LEbanese Water Actors Platform

Compte-rendu : Tuesday of LEWAP

Research and General Public Meetings

Assessing the sustainability of the water resources: the case of Qadisha River

Dr. Yasmine Jabaly: PhD, Assistant professor at the University of Balamand, Department of Civil and Environmental Engineering

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Dr. Rachad El Hajj: postdoctorant, Lebanese University, Faculty of Public Health, Branch 3

Tuesday 11 July from 10AM – 12AM

Conference room at Institut Français du Liban

French Embassy, Damas Street, Beirut

(Meeting organized in English

with simultaneous interpretation to Arabic)

LEbanese Water Actors Platform

1. Introduction

On July 11th 2023, LEWAP organized the first Mardi LEWAP for 2023 on « Assessing the sustainability of the water resources : the case of Qadisha River ».

The session started with an introduction from Ariane Visier, coordinator of the platform LEWAP, on LEWAP's goal and activities and the aim of Tuesday of LEWAP to bridge the gap between academics and other actors in the sector. She presented the panelists, Dr. Yasmine Jabaly from UoB, Dr. Jalal Halwani from UL, Rachad el Haj from UL who came to present the results of the water quality and quantity assessment conducted recently in the Qadisha river.

Jessy Farah, the coordinator of the Qadisha region's Regional Nature Park project within which the water assessments were conducted, gave a background on the context and the territory of the project. She started by highlighting that the economic activity in the area rely mainly on tourism and agriculture, making the sustainability of water resources crucial for the resilience of these sectors, particularly facing future climatic changes.

She continued by presenting **the main objectives of this project, which consist on :**

- **obtaining a simplified hydrological balance for the Qadisha watershed**
- **comparing the observed data with available historical data**
- **mapping the main sources of pollution in the two casas**
- **identifying major water resource preservation issues and possible solutions.**

The water quality and quantity assessments started in june 2022 in addition to a study on sources of pollution with the area.

The University Of Balamand (UoB) took charge of the quantitative assessment (flow and depth monitoring) under the supervision of Dr. Yasmine Jabaly, and the Lebanese University (LU) was responsible of the qualitative assessment (turbidity, bacteriological parameters, physio-chemical parameters) conducted by Dr. Rachad el Haj and Mrs. Hala Haydar, and supervised by Dr. Jalal Halawani, where Hala did the study of pollution sources as well.

2. Presentation of Dr. Jalal Halwani – click here

Dr. Jalal Halwani provided an overview of the pollution situation in the Qadisha River.

He explained that since 1996 the Lebanese University has been working on the pollution of water resources in North Lebanon, and particularly in the area of Tripoli. In 2009, the university started a doctoral program with French universities to study the type of pollutants existing in the Qadisha Basin.

He started by presenting the main sources of pollution around Qadisha river and the water status in the area and then continued with the main results of the water quality assessment done in the River :

- Significant microbiological contamination below 800 meters above sea level mainly due to discharge of wastewater
- Chemical contamination by pesticides due to agricultural practices

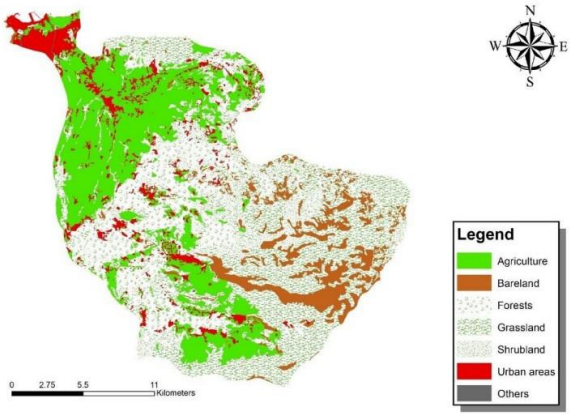
- High chemical contamination due to the discharge of effluents from agriculture farms and olive mill
- High leachate contamination from the illegal solid waste dumpsite around the river basin

Dr. Jalal concluded his presentation with recommendations for the sustainability of Qadisha River as per below:

- Accelerate the construction of wastewater networks in the villages located on the banks of Qadisha River and ensure conveying sewerage to the main pipeline which leads to the existing Tripoli WWTP ;
- Oblige pig farms to have unsealed pits for slurry and treat them on site or empty them regularly in the Tripoli WWTP ;
- Find a quick solution to the solid waste management crisis that threatens the quality of the river's waters ;
- Implement the principles of integrated water resource management in the basin and install meters with tariffication based on the volume of water consumed and its use ;
- Rehabilitate and renovate the hydroelectric power stations and the related infrastructures ;
- Take advantage of the declaration of the Qadisha Valley by the UNESCO as a World Heritage Site in 1998 to ban all activities that can pollute the environment and ensure financial aid to assess the sustainability of the water resources.

3. Presentation of Dr. Rachad el Haj - click here

Dr. Rachad el Haj was responsible to conduct the water quality assessment of Abu Ali's watershed for domestic and agriculture use. The study was conducted in the Abu Ali basin, a total area of 489 km2 with 600,000 residents.



Land cover use map.

50 samples were collected during 5 campaigns, December 2022, January 2023, April 2023, May 2023 and June 2023.

Onsite measurements consisted of the following parameters Temperature (T°C), Turbidity, pH, Electrical Conductivity (EC) and Total Dissolved Solid (TDS).

In the lab, the following parameters were measured : calcium, magnesium, bicarbonate, chloride, nitrate, sulfate, phosphate, sodium, potassium and E. Coli.

The parameters were then analyzed for domestic use (compared to WHO and EPA standards) and for irrigation use (with 7 indices computed, Wilcox diagram, USSL plot and Doneen plot).

Dr. Rachad concluded his presentation with the measurements results:

- Domestic use: the major ions concentrations of Abu Ali's samples were below the thresholds. However, Abu Ali's water is deemed unsuitable for drinking due to E. Coli contamination.
- Irrigation use: the RSC, Kelly's index and magnesium ratio values were low and indicate that the samples are safe for agriculture practices. Yet, the sodium percentages were high in 12 samples, which are considered less suitable for irrigation.

4. **Presentation of Dr. Yasmine Jabali -** click here

Dr. Yasmine Jabali presented the quantitative assessement conducted on Qadisha River.

She gave background on the Qadisha River being one of the four major rivers in North Lebanon (El Bared, El Jaouz, El Kabir and Qadisha/Abou Ali River) The Qadisha River is 44.5 km long covering a basin of 493 km2. It has two sources: Rachiine and Mar Sarkis.

A field investigation was first conducted to determine the priority and accessible sampling areas, the potential sources of pollution, and the land uses at each point. All this information was supplemented, where possible, with data from environmental assessment studies, hydrogeological information, and GIS data of the watershed. 5 sampling locations were determined: Qadisha Grotto, Ehden – Mar Sarkis, Daraya, Rachiine and Kousba – Sereel). The selection of samples was based on two considerations: representativeness and accessibility. Following the field and spatial inspection, the sampling campaign started, comprising 12 sampling batches from July 2022 and to May 2023.

Results showed that the highest flow rates were recorded at the lowest point of the river, which can be attributed to several factors:

1. Convergence of tributaries: Lower points in a river system often act as convergence points where multiple tributaries join. The combined flow from these tributaries can result in a higher flow rate at those locations.

2. Topography: The lower points in a river system may correspond to areas of lower elevation or natural depressions. Water naturally flows downhill, so these low-lying areas can accumulate water from upstream, leading to higher flow rates.

3. Channel width and depth: The channel characteristics of a river, such as width and depth, can influence the flow rate. In narrower and deeper sections, the flow can become more concentrated, resulting in higher velocities and flow rates.

4. Gradient: The slope or gradient of the river also plays a role. Steeper gradients in the lower sections can contribute to increased water velocity and higher flow rates.

5. Hydrological inputs: Factors such as heavy rainfall, snowmelt.

She then addressed the seasonal variations:

- Dry season : the absence or minimal precipitation recorded during these campaigns corresponds to the lower flow values observed :
- Wet season : characterized by increased flow rates due to higher precipitation and enhanced water inputs
- End of wet season: moderate flow variations.

Finally, Dr. Jabaly explained that it is important to note that other factors, such as local hydrological conditions, watershed characteristics, and water management practices, which can also contribute to flow variations. Therefore, understanding and considering these factors is crucial for assessing and managing water resources effectively backing them up with Hydrological models and monitoring systems to analyze and predict flow variations, aiding in water resource planning, flood control, drought management, and sustainable water allocation.

Questions and Answers :

- Alain Maroun (BTD) :
    - **Q :** Does the NLWE have the equipment for water quantity and do they know how to use them ?
        - **A :** Yes, these equipment were taken from the establishment and the measurements were done in coordination with NLWE employees
- Talal Darwish (CNRS) :
    - **Q :** Was snowmelt considered in the assessments conducted ?
        - **A :** It will be considered later on
    - **Q :** What is the difference between Arable and Agricultural land ?
        - **A :** Arable here represents grasslands or lands with grass only whereas agricultural land represents planted areas
- Gaby Milan (WEG) :
    - **Q :** Did the study tackle the impact of the use of polluted water in irrigation on the farmers and workers handling it ?
        - **A :** No, the focus of the study was just on the quality, moreover they are not at risk from heavy metals as no industries around the river basin
    - **Q :** We know that the water is not drinkable, but why no further parameters were conducted to determine drinkability ?
        - **A :** Time and budget restriction did not allow us to add further parameters

Marc Saade (KREDO): **Comment:** The qualitative assessment was not conducted correctly – DO, COD, BOD should have been considered to have a better representation of the water quality