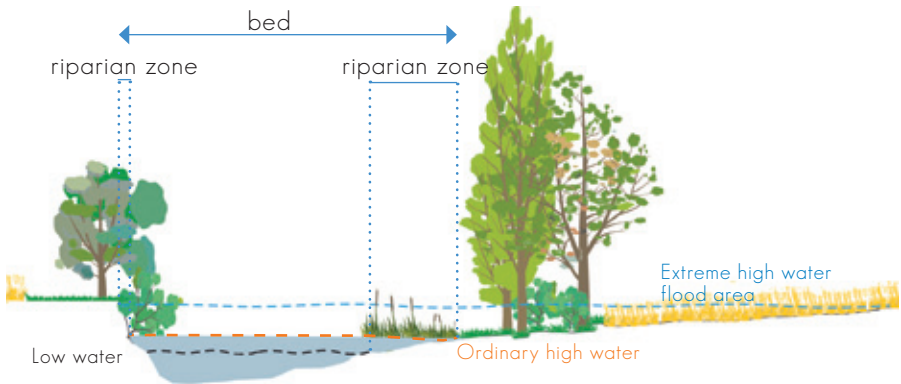
Source: Field worksheets. Explore your stream. Cantabrian Rural Development Network. Table drafted according to the classifications of Wentworth and DIN4022.

Stream materials can move by different means:

- Suspension.
- Saltation.
- Rolling.
- Sliding along the river bottom.



3.B What are the essential parts of a stream cross section?



3.C stream vegetation

One of the main elements of streams is the riparian zone, where many species of plants and animals live.

The presence of vegetation in streams is very important, because ...

... **it regulates the stream's climate**, providing shade and lowering the temperature, specially in the summer.

... **it houses a large number of animal species** (birds, mammals, reptiles, amphibians, invertebrates, etc.) and **plant species**.

... **it holds the banks of the stream** so they do not slide into the water.

... it acts as a **filter** to prevent contaminants from reaching the water in the stream.

... it has an **essential cultural, recreational and landscape value**.

Stream vegetation adapts to the conditions along and across the water course in such a way that we may outline a structure based on the proximity to the water course:

- **Aquatic vegetation:** it comprises the **species** which always have their stems submerged in the water. These are the rushes, reeds, cattails, water lilies, etc.



- **Bank vegetation:** it consists of **tree or shrub species** which need a lot of water and can endure flooding quite well. They are very adaptable plants and reproduce easily. It is here where willows and alders occur.



- **Floodplain vegetation:** these are **deciduous species** such as elms, ashes and poplars. They need abundant water but their roots must not be inundated.



Narrow-leaved ash
Fraxinus angustifolia



White poplar
Populus alba



Field elm
Ulmus minor



Black poplar
Populus nigra

● **Climax vegetation:** further from the stream, it consists of **vegetation adapted to each area's climate**. These would be pine trees, holm oaks or any other species characteristic of each latitude.

REMEMBER THAT THE WATER TABLE.

... is also known as the PHREATIC SURFACE.

... this name comes from the Greek word Phreat = well.

... the phreatic zone refers to fresh groundwater in our planet and it is located at different depths depending on the origin of the water or the sea level.

1 Aquatic vegetation

Rushes, reeds, cattails, water lilies, etc.

2 Bank vegetation

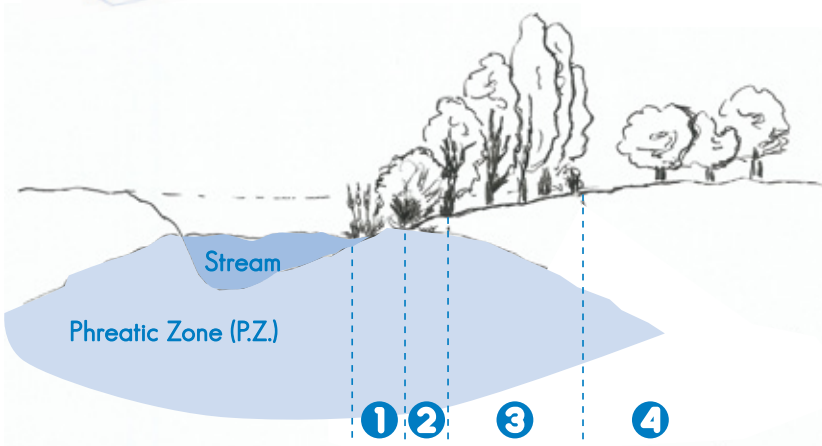
Willows, alders, etc.

3 Riparian vegetation

Poplars, elms, ashes, etc.

4 Climax vegetation

Pine trees, holm oaks, Portuguese oaks, etc.



3.D stream fauna

In a stream we can find plenty of animals that we may or may not be able to see with our naked eye. Stream fauna is diverse.

The group of vertebrate animals is usually the most noticeable one; among them stand out mammals such as the **water vole**, the **otter** or the **Pyrenean desman**, found in the upper stretches of streams in the Duero basin.

You may also see birds such as the **mallard**, the **grey heron**, the **common kingfisher**, or the friendly **white-throated dipper** in fast flowing streams. The curious **European robin**, the **Eurasian blue tit**, the **black redstart** or the **white wagtail** may show up and go along with you while you visit de stream, together with the **red kite**, always watchful.

Also, if you are lucky, you may be surprised by the sight of some fish while you explore the stream. The **bermejuela** (a cyprinid) or the **brown trout**, both native dwellers of our streams, or the not so welcome **black bass** may be found in the stream, together with amphibians such as **Perez's frog** or the **viperine water snake**. You should always be attentive to see them or discover their footprints or signs.



Southern water vole
Arvicola sapidus



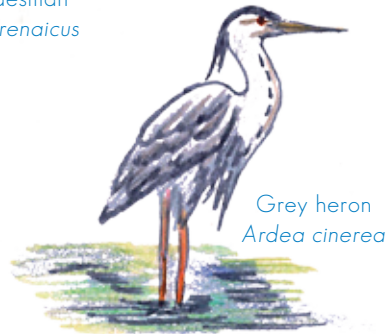
European otter
Lutra lutra



Pyrenean desman
Galemys pyrenaicus



Mallard
Anas platyrhynchos



Grey heron
Ardea cinerea



Common kingfisher
Alcedo atthis



White-throated dipper
Cinclus cinclus

White wagtail
Motacilla alba



Eurasian blue tit
Parus caeruleus



European robin
Erithacus rubecula

Black redstart
Phoenicurus ochruros



Red kite
Milvus milvus

Perez's frog
Rana perezi



Viperine water snake
Natrix maura



Bermejuela
Chondrostoma arcasii



Brown trout
Salmo trutta



Black bass
Micropterus salmoides

4 HOW DO WE KNOW THAT A STREAM IS IN A GOOD STATE?

You will find out analysing the following indicators:

- Hydrogeomorphological indicators.
- Physico-chemical indicators.
- Biological indicators.

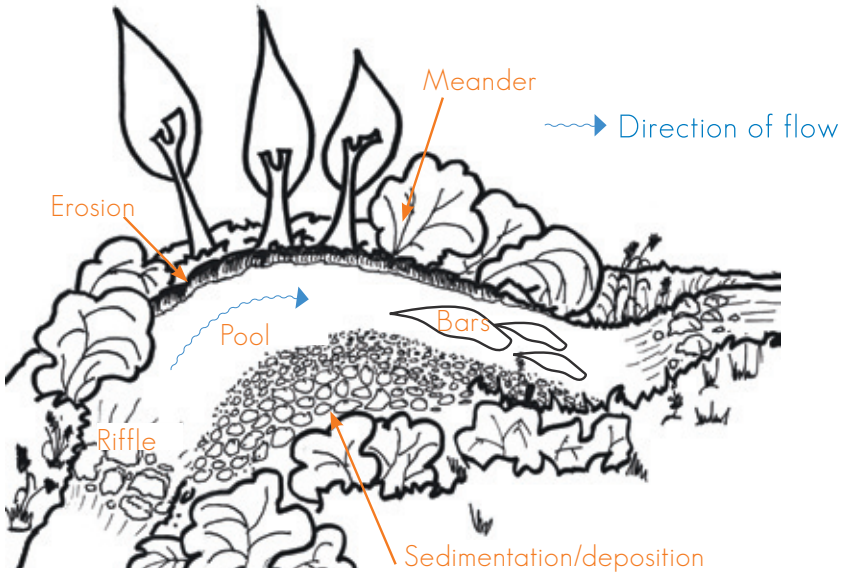
4.A Hydrogeomorphological indicators¹

Streams are constantly evolving systems. They are always changing; hence, your stream will never look the same way to you. For that reason, it is important to know:

- Water **velocity** in m/s.
- Stream **width** in m.
- Stream **depth** in m.

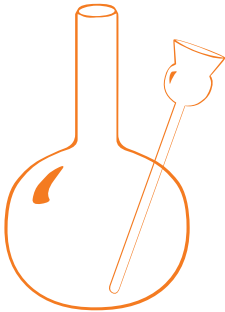
Since the river is not static, it creates its own distinct course with every step it takes. In the following sketch, you can see the name of each of the elements that it creates and the work it does along its course:

¹ Hydrogeomorphological = the study of landforms caused by the action of water (hydro = water; geo = land; morpho = form; logical = study).



4.B Physico-chemical indicators

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These are the elements that we can analyse to verify whether the water has or does not have a certain quality that allows the elements it contains to live in it. The main ones are as follows:

- **Turbidity:** a lack of water transparency due to the presence of suspended particles. In order to ensure the proper development of the living organisms present in the water, it is essential to have the lowest turbidity level possible.
- **Temperature:** an indicator that allows us to measure heat and cold. Water temperature is very important because it is an indicator of the amount of dissolved oxygen in the water: the lower the temperature, the greater the amount of oxygen in the water.
- **Dissolved oxygen (O_2):** the amount of oxygen dissolved in the water. Oxygen is essential for the life of the organisms that occur in the water.
- **pH:** a measure of the acidity of a liquid, water in this case. It ranges from 0 to 14. The pH value is very important for the development of life, since very few organisms can tolerate a pH below 7 or above this value.

- **Nitrates:** compounds containing nitrogen; their presence in our streams indicates that they may be subject to a certain degree of pollution. Nitrates result from human activity in cities, from industries, and from agricultural production (livestock and fertilizer use in crop cultivation).
- **Water hardness:** it depends on the content of calcium and magnesium in the water. Usually water hardness is a natural feature and is a result of the water flowing over and through the ground. In this way, those streams that flow over and through sandstones and granite have soft waters, and those which flow through limestone or gypsum terrain, have hard waters.

These indicators can be measured with the sampling equipment provided by **Adecagua**, which can be requested at their website: www.adecagua.es. Further information is available at <http://www.adecagua.es/dmcca.htm>.

These indicators can also be calculated using laboratory materials such as measurement bottles of different sizes and universal indicator paper strips (particularly in the case of the pH and nitrates).

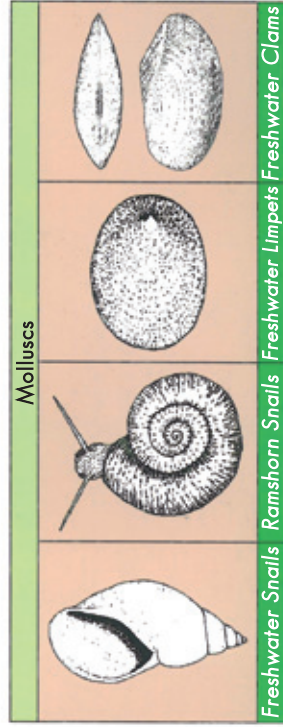
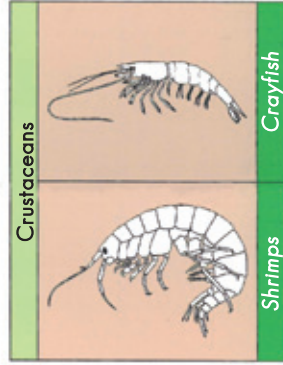
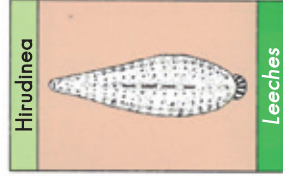
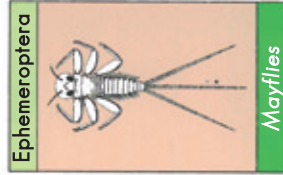
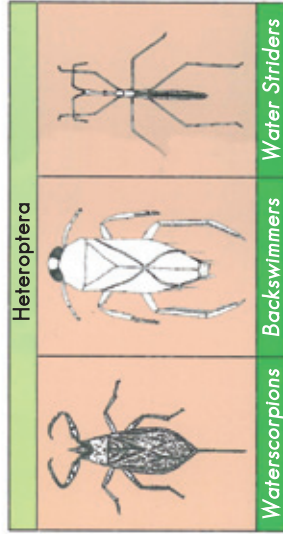
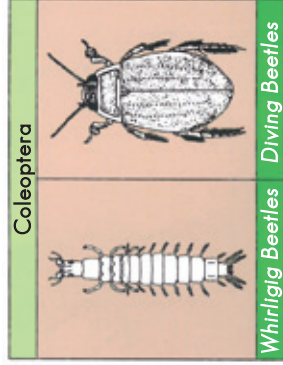
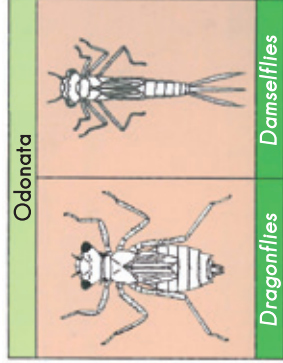
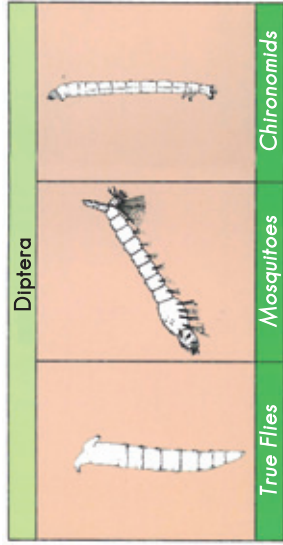
4.C Biological indicators

Earlier on we showed you vertebrate animals occurring in a stream; now we will show you some of the invertebrates that live in it.

To know whether water is in good condition from a biological perspective, we use an indicator known as **Macroinvertebrate Index**. **Macroinvertebrates** are bugs which can be seen with the naked eye (hence we call them macro); they are larger than 0.5 mm and smaller than 3 mm in size. These bugs are very sensitive to variations in water quality and will indicate whether the water quality in your stream is good or not. As well, they are easily seen and it is fun to find them. Here we show you a table where you can see the macroinvertebrates we may find adhered on to rocks, hidden in the river bed or suspended in the water.

This table can also be found in the Adeagua manual.





Molluscs

ACTIVITIES



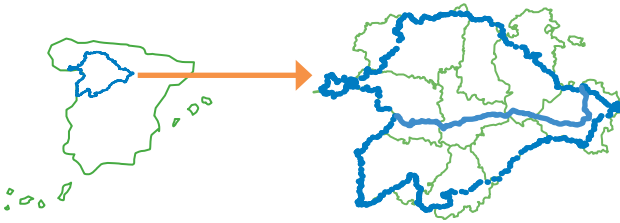
A1 WHERE ARE WE?

Once we have shown you the many attributes of stream ecosystems, we will start doing some interesting activities adapted to your stream. However, before we do that it is very important **to know where you are**.

Surely you already know the place we came to. You have probably walked and played around here many times and maybe you have even gone for a bike ride around here with your friends. To carry out the activity we have planned, it is important to know the elements that surround you, in order to find your way around and situate what you are going to do. The trees or animals that you see, the sounds you hear or any other element or clue that you consider appropriate to help you situate correctly, will help you understand the stream ecosystem.

Draw a sketch with the elements shown below to situate your stream.

20 activities



Trees



Shrubs



Aquatic vegetation



Houses and any other buildings



Stream/brook

A2 KNOW YOUR STREAM

A2.A How do we divide a stream lengthwise?

- In which stretch of the stream are you now? Please circle the correct option:

Upper stretch

Middle stretch

Lower stretch

- Next, identify the materials in your stream or brook and mark them down in the following table:

Type of substrate

Boulders

Pebbles and cobbles

Gravel

Sand

Silt

- How do you think those materials arrived here? Why?

- Through suspension, because
- Through saltation, because
- Rolling, because
- Sliding along the river bottom, because

A2.B What are the essential parts of a stream cross section?

Remember the parts of a stream and try to locate them in the following sketch:

Element

No.

Bed

Riparian zone

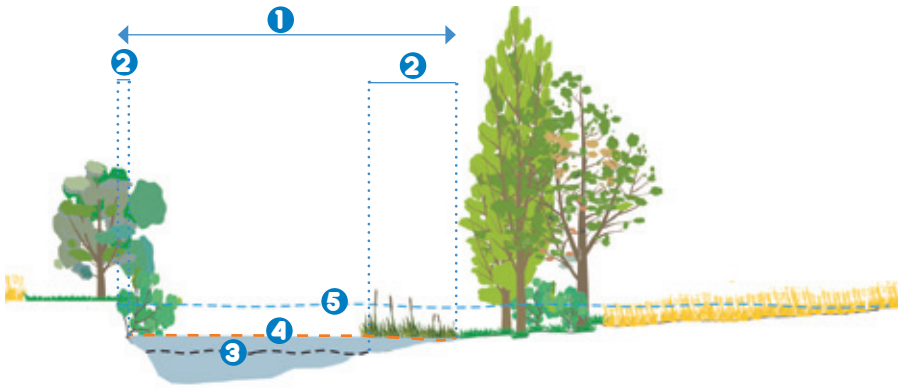
Extreme high water flood area

Element

No.

Low water

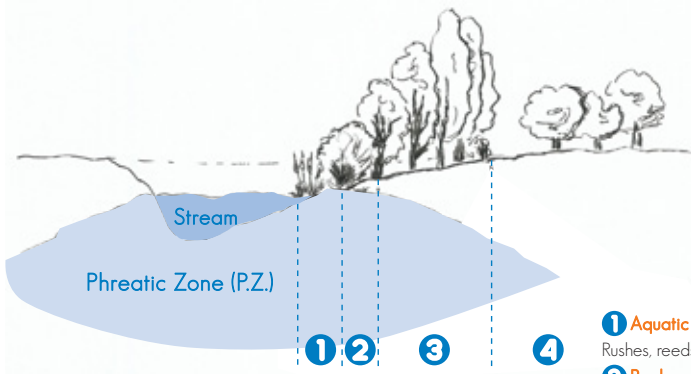
Ordinary high water



A2.C stream vegetation

Please indicate which trees or shrubs you see in your stretch of stream and write them down in the sketch we show you below.

1. _____
2. _____
3. _____
4. _____



- 1 Aquatic vegetation**
Rushes, reeds, cattails, water lilies, etc.
- 2 Bank vegetation**
Willows, alders, etc.
- 3 Riparian vegetation**
Poplars, elms, ashes, etc.
- 4 Climax vegetation**
Pine trees, holm oaks, Portuguese oaks, etc.

A3 HOW DO WE KNOW THAT A STREAM IS IN A GOOD STATE?

A3.A Hydrogeomorphological indicators

WATCH OUT! First take a look and observe where did the high water level reach up to during the past year.

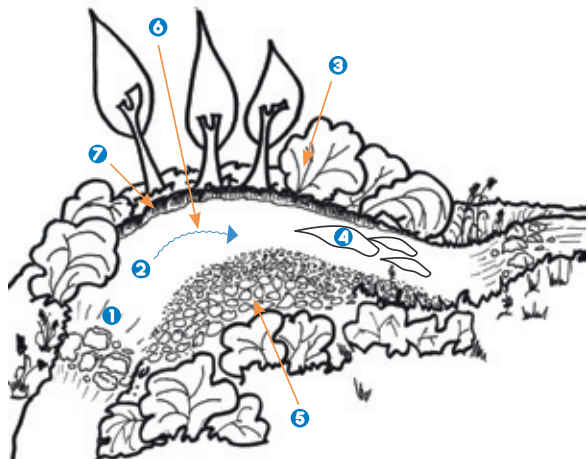
Follow the explanations of your instructor at all times and you will see that the stream reveals all of its secrets:

- ... what is the water velocity in m/s:
- ... what is the stream width in m:
- ... what is the stream depth in m:

Furthermore, since the river is not static, but constantly moving, it is important for you to become a real stream detective and indicate what you can see in the stream stretch that you are studying. Please indicate in the following drawing the elements that we show you:

Element	Number
Meander	
Erosion	
Sedimentation, deposition	
Bars	

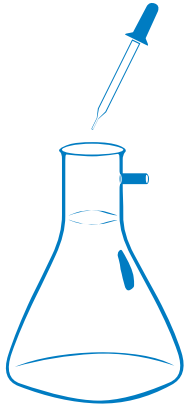
Element	Number
Riffle	
Pool	
Direction of flow	



A3.B Physico-chemical indicators

Please write down next to each indicator the results that you obtain from the analysis you do with your classmates. Follow closely the steps your instructor demonstrates and the materials that he/she uses to find out what the water of the stream contains:

Parameter	Result
Temperature	
Turbidity	
Dissolved oxygen (O ₂)	
pH	
Nitrates	
Water hardness	



activities

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A3.C Biological indicators- macroinvertebrates

Follow the guidelines in the template you have on page 18 to find out which macroinvertebrates are on the bottom of the stream, suspended in the water, hidden between the rocks, or just carried by the current. **You will discover a world of residents and dwellers you had never seen before!**

Collect the macroinvertebrates as your instructor shows you and follow his/her indications at all times.

Name



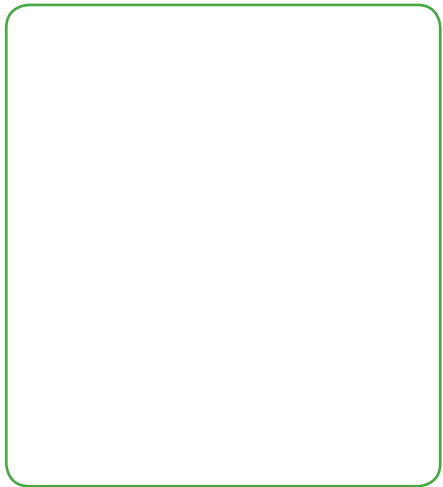
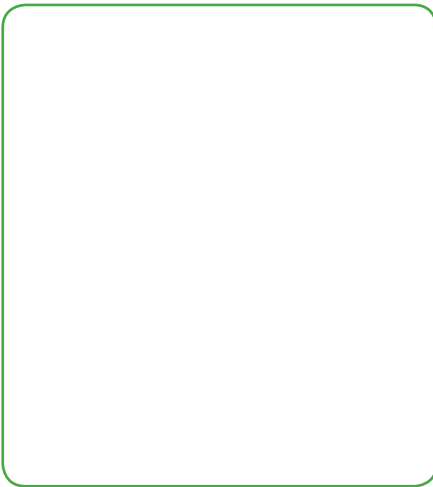
A4 LOOK!

You can also see and observe the stream through its smells, colours, sounds, and sensations, that is, you can feel it.

Draw what you see in the space below, using simple curves and straight lines.



Now divide the drawing you just did into two parts: on one side you will draw the **man made elements**, and on the other side, **the natural elements**.



A5 LISTEN!

Next, please write down 4 sounds that you identify:

- 1
- 2
- 3
- 4

A6 SMELL!

In this riparian space there are smells that cannot be noticed elsewhere. Write down 3 different smells you notice and describe how you perceive them to be:

activities

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Smell	Pleasant/Unpleasant
_____	_____
_____	_____
_____	_____

A7 TOUCH!

Look at the leaves on the ground. They come from the trees or shrubs that grow in the riparian zone of streams.

You can touch them and feel them.

Touch two leaves, close your eyes and write down what you feel: roughness, smoothness, heat, cold, bumpiness, velvet-like, etc.

Leaf	Feeling
_____	_____
_____	_____

A8 WHAT DO YOU KNOW ABOUT THE PLANTS OF OUR STREAMS?

Please indicate whether the following statements are true (T) or false (F).

T/F

The black poplar is a small tree that never loses its leaves.

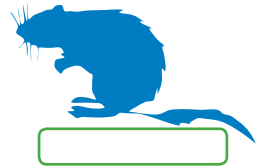
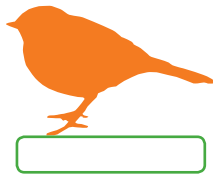
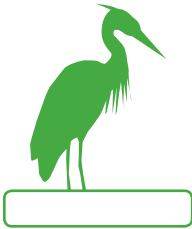
The willow has flexible leaves and some species of willows are used to make wicker baskets to carry mushrooms, bread, etc.

Beside the trees there are always other plants, shorter ones, the SHRUBS; they are harmful for the trees and the stream.

The elm is a tree species which is disappearing from riparian zones because it suffers from a disease known as DUTCH ELM DISEASE.

A9 IDENTIFY!

In the riparian zone of our streams there are always animals; some can be seen and others cannot, but they are there and live thanks to the nourishment that the stream provides them. You might be lucky and see many of them. If that is not the case, don't worry! Maybe next time. Try to identify to which animal corresponds each of these outlines



A10 KNOW THE TREES AND THE ANIMALS

To finish the study of your stream, **you will learn how to complete a worksheet about a tree or an animal.** Since you are bound to enjoy this activity, we will leave with you more worksheet templates, so that another day you can fill in the information on plants and animals that you learn about today. You can look for help in guides, in the Internet, etc.

Tree worksheet No. 1

Stream where it is located:

Date:

Common Name:

Scientific Name:

Family:

Height (make a drawing)

Bark (make a bark rubbing)

Colour:

Texture:

Leaves (make a drawing)

Type: simple compound

Edge:

Shape:

Veins:

Name of the fruit
(Make a drawing)

Flower
(Make a drawing)

Observations (habitat, etc.)

Tree worksheet No. 2

Stream where it is located:

Date:

Common Name:

Scientific Name:

Family:

Height (make a drawing)

Bark (make a bark rubbing)

Colour:

Texture:

Leaves (make a drawing)

Type: simple compound

Edge:

Shape:

Veins:

Name of the fruit
(Make a drawing)

Flower
(Make a drawing)

Observations (habitat, etc.)

Fauna worksheet No. 1

Stream where it is located:

Date:

Common name:

Scientific name:

Family:

Indicate the type of animal:

mammal bird reptile amphibian fish insect

Size. How big is it? To find out, compare it to an object you know.

Where did you see it?

Make a drawing

Where do you think it lives?

Fauna worksheet No. 2

Stream where it is located:

Date:

Common name:

Scientific name:

Family:

Indicate the type of animal:

mammal bird reptile amphibian fish insect

Size. How big is it? To find out, compare it to an object you know.

Where did you see it?

Make a drawing

Where do you think it lives?

All LET'S TAKE CARE OF THE STREAM!

Write down 4 pieces of advice so that, TOGETHER, we can **take care** of the stream and **preserve** it.

1

2

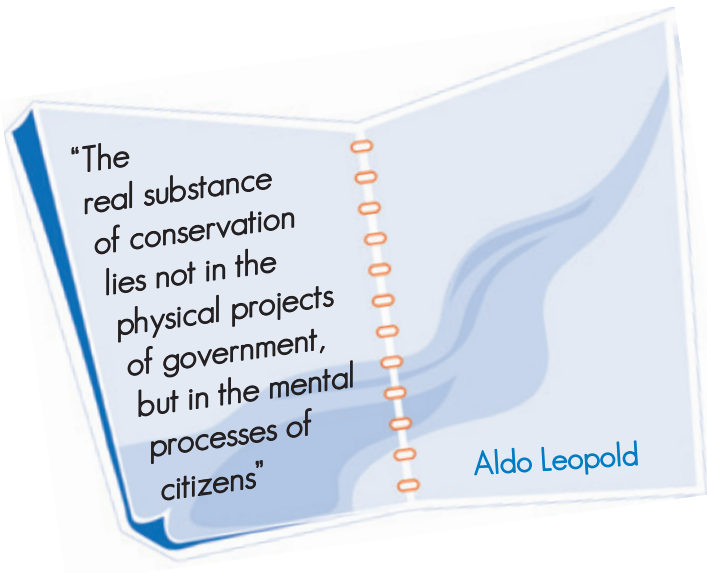
3

4

MY NOTES

A series of horizontal dotted lines for writing notes.

MY NOTES

An illustration of an open book. The left page contains a quote in black text. The right page is light blue with a wavy pattern and the author's name in blue text. The book has a white spine with orange rings.

“The
real substance
of conservation
lies not in the
physical projects
of government,
but in the mental
processes of
citizens”

Aldo Leopold



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DE ESPAÑA

MINISTERIO
DE AGRICULTURA, ALIMENTACIÓN
Y MEDIO AMBIENTE

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