Effect of rainwater on the characteristics of the groundwater in Al-Buraimi Governorate

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Abstract

The present study aimed at detecting the effect of rainwater on the characteristics of groundwater in Al Buraimi Governorate. he people in the villages which are depending on ground water sources noticed water taster change after the rain and most of people which I spoke with them are emphasize thats. Therefore, two places were chosen for the application of the study: the village of the Al Mualaqa and the village of Al Wasit because of the abundance of rainfall and easy access to them and the dependence of the people on the ground water, unlike the cities that rely on desalinated water. The research questions are: What is the impact of rainwater on the salinity of groundwater in the villages of Al Mualaqa and Al Wasit? What is the effect of rainwater on pH (acidity) of groundwater in the villages of Al-Mualaqa and Al-Wasit? And the effect of soil on the characteristics of groundwater after rainfall. The water protocol was applied to rainwater and groundwater before and after rainfall, and the measurements of acidity and conductivity as well as the soil protocol in the specified areas. The results were as follows: The data show that after rainfall, the salinity of the groundwater increased by approximately 300 ppm and its pH decreased by 0.8. The soil in these areas is acidic with a pH number (6). In collaboration with the staff of the Water Resources Department, it was found that the rainwater melted a layer of

salts of the soil such as sodium chloride, or sodium fluoride, which increased salinity of the water and reduced pH. Therefore, the study confirmed that rainwater affects groundwater due to the soil characteristics of these areas. We recommend using single water filters in kitchens and in drinking refrigerators to balance salts from any climatic changes that lead to soil salinity change especially for people who are suffer from blood pressure and kidney disease. In addition to raising the awareness of parents who rely on groundwater through the media or awareness campaigns by the concerned authorities and follow the changes in water characteristics periodically.

Basic terms:

Salinity: Salinity is the content of dissolved salt in water. It is a generic term used to describe the levels of various salts such as sodium chloride, magnesium sulphate, calcium sulphate, various bicarbonate salts and other salts in water. A salinity meter is used in a ppm unit. Salinity may also refer to soil content of salts. (Alwani, 2013)

PH: The measurement that determines whether the fluid is acidic, alkaline or neutral. Fluids with a pH of less than 7 is acids but fluids with a pH higher than 7 is alkaline solutions or bases. PH 7 is neutral (Kubaisi, 2017).

Al-Mualaqa village and Wasit village: are villages in Al-Buraimi Governorate in the Sultanate of Oman. The people of these areas rely on the groundwater that feeds from the rain in their drinking and daily use.

Research questions:

1- What is the impact of rainwater on the percentage of salinity of groundwater in the village of AlMualaqa and Al-Wasit?
2- What is the effect of rainwater on the pH of the groundwater in the villages of Al Mualaqa and Alwasit?
3- What is the effect of soils on the characteristics of groundwater after rainfall?

Introduction

Groundwater is a water found in the pores of sedimentary rocks formed over different times، the source of this water is often rain, permanent or seasonal rivers or melting ice, and this water leaks from the surface of the earth into the bottom which is called nutrition. (Nairokh, 2015). The leakage process depends on the type of soil on the surface that touches the surface water (the source of nutrition). The more the soil is loose with big holes and high porosity, the more leakage of water is good. So, we will have a good supply of groundwater by time. Groundwater is extract by several ways, including drilling of groundwater wells or through springs or feeding rivers. (Morgan, 2017)

Most villages in the Sultanate of Oman rely on groundwater, and valleys in drinking and cooking and their necessities such as the villages of Al-Wasit and Al-Mulaqa in Al Buraimi Governorate. The Water Resources Department of the General Directorate of Regional Municipalities and Water Resources of the Governorate continuously monitors this to ensure the quality of the water and its lack of microbes according to the water standards of the Sultanate of Oman.

But I have noticed the poor health of my family, which suffers from kidney disease during the period of rainfall compared to the rest of the days and many of the people Confirmed their sense of change in the taste of water and salinity after the fall of the rains. In addition to my observations to change the characteristics of groundwater through the application of the water protocol during the year, which formed a number of questions, the most important of which is rain water impact on the characteristics of groundwater? this subject is important , especially for people suffering from diseases of blood pressure and kidneys and rely mainly on groundwater, for that came the idea of this research.

I will study the effect of rain water on the groundwater in the governorate through the application of the water protocol on both rain water and groundwater before and after the rains in the villages of the Almualaqa and Al wasit. In addition to the soil protocol in cooperation with the competent authorities.

Research methods

First: the research plan

1- I felt the problem and I worked interviews with parents to identify then I discussed it with the teacher.
2- The locations of the measurements were determined in cooperation with the people of the areas in the villages of Al-Mualaqa and Al-Wasit and the school of Hudhayfah bin Mahsin.

3- Addressing the Directorate General of Regional Municipalities and Water Resources in Al Buraimi Governorate (Water Resources Affairs Department) to approve the implementation of the research in cooperation with them.
4- Starting to collect information and data needed to answer research questions by applying the water protocol and taking measurements of salinity and acidity of groundwater before and after rainfall.
5- The soil protocol was implemented in the villages of Wasit and Al-mualaqa.
6- Comparing results and write recommendations

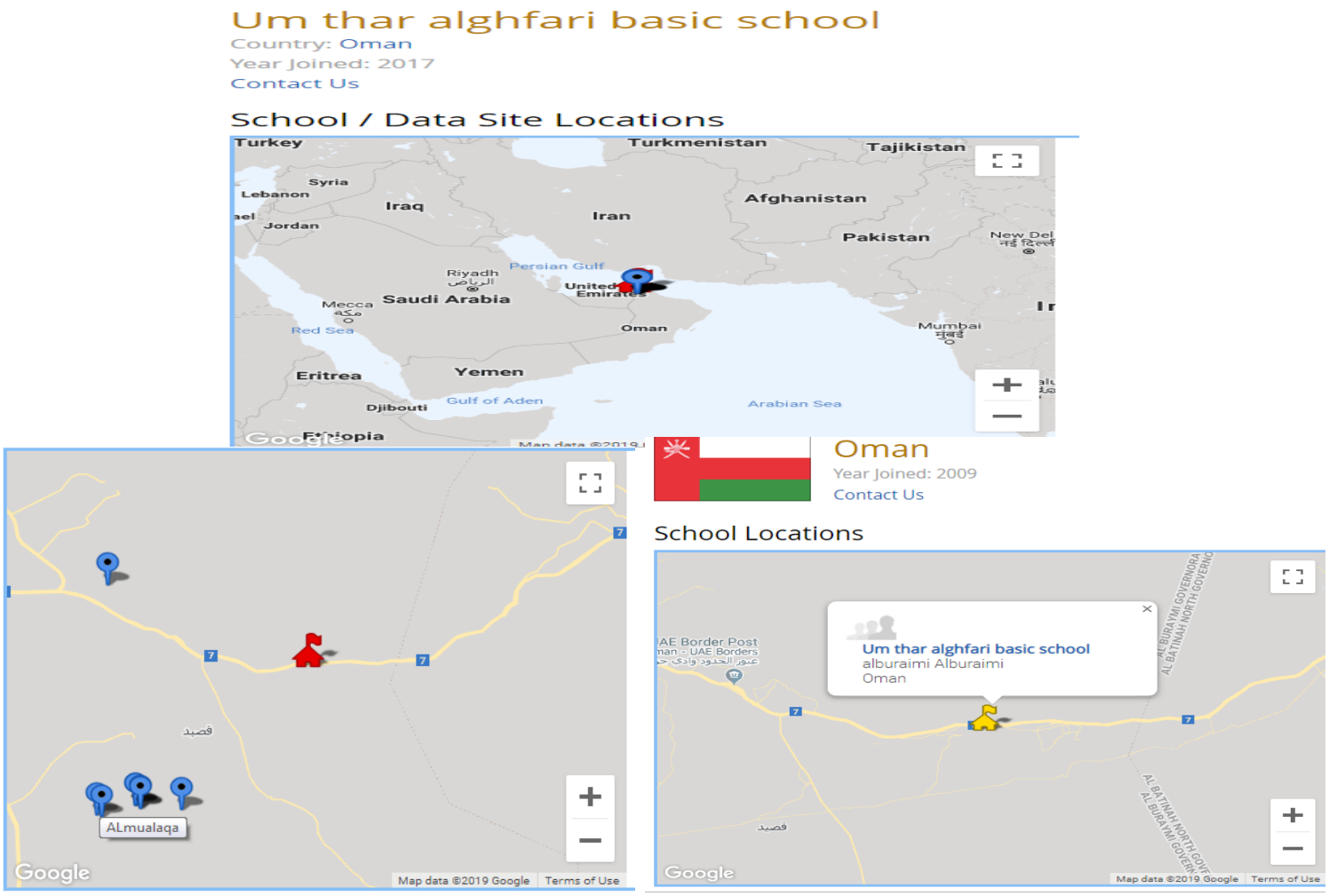
After the development of the research plan, I have implemented and the implementation of the water water protocol in the villages of the Al-Mualqa and Wasit. And sampling of water in coordination and cooperation with the people of the regions and staff of the Department of Water Resources Affairs in addition to the application of the soil protocol near the location of groundwater and then collect and analyze the results.

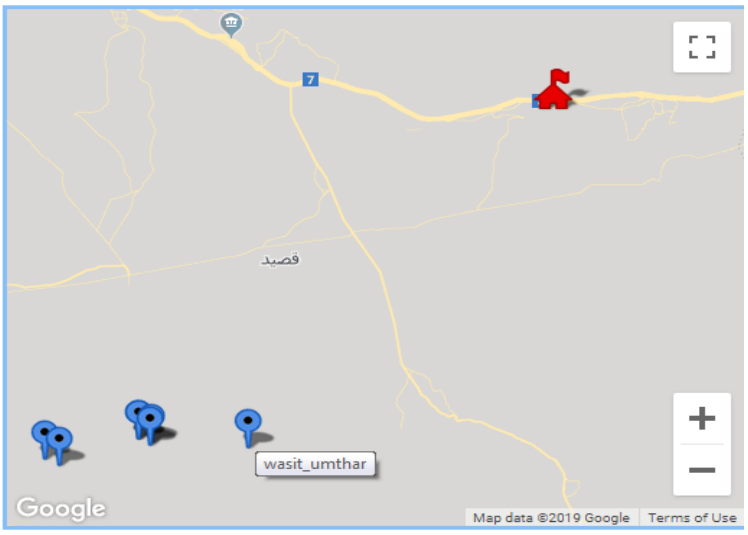
The time plan for preparing the research was as follows:

Activity	month
Select and identify the problem and set the time plan for the search	Oct
Addressing the Directorate General of Regional Municipalities and Water Resources in Al Buraimi Governorate to assist in research and interviews with the residents	Nov
Application of the water protocol in the specific locations of the study،	Dec

Application of the soil protocol from the study sample sites Record data in the GLOBE site www.globe.gov	
Analyzing data, making recommendations, writing research and reviewing Awareness campaigns for parents	Feb

Second: The location of the study: Sultanate of Oman, Al Buraimi Governorate, Al-Mualaqa village (longitude 56.12) east, latitude 24.12 north, height 542 meters، And the village of Wasit which lies (longitude (56.16812) east, latitude (24.12289) north, height (471) meters), the application was on November, December and February, in cool atmosphere, Also water and soil protocol was used.





Third: Data collection and analysis:

To answer the first and second questions, the water protocol was applied and the salinity of groundwater and pH was measured before and after rainfal . As well as the pH of rainwater in the village of Wasit and ALmualaqa village.

The Directorate General of the Regional Municipalities and Water Resources (Water Resources Division) was also visited and made an interview with water analysis laboratory technician Abdulhakim Al-Farsi and with STEM Specialist Salem Al-Muzahmi. Also, I presented my research data for them to discuss it, interpreted and finding appropriate solutions to the problem.

In order to reach the answer to question 3, the soil protocol was applied to the soil of the sites of the village of Al-Mualaqa and Wasit, its pH measurement, salinity and some characteristics .i did An interview with the chemistry teacher in the school to contribute to the analysis and interpretation of the data.

Results:

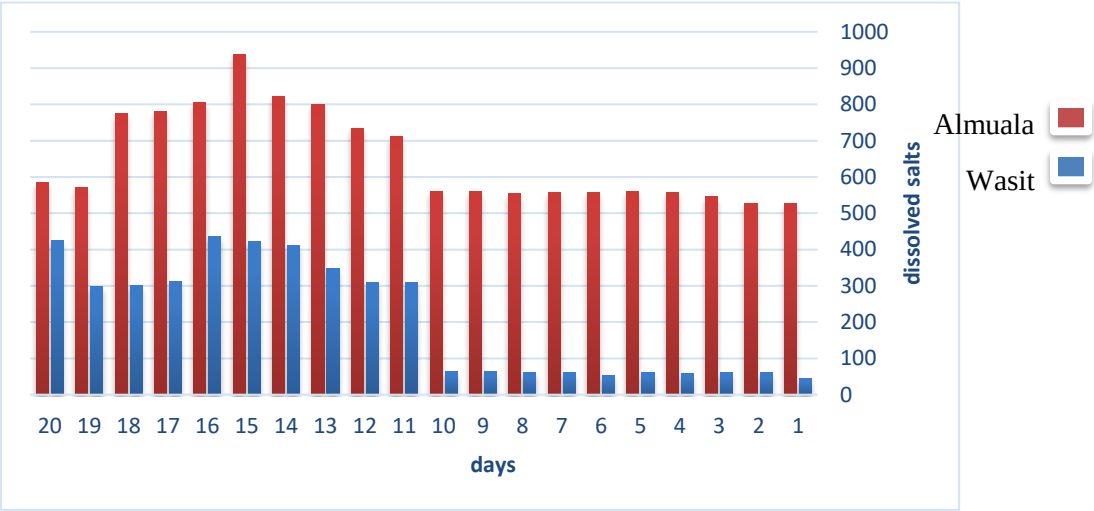
A- Application of water protocol (measurement of salinity)):

The water protocol was applied in both Wasit and Al-Mualqa villages, and the water salinity index was measured before and after the rains. The following table shows the results obtained:

Table (1) Results of the measurement of salinity of groundwater and rainfall in Wasit village and outstanding village

Notes		Measurement of water salinity (ppm)						
Amount of increase		After the rain			Rain water	Before the rain		
Almualaqa	Wasit	Almualaqa	Wasit	Date		Almualaqa	Wasit	Date
184	264.2	711	308	10/16	63.6	527	43.8	9/12
208	248	735	308	10/17	59.5	527	60	9/16
253	288	800	349	10/20	140	547	60.1	9/19
262.6	352	820.6	411	10/21	45.2	558	59	9/24
379	363	938	423	11/11	274	559	60	9/27
249	382	805	436	11/21	-	556	54	10/1
224	249	780	311	12/10	-	556	62	10/3
220	239	775	300	12/18	-	555	61	10/7
10	235	570	298	12/31	-	560	63	10/10
23	362	584	425	2/17	50.2	561	63	10/14

Diagram 1: Comparison of the salinity of groundwater before and after rainfall in the villages of Al-mualaqa and Al-Wasit



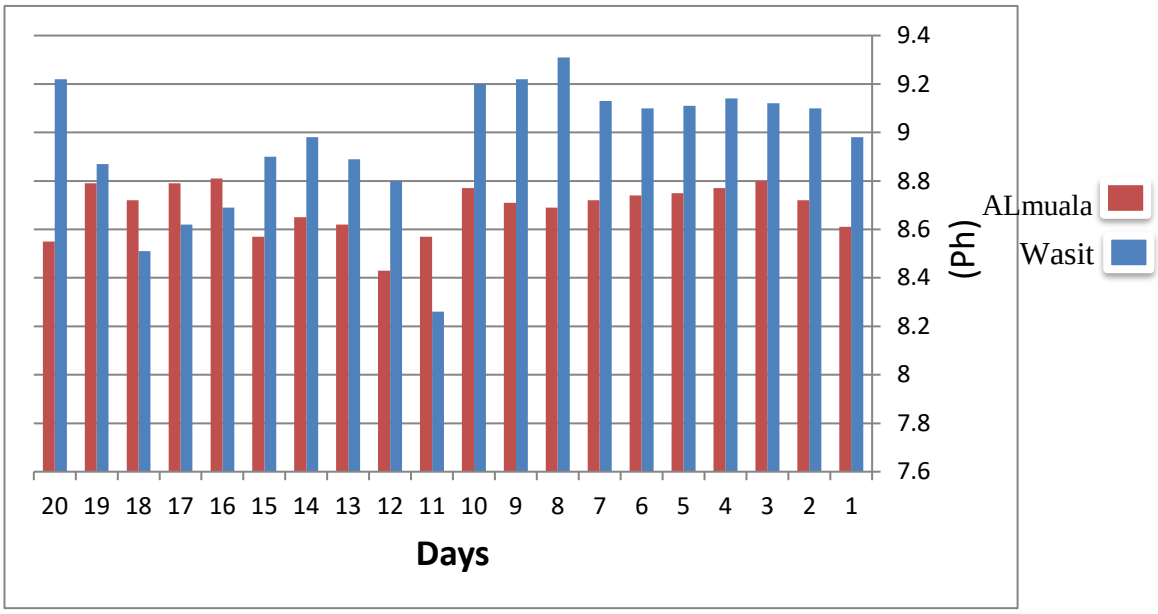
B- Application of water protocol (pH measurement):

The water protocol was also used to measure the pH of groundwater before and after rainfall. The results were as follows:

Table (2) Results of pH measurement of groundwater and rainfall in the villages of Wasit and suspended

PH measurement of groundwater						
After the rain			Rainwater	Before the rain		
Almualaqa	Wasit	Date		Almualaqa	Wasit	Date
8.57	8.26	10/16	8.65	8.61	8.98	9/12
8.43	8.80	10/17	8.39	8.72	9.1	9/16
8.62	8.89	10/20	8.22	8.80	9.12	9/19
8.65	8.98	10/21	8.19	8.77	9.14	9/24
8.57	8.90	11/11	7.35	8.75	9.11	9/27
8.81	8.69	11/21	-	8.74	9.10	10/1
8.79	8.62	12/10	-	8.72	9.13	10/3
8.72	8.51	12/18	-	8.69	9.31	10/7
8.79	8.87	12/31	-	8.71	9.22	10/10
8.55	9.22	2/17	8.40	8.77	9.2	10/14

Diagram (2) Comparison of pH of groundwater before and after rainfall at study sites



C- Application of the Soil Protocol:

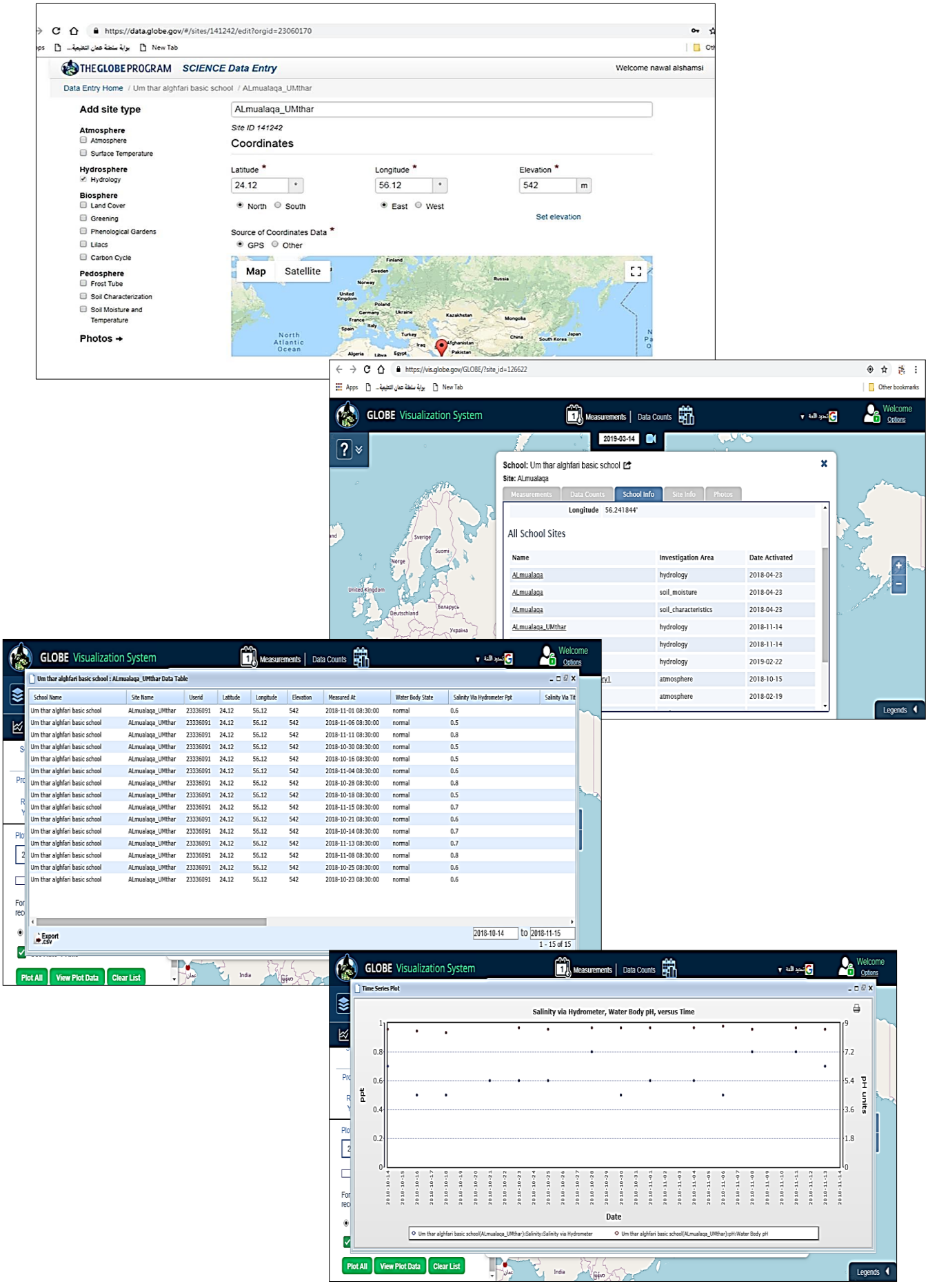
The following table shows the results of applying the soil protocol in the villages of Al-Wasit and Al-Mulaqa near the groundwater:

Table (3) Measurement of the soil protocol of the surface layer in the study sites

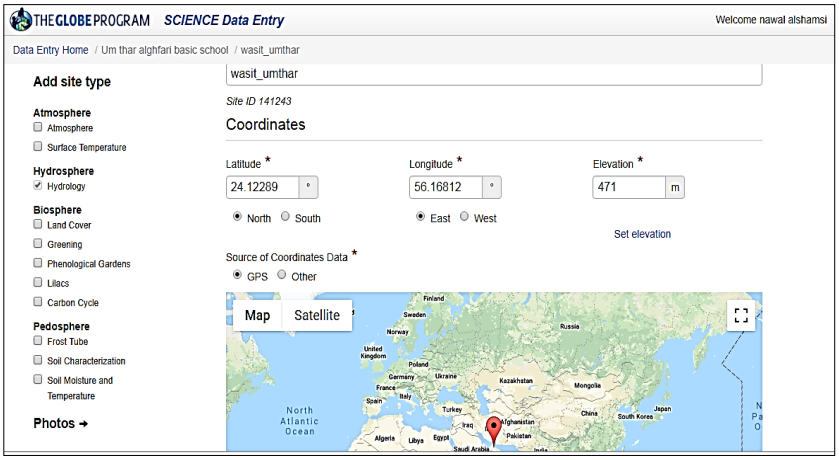
Organic materials		The extent of carbon		Soil salinity (ppm)		Ph for soil		Measurement period
Almualaqa	Wasit	Almualaqa	Wasit	Almualaqa	Wasit	Almualaqa	Wasit	Measurement
exist	exist	Medium	large	844	593	8.11	6.2	1
exist	exist	Medium	large	876	611	8.32	6	2

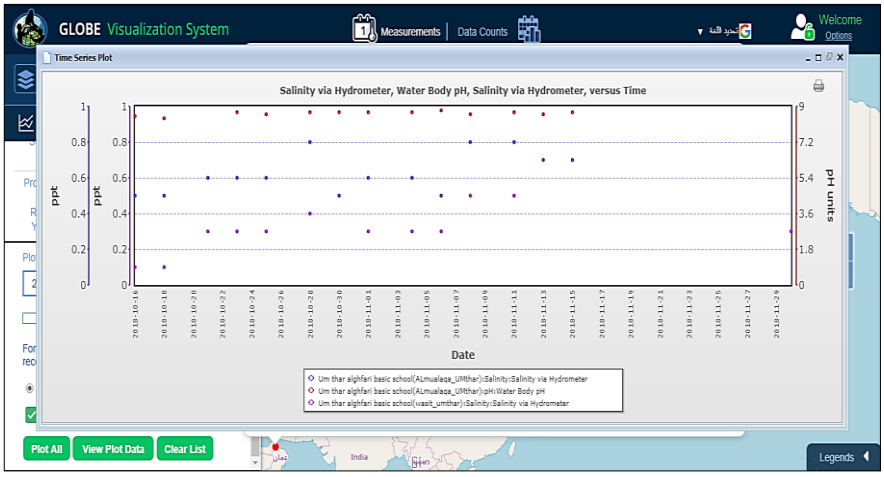
The data was entered and sent at the program site (www.GLOBE.gov) by applying DATA ENTRY. A new location was added and the data collected in the search was added as follows:

Almualaqa village site (site configuration and data entry)



Al Wasit Village / Location and data entry





Discussion of results:

From the previous results, and as a response to the first question, we note that groundwater salinity is affected by rainfall. The results of the water protocol in Wasit village (Table 1 and Figure 1) The salinity of groundwater increased from (43-60ppm) before the rain to (63-275) after the rainy which mean increase by (264-363ppm). But after several weeks of stop the rain, the salinity rate began to decline. While the salinity percentage in groundwater of Al Mualaqa village rose from (527-560ppm) before precipitation to (800-937ppm) after rain. We also noticed that several weeks after the rains stopped, the salinity value began to decline.

However, it is noted that the salinity of the waters of the Groundwater of the Wasit is very low in contrast to the water of the village of the Almualaqa is high salinity, which is not preferred to drink, especially for people suffering from kidney disease and blood pressure. Therefore, groundwater salinity should be followed by Omani standards to ensure the health of the citizen.

The second question was answered by observing the results of pH measurement of groundwater before and after rainfall (Table 2 and Diagram 2), Which show that the pH of the groundwater is affected by precipitation. Where we note that the pH in the water of both villages decreased after the rains, where it decreased in the water of the village of Wasit after the fall of rainfall about (0.96), While the slight change in village water Almualaqa was almost (0.02). But what are the factors that led to this disparity, although rainwater ranged between 8 and 7?

To investigate the causes of these changes and to answer the third question, the soil protocol (Table 3) was made. It showed that the salts in Wasit soil ranged between 611-539ppm and pH (6). As for the Almualaqa village, its salinity measured ranged from (844-876ppm) with a pH (8.32-8.11). The chemistry teacher in the school said during the interview that this indicates that the quality of salts found in sodium, ammonia chloride or sodium fluoride in the soil is related to the increase or decrease of the pH of the groundwater, As rain descends to the earth's layers, it dissolves its salts, which in turn increases or decreases the pH as well as the salinity of the groundwater.

Conclusion

The characteristics of groundwater do not remain constant but are affected by many factors, including precipitation that affect the measure of the salinity and pH by increasing or decreasing that depending on the characteristics of fallen rainwater and the purity or pollution of the atmosphere, in addition to the characteristics of the soil of the target area. There is also a continuing need for communication between society and its institutions, and a focus on all environmental phenomena.

And by interviewing the parents in some nearby villages, namely the villages of Al-mualaqa and Al-Wasit, which basically mainly on underground water for drinking and daily life, and to answer some questions about the extent of the change in the taste of water after rain and through their cooperation with me to obtain samples of water to apply the water protocol to Different periods before and after the rains as well as application of the soil protocol at the sites of the study I was able to obtain accurate information on the extent of change in the characteristics of groundwater, especially salinity and pH before and after the rains, in addition to the cooperation of officials in the Director General of the Regional Municipalities and Water Resources in the Governorate in the interpretation of the results reached.

The results showed that the salinity of the groundwater in the villages of Al-mualaqa and Al-Wasit increased after the rains and then decreased after several weeks after the precipitation stopped. This is due to the soil containing a layer of salts and during the runoff of the rain water, it dissolves these salts to increase the percentage of dissolved salts in the groundwater, while I observed a decrease in the pH of the groundwater

after the rain, but it is still between (8-9) and this water is according to the Omani standards for drinking water is valid to drink. However, the risk is high in the percentage of soluble salts in water after the rains, where it is not recommended to drink that water, which has a salinity of more than (1000ppm) but the proportion of (800ppm) and above is not preferred to drink, especially for people suffering from kidney disease and blood pressure.

And here is the importance of this research and therefore was alert people for the need to make filters in kitchens and in refrigerators for drinking to balance salts, especially people who rely on drinking on ground water and people who is suffered of blood pressure and kidney diseases, in addition to the need to know the people to the hot number of the municipality to communicate in the event of a smell Or change the taste of water for the concerned parties to take the necessary action.

The strengths of the research were the follow-up of groundwater over the course of a whole period and cooperation with the institutions of the community for the benefit of the community in which I live. I also acquired the skills of communication and communication, the skill of using the salinity device and the pH meter, the application of the soil protocol. I learned how can i investigate scientific and environmental problems and contribute to solving them, which has had a positive impact on increasing the community awareness of the importance of the presence of filters at home.

As for the development points, I consider the need to continue research and detection of soil components and their laboratory analysis to explain and understand the phenomenon related to water and soil in cooperation with the competent authorities.

This research will benefit the society by drawing the attention of the concerned parties to the factors affecting the characteristics of groundwater, and alerting people about the consequences of changes in the characteristics of water, especially on patients and thus taking the necessary measures.

Thanks, and appreciation

I am pleased to extend my sincere thanks and appreciation to Nizira Al Harthiya, the national coordinator of the GLOBE Environmental Program in the Sultanate of Oman, for all the information she has provided and to the members of the Central Team of the Program and the local team for their continued follow-up and encouragement. I would also like to thank Ms. Nawal Al Shamsi, the program's teacher at Umm Al-Ghaffari School, for giving me the opportunity to prepare this research and to the former program supervisor, Mrs. Moza Al-Khamisani for her support and follow-up for each step of the preparation of the research.

I would also like to extend my thanks and appreciation to the people of the villages of Al-Mualaqa and Wasit to assist me in providing the necessary information for the research, and to the officials of the General Directorate of Regional Municipalities and Water Resources in Buraimi Governorate and also STEM specialists for their cooperation and support and providing scientific and knowledge guidance on the subject matter. I thank the distinguished chemistry teacher at the school, Ms. Mona El Naqbi for the useful information she provided, and the school of Hudhayfah bin Mahsin for helping us collect water samples for the village of Wasit and for everyone who contributed to the success of this research.

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