



# Eutrophication

Modules:

**Impacts of human intervention  
on river ecosystem**

**Total duration:** 6 hours

**Field work:** Yes

**List of materials:**

Map of the river  
Science lab with equipment  
for chemical- physical-  
biological such as beakers,  
flasks, test tubes, funnel for  
experiments on water  
Chemical reagents  
Photometer  
Microscope

**Worksheets:** 3

**Students' age:** 15-18

**Use of apps/software:** videos

## Brief disciplinary introduction

The word "eutrophication" has Greek roots. Eutrophication, which comes from the Greek *eutrophos*, "well-nourished", has become a major environmental problem.

Natural eutrophication is a very slow process. Watercourses and bodies of water change very gradually, thus maintaining habitat for various species for long periods. Human activities such as the discharge of waste water, deforestation, wetland drainage, development of arable land and fertilization have accelerated the eutrophication process several times.

Cow manure, agricultural fertilizer, detergents, and human waste are often to blame as well. Nitrates and phosphates, especially from lawn fertilizers, run off the land into rivers and lakes, promoting the growth of algae and other plant life, which take oxygen from the water, causing the death of fish and mollusks. Today, many areas of the oceans worldwide, some more than 20,000 square miles in extent, have become "dead zones", where almost no life of any kind exists.

[https://www.merriam-  
webster.com/dictionary/eutrophication](https://www.merriam-webster.com/dictionary/eutrophication)  
[http://www.upplandsstiftelsen.se/UserFiles/Archive/4947/Fa  
ctsheets/Factsheet\\_Effects\\_of\\_Eutrophication.pdf](http://www.upplandsstiftelsen.se/UserFiles/Archive/4947/Factsheets/Factsheet_Effects_of_Eutrophication.pdf)



## Objective of the learning unit

To learn about :

- ✓ Relationship between chemical nutrients (nitrates and phosphates) in water and algal mass
- ✓ Organoleptic, physical, chemical and microbiological parameters
- ✓ Water properties
- ✓ Eutrophication in its many aspects

To be able to :

- ✓ Carry out a sampling of river water
- ✓ Apply water survey techniques (chemical investigations, microscopy, photometry)



## Introduction (orientation)

**Time estimated:** 10 minutes

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

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

**Instructions for the teacher:**

In order to arise students' curiosity a video and a Power Point presentation are shown to introduce eutrophication.

Link to video: [https://www.youtube.com/watch?v=y\\_8oz\\_4irQE](https://www.youtube.com/watch?v=y_8oz_4irQE)

Link to PowerPoint video: <https://youtu.be/G6qspGgeE8U>

Link to PowerPoint: <https://1drv.ms/p/s!AqWmU2xlGjjZjHGx5fbQBmFlwRKg>

Then there is a brainstorming session to bring out the students' previous knowledge and experiences about this issue. Students are asked to schedule an experiment to be carried out in the science lab that simulates this phenomenon in an aquatic ecosystem (obtained by taking samples of water from the local river Sarno).

Then the students are asked the following questions:

*"Why do so many plant organisms grow so strongly in rivers, in the sea, but especially in lakes or ponds?"*

*"Can river water be used to irrigate fields or you think it may harm crops and plants?"*

*"What causes the disappearance or the reduction of fish?"*

## Conceptualization

**Time estimated:** 20 minutes

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

**Method (how the students have to work):** group-work, use worksheet 1.

**Instructions for the teacher:**

The students are asked to formulate a hypothesis about the causes of eutrophication, the causing mechanism and the effects.

Then, they are given worksheet 1 to discuss the causes of eutrophication, the bio-chemical transformations which occur and what their final effects are.

They are asked the following questions:

*"How can water quality be assessed for agricultural and civil uses?"*

*"Does eutrophication take place through different phases?"*

## Investigation

**Time estimated:** 4 hrs

**Where the activity takes place:** outdoor by the river and in the science lab

**Method (how the students have to work):** group-work, use worksheet 1, 2.

**Instructions for the teacher:**

### 1) Planning

**Location:** in classroom

Ask students

*“How and where would you investigate the effects of eutrophication?”*

- ✓ Students decide where they want to carry out the survey and select different areas of the river Sarno on the map
- ✓ Students decide how to conduct the survey (measurements, materials, methods).
- ✓ The groups present their survey plan and agree on the most reliable and feasible one.

**Time needed:** 30 minutes

### 2) Performing

**Phase 1 location:** by the river

**Materials:** Water-testing equipment to collect water samples along the river and to carry out a physical- chemical and biological analysis of the water in the field (e.g. photometer).

The students are given worksheet 2 to fill in: the students walk along the pre-established path and fill in a questionnaire about the environmental conditions (of the river) at sampling points. Use Worksheets 1 and 2.

**Time needed:** 60 minutes

**Phase 2 location:** in the science lab

**Materials:**

Worksheet 2 and PC with worksheets (for example: Excel worksheet)

The students systematically report the data of their physical-chemical and biological analysis of the water samples taken from the river Sarno (data processing boards).

**Time needed:** 3 hours (1hr/day)

## Conclusion

**Time estimated:** 30 minutes

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

**Method (how the students have to work):** group-work, use worksheet 3 (Document Survey).

**Instructions for the teacher:**

The different groups report their conclusions on the activities carried out:

- ✓ variations in the physical, chemical and biological characteristics of the water samples analyzed over some days;



- ✓ awareness of the problem and the importance of recovering the integrity of ecosystems
- ✓ awareness of the degradation of the "Sarno river ecosystem"

Students compare the final results of their survey with the hypotheses formulated in the conceptualization phase (worksheet1 and worksheet 2).

After careful discussion and comparison, students report their observations in a final worksheet (worksheet 3).

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## Discussion

**Time estimated:** 30 minutes

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

**Method (how the students have to work):** group work, use worksheet 3 (Document Survey)

**Instructions for the teacher:**

The different groups are involved in a discussion about the main causes of eutrophication in their area, the role of water treatment plants and the possible solutions to this threat.