

**C. A summary report describing the learning process - to be prepared by the referent (teacher or other adult supervisor)**

## **"Daylighting Rivers Science Education for Civic Ecology"**

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- Engagement of the students by the teacher/supervisor (method of communication).

In the greek educational system, especially in Lyceum level, there is, unfortunately, scarce free time for interdisciplinary projects like DAYLIGHTING RIVERS.

Learning approach through Natural Sciences, Mathematics, Technology, History, Sociology and Economics is definitely a challenge for a school with such a strict teaching structure.

Our programm was pilot and its goal was to demonstrate whether the students would be able to approach interdisciplinary subjects concerning rivers and their ecology and if they could match all this knowledge with the courses of the School Curriculum.

In order to attain the project goals, students, teachers, but also specialised scientists had to succeed in working closely together in subjects like the study of the water catchment area of the river, land use, ecological river management, changes over time in water management, water quality, flood danger and its avoidance and many more.

The challenge was huge.

The project was quite demanding.

Yet in spite of all objective difficulties, it ran more or less successfully.

It has been established that a crucial factor was the interest of the students who longed for a different learning approach, both cross-thematic and multidisciplinary.

It became possible through working with a small group of students, that every time included roughly twelve to fifteen of them, to fulfill tasks that even now would appear almost impossible for us.

Thanks to the interest and passion of the students every adversity was bypassed in quite an amazing way.

We just tried to support the students through this whole journey.

Sometimes it looked like O'Neill's "Long Day's Journey Into the Night".

Of course, the great protagonist was the ecosystem itself, the Great Stream of Rafina, that evolved into a real magnet for the students.

The Great Stream of Rafina is a river that crosses Rafina and is the only natural reserve in the area. It extends from the southern slope of the mountain of Penteli and the northeastern slope of Ymittos, crossing the plain of Spata and flows into the sea in Rafina. It is an important wetland of Eastern Attica and one of the few streams that retains water all year round. Its importance for birdlife is evidenced by the fact that more than 100 species of birds have been recorded there.

A small group of students attempted to do what the State itself neglected, i.e. to study the river ecosystem and the important wildlife it hosts.

A vital question was at which time could we realise everything we wanted to.

The answer was given by the students themselves "Saturdays and Sundays in the Great Stream"

Thus occurred ten exploratory surveys, ten excursions in the magic world of the Great Stream of Rafina.

The project activities started in October 2018 as pilot and kept going until May 2019.

The official application of Learning Units started in February 2019 when most of the group students were still in the first Lyceum grade, even if there were also a few in the second and third school grades.

Essentially though, the preparation that started in October 2018 was proven valuable, a central factor towards success.

Stamatis Zoggaris, researcher in the Hellenic Centre for Marine Research, stood by with advice and expert help at all times, wholeheartedly supporting this major and demanding experiment.

All this along the tragic circumstances of the 23 July 2018 great wildfire in Mati and Rafina that radically altered the whole region.

One hundred and two victims, thousands of dwellings burnt to the ground, one thousand two hundred hectares of burnt land and countless animals dead.

As if that were not enough, the Covid 2019 pandemic was added towards the end of the project.

The implemented quarantine and the interruption of lessons prevented the students from creating a Location-based game as was their initial planning.

The game in which the problem of the river canalisation would be presented along with the student proposal for an alternative solution, undertook a considerable enshrinkment as a result of the March to May quarantine obstacle, and also the new quarantine in November 2020 where schools were shut and still remain closed.

What is more, the vast majority of the project students have advanced by now in the third Lyceum grade and are currently preparing for the exceedingly difficult and stressful June 2021 Panhellenic Examinations.

## - Case Study

The ambitious goals of our project were:

- a) To study and highlight the *Great Stream of Rafina* ecosystem that faces the immediate danger to be transformed into a canalised river.
- b) To address the key question that focuses on whether a canalised or a natural flow river performs its hydraulic function more successfully. When does a river protect us better from a possible flood; when in natural condition or converted into a semi-enclosed cement canal?

Ecosystem, organisms - habitat - interaction between them.

During the previous years the authorities have pressed to apply what they call an anti-flood method and what we call a disaster. 15 kilometres of the most rich in beauty river parts are planned to be deprived of their natural vegetation. More than 3000 trees, some of these centuries old, will be cut, never to grow again, since the entirety of the banks and the riverbed will be covered in cement and gabions (metal boxes containing rocks), turning what now is a diverse ecosystem into an open water pipe with no eco-value.

Despite all efforts, the plan seems to have almost fully unwrapped and its implementation is due to start in a few months time. Greek people and politicians may eagerly announce their concern for the environment every now and then, but few of them actually seem to care.

The *Great Stream* ecosystem was proven, as expected, to be quite complex posing severe adversities to the researcher.

It is a dynamic ecosystem, constantly changing throughout the year.

It is an ecosystem that had each year an important portion of it destroyed under the bulldozers that are supposed to "clean" it from the fluvial sediment it transports.

Each year we witness the *Great Stream* ecosystem being reborn from its own ashes.

The latest catastrophic intervention took place in late July 2018 shortly after the great 23 July wildfire when the Hellenic Army bulldozers destroyed everything on their path.

The students tried, as far as they could, to accomplish what the State and the public offices failed to, that is, to study the river ecology and to attempt to understand its function...

The State is unaware and, I dare to say, indifferent to the Stream ecology. For the State the *Great Stream* of Rafina is nothing more than a simple urban waste pipeline.

The State is solely concerned about the maximum flow capacity of the stream. The river ecosystem for them is close to non-existing.

And that is why it is about to destroy it.

The State uses the flood as a pretext.

Many are the questions hidden behind this undeclared war against the Attica wildlife.

Even more so, after the disastrous 23 July 2018 wildfire.

The State remains trapped between the concepts of "Fire" and "Flood".

On the contrary, the students accompanied by researchers and scientists struggled to reveal and feel what the river had to say them.

"To study, to learn, to love..." is the triptych on which we worked.

- Carrying out of research / practical actions (e.g. field work, laboratory analyses, use of certain tools).

We planned the investigation of the **diversity of the river**.

We focused mainly on **Eels and Fishes** as they are very good markers of the ecological situation of the ecosystem.

We also investigated **Plants, Insects, Birds, Reptiles and Frogs**.

First of all we were going to find out if there were eels in the **Great Stream of Rafina** and other species of fish.

### EELS AND OTHER SPECIES OF FISH

At a certain place of the river ("Arionos Bridge"), fish were collected for a short period using the method of **electrofishing** with the help of **Mr Stamatis Zoggaris, researcher of Hellenic Centre for Marine Research**.

Another activity took place during the International Day of Fish Migration on 21 of April 2018 near the estuary of Great Stream of Rafina and some students of our school participated.

The **method of electrofishing** is very interesting as it combines Physics and Biology and quite useful too as the fish is attracted by electricity and remains unharmed.

**Electrofishing** uses direct electricity current flowing between a submerged cathode and anode. This affects the movement of the fish so that they swim toward the anode, where they can be caught.

We planned the investigation of river **biology (focusing on algae)** and **chemistry profile**. This included the investigation of the effect of disposal of urban sewage and other pollutants in the **Great Stream of Rafina** and how that leads to eutrophication and other problems.

We also asked students if there might be a correlation between the disposal of various pollutants in the **Great Stream of Rafina** and the resident well-being (Human Health).

We studied the increase of **green algae (seaweed)** and other plants.

We choosed the sites where we should take water samples. We would take samples of water for chemical analysis and samples of geological rocks.

We took also samples for measuring the quantity of certain micro-organisms (*Escherichia coli*).

We investigated the causes of eutrophication.

**Possible factors leading to eutrophication:**

- Discharge of Sewage (waste water)
- Fertilizer runoff
- Runoff water of Attiki Odos (great closed motorway )
- Runoff water of Athens International Airport "Eleftherios Venizelos"

**We measured:**

- -NO<sub>3</sub> (nitrates)
- -PO<sub>4</sub> (phosphates)
- Temperature of the water
- pH
- Dissolved Oxygen
- Conductivity
- Salinity
- TDS (% or ppm)
- Quantity of *Escherichia coli*

As mentioned before the river is an important wetland of Eastern Attica and one of the few streams that retain water all year round. Its importance for birdlife is evidenced by the fact that more than 100 species of birds have been recorded. Some of them are:

- The little egret (*Egretta garzetta*)
- The great cormorant (*Phalacrocorax carbo*)
- The common kingfisher (*Alcedo atthis*)
- The little ringed plover (*Charadrius dubius*) which is accustomed to nesting in the Stream
- The yellow-legged gull (*Larus michahellis*)

- The grey wagtail (*Motacilla cinerea*)
- The black redstart (*Phoenicurus ochruros*)
- The Madeiran chaffinch (*Fringilla coelebs maderensis*)
- The common chaffinch or simply the chaffinch (*Fringilla coelebs*)
- The barn swallow (*Hirundo rustica*)

Most occur in spring and autumn during migratory seasons/ homing seasons and are in urgent need of wetlands. These species travel very long distances during migration and need to make stops for rest and refueling. The estuary of the Great Stream offers them both since in its waters we find fish, amphibians and insects.

Some of them are:

- Frogs (Anura)
- Bufos/ Bufonidae (Bufo)
- Eels (Anguiliformes) which are coming from the Gulf of Mexico where they go to reproduct.
- Snakes (Serpentes)
- Turtles (Testudines)

And much more

Hundreds of tree species grow on its banks among the age-old aquatic plants such as plane trees (Platanus) and willows (Salix). Also, we can find common reeds (Phragmites australis), common bulrush (Typha latifolia) and other plants and flowers.

### - Conclusions and awareness-raising

Wetlands are wonderful places, complex and unexplored.

Human vanity has been scarcely able to study and decipher them.

Wetlands form a palimpsest, keeping a record of the evolutionary track both of the river itself and of the organisms living in and close to it.

This rich ecosystem of the stream works beneficially for the whole of Eastern Attica and especially for our city. Its natural vegetation filters



the pollutants that illegally end up in the stream from the surrounding businesses before they reach the beaches of the area. It largely filters the air pollutants from the port and the airport, regulates the climate and especially the temperature of the area, saves our city from the catastrophic floods that affect areas with muddy or covered streams, operates educationally and is a refuge for the conservation of biodiversity.

Despite what the Great Stream of Rafina offers us, the municipality and the periphery have decided and tried to cement it and turn it completely into an open rainwater pipe, ostensibly for flood reasons. The real reason, however, is the plans to expand the port of Rafina, and also a rumoured plan concerning the expansion of the Attica suburban railway. Although many actions have been taken to prevent the implementation of these plans, we have not seen a great response from the community and especially the municipality.

However, what we must understand is that not only the ecosystem of the stream is endangered but also ourselves. We focus on profit and forget the value of Mother Earth that has become a living dead. One more reason to protect this huge asset is climate change and the planet's screams for help. As long as we continue to destroy and neglect the environment, unfortunately, we will not be able to see any recovery of the situation. We will perish in the end and we will be to blame for our own extinction. We forget that we are part of the earth, as a result of which we constantly try to dominate and impose ourselves over it. What do we think we will prove with these actions? How powerful do we think we are? After all, nothing matters to man in this world. He is not interested in rivers and flowers. Everything is lost in this hazy fog created by the fire of the sun with its light that penetrates and stabs the Earth. You know, she is bleeding. After all, all the mornings in the world are the same. We are standing in the middle of a hurricane. The point is, we must not sink into the abyss in order to be reborn.

The plan of the Government for the River will erase this natural landmark from the map, only to pave the road for the alleged economic growth that extensive building will bring to the area. Practically, it will also affect the microclimate, since the average temperatures will rise. Removal of trees

will make the river's self-cleaning impossible, rendering the Attica coast prone to the critical danger of pollution rise. Climate change always settles step by step. Cement comes at a cost.

There will be an attempt to annul the plan in the Supreme Court of Greece but help is needed, since the situation is critical. Our towns are devoid of sensitivity. I'm afraid everyone's trying to profit for his own good, too settled as he is in his own ways to fight for a common cause. Indifference reigns, not only towards nature, but at the same time towards the European legislation, which downright prohibits alterations of this sort in rivers, advising in favor of more environmental-friendly flood management.

- Dissemination of the results (e.g. at science fairs, public events) and involvement of local institutions, if any.

On 11 May 2019 as part of the European Project "DAYLIGHTING RIVERS" a workshop took place in our school.

Presenting participants were:

- **Dr. Constantinos Vouvalidis**, Senior Lecturer in the Faculty of Geology in the Aristotelian University in Thessaloniki,

«The natural function of peri-urban streams: The Great Stream of Rafina hydromorphology»

- **Dr. Stamatis Zoggaris**, Appointed Researcher in the Hellenic Centre for Marine Research - HCMR  
Institute for Marine Biological Resources and Internal Waters

«What we know about the river wildlife?»

- **Stathis Dimitrakos**, doctor, local history researcher

«Great Stream of Rafina, integral element of our town's identity»

- **Students and Teachers participating in the Project.**

«Great Stream of Rafina: the future lies on your hands»

The event was open to students, parents, teachers and residents.

On 18 December 2019 an open event-presentation of the project took place in a Hotel at central Athens.

Our students presentation was great.

The *Great Stream of Rafina* actually came to the fore through the passion, love and enthusiasm of the students participating in this project....

We have created a blog for the project and its environmental actions:

<http://daylightingrivers.blogspot.com/2019/03/daylighting-rivers-daylighting-rafina.html>

<http://daylightingrivers.blogspot.com/2018/11/menei.html>

<http://daylightingrivers.blogspot.com/2018/11/blog-post.html>

<http://daylightingrivers.blogspot.com/2018/11/sos.html>

[http://daylightingrivers.blogspot.com/2019/04/blog-post\\_27.html](http://daylightingrivers.blogspot.com/2019/04/blog-post_27.html)

<http://daylightingrivers.blogspot.com/2018/10/blog-post.html>