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DAYLIGHTING RIVERS
SCIENCE EDUCATION FOR CIVIC ECOLOGY

Investigation of little meander

Module:

Water cycle

Impacts of human intervention on river ecosystem

River management

Total duration: 5 hours
Field work: yes
List of materials:
PC, beamer (IWB)
Internet
Water Quality Measurement Devices
Soil Quality Measurement Devices
Worksheets: 1
Students' age: 16-18
Use of apps/software: GIS

Brief disciplinary introduction

This activity, describes the Küçük Menderes ("Little Meander"), but it can be adapted to other rivers. Cayster (or Kaystros) River is located at the south of İzmir, Turkey. It generally flows westward, toward the Aegean Sea, at Pamucak beach, near Selçuk. The ancient city of Ephesus was once an important port on the river, but over the centuries, sedimentation gradually filled in the inlet around the city. The coastlines moved seaward, and the ruins of Ephesus are now some 8 km inland from the coast[1]. Over-usage of groundwater has violated the fresh water-sea water balance in the area and caused seawater leaked into groundwater. For example, more than 600 water wells exist within the geographic borders of Selcuk County including the Little Meander delta plain and these are used for agricultural irrigation. Additionally many swamps, including Little Meander delta and some of the lagoons existing in the delta were dried for preventing Soke plain from overflow. Today, intensive agricultural in delta plains still continues together with those ones along the river basins, making these deltas threaten wetlands, because water of these rivers is important for agricultural activities.

1 https://en.wikipedia.org/wiki/K%C3%BC%C3%A7%C3%BCkmenderes_River

The problems, which are being experienced in Gediz Delta, such as the reduced amount of fresh water reaching the delta and drying, endangering large reed areas and swamps existing between the place where the river runs and the fish are trapped, will be experienced in the future in Little Meander delta also, because of four dam projects on the river and its branches. For example, Beydag dam, which is one of the most important projects, started to collect water in 2007.

Another problem caused by agricultural activities is soil and water pollution caused by agricultural inputs. For example, the waters of Little Meander and Great Meander fall into the 4th grade water quality because of the nitrogen from nitrite, total phosphorus, lead, cadmium, sulphur, the BoI and CoI values suggest that water pollution is caused by pesticide and fertilizer[2].

Recently, WWF organized the Living Rivers Project for the adoption of an integrated watershed management approach, which will bring together the parties on the management and use of water in the Great Meander Basin, and to take decisions from a holistic perspective. A similar study will be conducted with students to propose solutions and take actions for solving the water management problem in the Little Meander River Basin.

Training materials on how to use QGIS are available at this Google Drive link https://drive.google.com/open?id=170DWr3JcIxkBAByoA5_aRiXcmnI6JAuR, in the folder Action_C1_QGIS Training in which you can also find an exercise in the folder Data/Campania, about Sarno river catchment that can be used as an example.

Objective of the learning unit

To learn about:

- ✓ Carry out water quality management study at the river basin scale
- ✓ Discuss the importance of water quality management, its role in river basin management, regulations related to the management of water resources in the country and European Union.
- ✓ Collect information about the characteristics of the selected river basin.

To be able to:

- ✓ Evaluate the water masses in terms of water quality of the entire river basin, pollutant loads, structure of water masses in the Little Meander River Basin, and also properties of depression and influence stated in the Water Framework Directive.
- ✓ Use of GIS software
- ✓ Work in groups

Introduction (orientation)

Time estimated: 15 minutes
Where the activity takes place: in the classroom
Method (how the students have to work): class brainstorming
Instructions for the teacher:

The students are shown the photos of Little Meander Basin from 1900s to 2018.

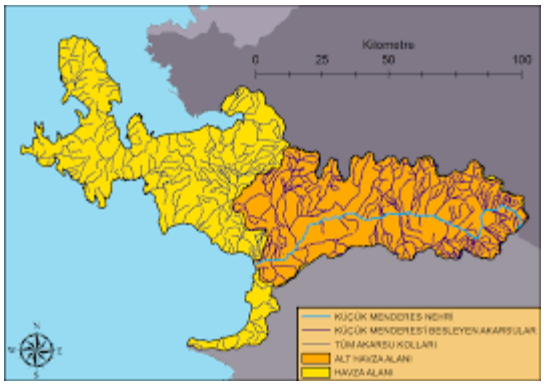
They are at the same time acknowledged that they will work on Little Meander Basin for the coming weeks. Through the photos, inform students about the Little Meander in terms of its geographic characteristics.

Then, students can be asked if they observe any change in the photos. Their observations are taken and they are also asked to speculate about the possible reasons for the observed changes.

Also the discussion can proceed with the possible effects of the observed changes on the soil quality, water quality, ecosystem in general, and the population living there.

Then the students may have shown the videos and the photos of the Great Meander Preservation Project by WWF.

The details of the project can be found at http://awsassets.wwftr.panda.org/downloads/atlas_web_download.pdf



Next, show the video prepared and distributed by the TC (The Republic of Turkey) Ministry of Forestry and Water Management IV. Regional Directorate Izmir Branch. The video is about Little Meander Basin reclamation work.

Conceptualization

Time estimated: 15 minutes
Where the activity takes place: in the classroom
Method (how the students have to work): group discussion
Instructions for the teacher:
Organize the groups of students and ask them:

"How would you evaluate the effects on the components of the ecosystem?"

For example, the students can write their hypotheses about the water quality of the entire river basin, pollutant loads, structure of water masses in the Little Meander River Basin, and also the impact on agricultural production and population life standards.

The Great Meander Preservation Project Report can be provided as a handout.

Investigation

Time estimated: 6 hours
Where the activity takes place: in the classroom and outdoor
Method (how the students have to work): group-work
Instructions for the teacher:
In the classroom, the students are divided in groups.

1) Planning

The teacher should provide the informative materials in terms of GIS layers (shapefiles and additional files). Students decide the steps of investigation (for instance land use along time). Use worksheet 1 for this phase. (Time needed: 15 minutes).

2) Performing

a) Students perform the GIS activity using QGIS or other software and provide a layout of the current land cover map. (Time needed: 180 minutes).

If skilled, using an older map, they can provide a map of the land use change by intersecting the two maps. They can derive the table with the surfaces for cover classes and calculate (in Excel) the land cover change in that period of time.

The teacher can use the files of the exercise on Sarno catchment as example to run in the local administrative district. At this Google Drive link to folder Action_C1_QGIS Training

https://drive.google.com/open?id=170DWr3JcIxkBAByoA5_aRiXcmnI6JAuR -, search for the folder Data/Campania. The exercise about Sarno river catchment can be used as an example. We suggest looking at this exercise in large advance. Then, students can perform a similar analysis for the Little Meander Basin.

Also, students may benefit from Landsat TM satellite images, and may use remote sensing software in processing these images. For example, in a study by Gulersoy and Celik (2014), the researchers used ISODATA technique in uncontrolled classification. Uncontrolled classification is based on the fact that similar pixels are automatically detected and assigned to classes depending on the reflection values in the satellite image.

b) Additionally, the Little Meander Region can be visited with the students. For this visit, first, students should prepare their investigation. For example, students may conduct scientific measurements about the water quality, or perform a social research by interviewing with the local people, or collect data regarding the amount of pollutants in the soil or in the water.

For this visit, the students first make an intensive research on how to conduct their investigation. They can be provided research readings at this stage such as the one at this link: http://debis.deu.edu.tr/userweb//melis.somay/dosyalar/GEOSOUND.pdf by Somay and Filiz, or the thesis by Yenici (2010), at https://polen.itu.edu.tr/xmlui/handle/11527/9011. Students submit the investigation proposal to the teacher. The investigation proposal example is attached (Worksheet 1). In this proposal, the students must list the materials that they will need to conduct investigation so the teacher can guide them either to the related departments that they can get help from, or organize another visit to the places that they can gather information and materials (such as universities, research laboratories), or share the available materials that they can use for the investigation.

c) During the visit, the students perform their investigation and collect data.

d) Post-visit activity is to make sense of the data collected and drawing inferences. (Time needed: 180 minutes).

Conclusion

Time estimated: 45 minutes
Where the activity takes place: in the classroom
Method (how the students have to work): group-work
Instructions for the teacher:
The students prepare a presentation where they will share their results and inferences. At the end of their presentation, they should come up with a water management plan.

Discussion

Time estimated: 30 minutes

Where the activity takes place: in the classrooms

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

Instructions for teacher:

The water management plans suggested by students are listened and feedback is provided both by their peers and the teacher. An expert may be invited to the classroom to listen to the presentations and give feedback as well.