Sultanate of Oman
Ministry of Education
Al Dhahirah Governorate
Souda Umm Al-Mu'minin Primary School (5-12)

Study of the characteristics of water resources and their suitability for agriculture in Al-Deriz village (Ibri)

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(In Willayat of Ibri)

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Abstract:

This research aims to study the characteristics of groundwater and freshwater in Al-Dreiz village, and its suitability for agriculture, and the comparison between the two types of water due to the high salinity of groundwater, by answering the following two questions:

1- What are the reasons for the high salinity of groundwater in the village of Al-Dreiz?

2- What is the difference between the salinity and acidity of groundwater and well water? Which one is more suitable for agricultural use?

This research was applied in the village of Al-Dreiz in the Wilayat of Ibri, to study the causes of the problem through field visits and questioning some of the villagers, as well as interviewing some farmers to deduce a problem for the study.

Through this, it became clear to us that farmers and residents are suffering from a sudden increase in the salinity of groundwater. Compared to the salinity of the waters (Note that the salinity of Al-Masarat water was previously higher than that of groundwater). The main water sources in the village are Al-Masarat water and groundwater, and the acidity of the groundwater and Al-Masarat water was almost moderate (as the proportions were close to each other). Through the samples taken from the groundwater and

Al-Masarat water, we applied the water protocol in the school laboratory to measure the salinity and acidity properties of the water samples. The research results indicated that there is a difference in the properties of the water, as it indicated the following:

The characteristics of the groundwater were different from those of Al-Masarat water; the salinity was higher in the groundwater (716ppm), in contrast to that in the water of Al-Masarat, where it was approximately (515ppt), and the acidity of the two types of water was similar and moderate (ranging from 8pH to 8.80pH).

Based on the research results, the researchers recommend that the relevant authorities intensify campaigns to monitor and examine the characteristics of groundwater and well water to determine their suitability for agriculture, as well as to ensure that citizens are aware of the use of modern irrigation methods, while setting guidelines to protect the water protocol from pollution that may result in a change in the basic characteristics of the water.

Key terms:

1- Field visits: These are visits conducted to inspect the place, learn about the environmental problems, and then study them.
2- Al-Masarat Water: It is the groundwater basin that was discovered in Al Dhahirah Governorate, as it contains large quantities of water, and rain is what feeds this groundwater reserve.
3- Alkaline water: It has a higher acidity than Ph7. It is produced by adding some chemicals and gases, and causes the water to have a bitter taste.

Research questions:

This research seeks to answer the following questions

1- What are the reasons for the high salinity of groundwater in the village of Al-Deriz?

2- What is the difference between the salinity and acidity of groundwater and well water? Which is more suitable for agricultural use?

Through the previous questions, we will begin our research and employ all the data, discuss the results, and answer each question we asked previously to reach the reasons leading to the high salinity of groundwater in the village.

Introduction and literature review:

The problem of high water salinity is considered one of the most important environmental problems at the present time, and the residents of Al-Dhuwairiyah villge suffer from a sudden increase in the salinity of groundwater, as the salinity of groundwater was moderate in the last three years. What is meant by high water salinity is the increase in the percentage of salts in the water, which sometimes makes it unsuitable for agricultural use.

Groundwater in the village is almost the secondary source after Al-Masarat water, as most farmers depend on groundwater to irrigate their crops. Therefore, the high salinity of groundwater poses a threat to the life of crops.

Some of the wells in the village had previously dried up due to the lack of rainfall, as rainwater is a major source of groundwater in the village. The drought lasted for about a month or more, but after that, thanks to God, water returned to the wells again, but with environmental problems that we had not known before, such as high salinity of the water.

Therefore, this topic was chosen for study to ensure the suitability of this water for agriculture, and to identify the reasons leading to the high salinity of groundwater in the village by applying the water protocol.
God willing, in this study we will try to reach correct conclusions, to contribute in solving this environmental problem.

Research methods:

First: Research plan

At the first, we identified the sources of water in the village, and we found that; the well water was the most common in terms of use. We concluded that farmers and villagers suffer from the problem of high groundwater salinity. Then, we conducted interviews with farmers and residents of the village to identify the reasons that might have led to this and to collect information about the research topic from various sources.

The team was divided into two groups, and each researcher examined and tested only one type of water, to deduce the characteristics of both (Al-Masarat water and groundwater), in terms of salinity and acidity, and to reach the difference between them, as well as to know the reasons that led to the increase in groundwater salinity. The water protocol was applied in the school laboratory and we consulted some companies specialized in the field of water, such as Sahara Al-Masarat Store in Yanqul.

Proposed timeline:

workplan	The month
Formulating the research problem - Determine the tools and take water samples. -	November/2024
Conducting field visits - Conducting interviews with farmers and locals -	November/2024
come to conclusions - Start writing your research -	December/2024
Complete research, audit and make recommendations - Research envelope format -	January/2025
Submit your research	February/2025

Table (1)

Distribution the roles on the research team:

- Distributing the roles to the research team, represented in preparing tools and field application.

Student's name	Mission
Aya Sultan - Lian Salim	Clearly formulate the research problem and identify and prepare the required tools.
Aya Sultan - Lian Salim	Collecting and analyzing data through the application of the water protocol and conducting some interviews with the residents, and entering the data into the site
Aya Sultan	Reaching conclusions through the collected data and interviews, and from there formulating the summary and starting to write the research
Lian Salim	Water sample testing at Sahara Al Masarat store in Yanqul
Aya Sultan	Complete the search
Lian Salim	Make recommendations and audit

Table (2)

- Identifying and reviewing some sources related to the research topic, such as collecting information from the school's learning resources center, such as scientific encyclopedias, and using the information network (Internet); to obtain some articles, documents, in addition to the notes of the protocols from GLOBE program.

- Precisely identifying the locations from which water was taken, in preparation for the data collection process.

Research plan application sites:

the job	the site
Study of the properties of water	School, Sahara Al-Masarat store in Yanqul
Study the area surrounding the well	Well location

Table (3)

Protocols applied in the research:

Applied protocol	the job
Water Protocol	Study of the properties of groundwater and well water, by measuring salinity, acidity and temperature.

Table (4)

- Determine the appropriate equipments and tools to perform the work. (PH meter- Salinity meter- GPS- Thermometer - Cups - Paper - Pen).

- Apply research to samples by applying appropriate protocol activities (Water).

Mechanism for implementing the Water Protocol for data collection:

Application mechanism	Protocol	Research question
Use a salinometer to measure the salinity of groundwater. -1 A field visit to the well site, a careful inspection of the place, and an interview with one of the residents to determine the reasons that may have affected the water properties. -2	Water	the first
Use a salinometer and a pH meter to measure the properties of both types of water. -1 Comparing the characteristics of freshwater and groundwater to determine the difference between them and which one is more suitable for agriculture. -2		the second

Table (5)

- Sampling, where a sample was taken from one of the wells in the village, and another sample was taken from the water of Al-Masarat.

- Recording data about the characteristics of each type of water.

- Collecting data and organizing it in tables.

- Examining water samples at Sahara Al Masarat Store in Yanqul.

- Data analysis and graphic representation.

- Conducting an interview with one of the residents, where he was asked some questions and his answers were as follows:

1- In your opinion, what are the reasons that led to the increase in groundwater salinity?

It may be due to the large depletion of well water, or maybe there are other factors, such as the growth of some harmful weeds near it that consume large amounts of water.

2- Does the high salinity of groundwater affect the growth of agricultural crops?

Yes, it affected the growth of agricultural crops significantly, as mango flowering decreased and palm trees were destroyed.

3- What solutions do you suggest to solve this problem?

Rationalizing the consumption of water, periodically cleaning the area surrounding the well and removing weeds and harmful trees if any, and checking the well water from time to time to ensure its safety.

- Conducting another interview with Ms. Kholoud Al-Hana'i; an employee at Bee'ah Company, and asking her the following question:

- What is the role of Bee'ah in protecting groundwater? Does waste have an impact on groundwater pollution?

Bee'ah has been concerned with the safety of groundwater, as the company has closed all traditional landfills that might have posed a threat to the health of groundwater, and at present, waste has almost no effect on groundwater.

- Reaching results and recommendations.

Second: Study location

The plan of this research was implemented in Sultanate of Oman - Al Dhahirah Governorate- Ibri- Al Deriz Village. In the months of November and February when the weather was moderate, and the water protocol was used.

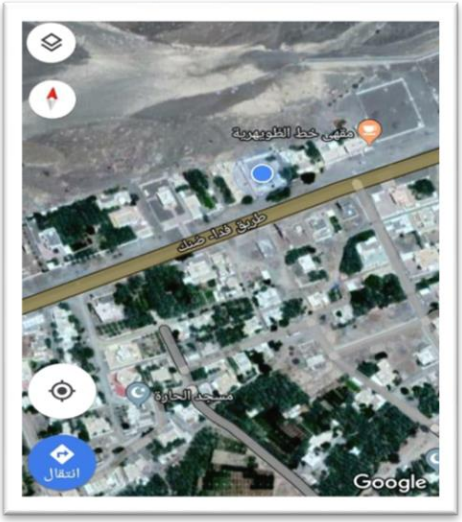
Samples of both types of water were taken, and the water protocol was applied in the school laboratory, and the well site (for groundwater) was visited. The maps below show the geographical location from which both the well water (groundwater) and Al-Masarat water samples were taken.

Location coordinates:

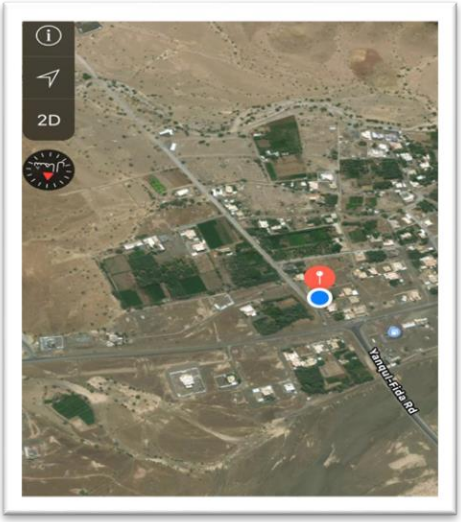
Longitude: 23.3

Latitude: 56.29

Height: 499 meters



Groundwater sample location



Al-Masarat Water Sample Location

Third: Data collection and analysis

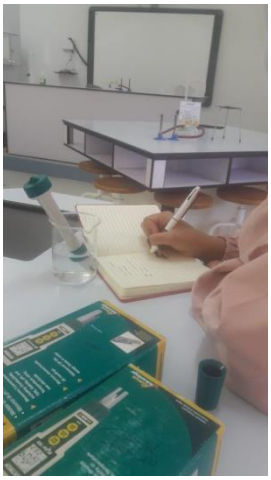
At the first, the work of each student in the team was determined through a schedule that specifies the work of each student and the protocols that they will implement. After that, the following steps were taken:

1- Water protocol application: Two water samples were taken (Al-Masarat water and groundwater) and examined using a salinity and acidity device.

2- Comparing the salinity and acidity of the two types of water through the samples taken.

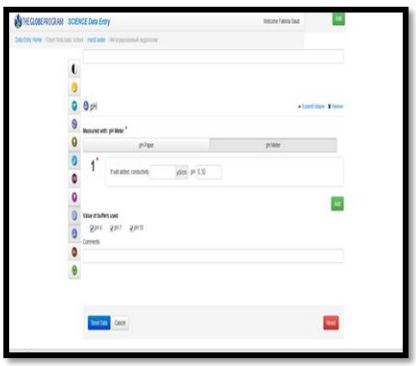
3- Create a comparison table containing all of the above and charts to know the difference between the two types of water and then reach the reasons leading to the increase in groundwater salinity.

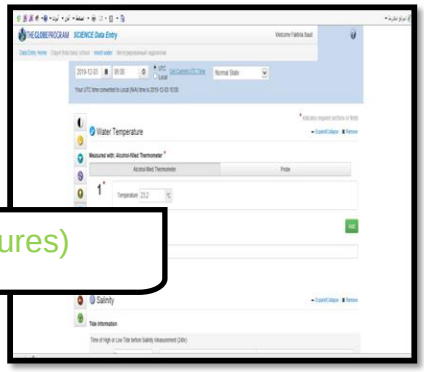
4- By studying the well site; external factors and causes surrounding the study area became clear, through which we will reach recommendations to solve this problem and try to get rid of it.



5- All water protocol data and study sites were recorded on the program website and copied as follows:

Water Protocol Data (Groundwater)





Water Protocol Data (Water of Pleasures)

Results:

Software Devices GLOBE:

Average temperature	Medium acidity	Average salinity	Comparison Point
24	8.80ph	716ppm	Groundwater
23.2	8.30ph	515ppm	Water of Delights

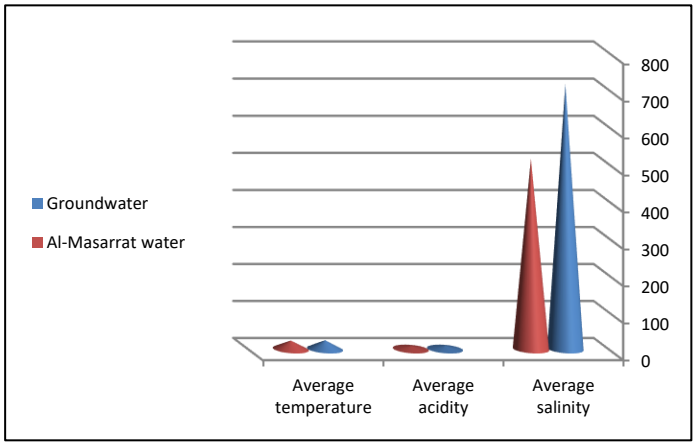
Table (6): Comparison between the characteristics of groundwater and well water

Salinity meter in Sahara Al-Masarat Store:

Average salinity	Comparison Point
705ppm	Groundwater
510ppm	Water of Delights

Table (7): Comparison of salinity characteristics of groundwater and freshwater

The following data were obtained by comparing the salinity and acidity of groundwater and Al-Masarat water as follows:



Flowchart (1): Comparison of Water Protocol Properties (Software Hardware)

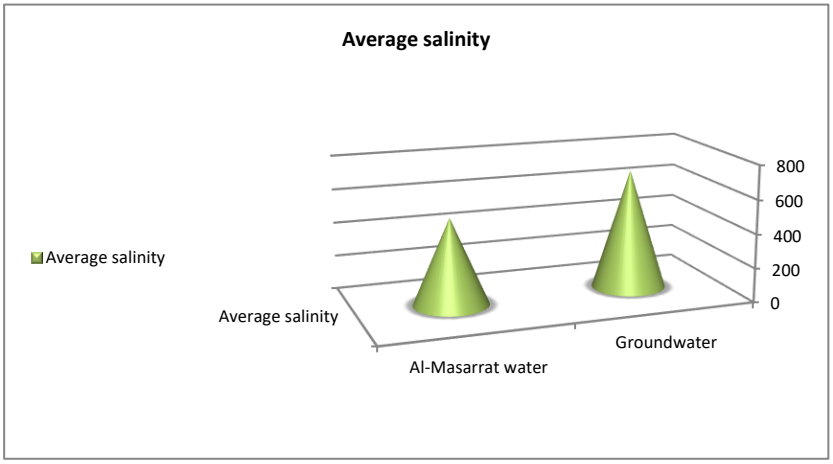


Chart (2): Comparison of salinity characteristics (store devices)

Discussion of results:

Through the results that we reached, it became clear to us that the salinity of groundwater is high compared to the waters of Al-Masarat, and with research and scrutiny, it became clear to us that the external factors surrounding the area that was studied, are negatively affecting the well. Then we found that the acidity of the two types of water was close, as there was a slight difference between them. Note that the acidity of both types is moderate.

It turns out that the answer of the first question is as follows:

After examining the location of the well and visiting the site more than once, it became clear to us that the reasons that led to the increase of water salinity above the previously known rate were probably due to excessive depletion of groundwater, planting crops that consume large amounts of water, and using traditional irrigation methods that drain quantities of water, in addition to the growth of some harmful weeds that may drain large quantities of water. Through interviewing the honorable Kholoud Al-Hana'i, it became clear to us that the waste has nothing to do with changing the properties of the water, due to Bee'ah's interest in disposing of it and not accumulating it (i.e. the company transports the waste in large trucks to the engineering landfill). As we mentioned, all traditional landfills that were previously among the causes leading to groundwater pollution and changing its properties have been closed. There may be other reasons that we have not discussed.

To answer the second question:

Yes, there is a difference between the properties of Al-Masarat water and groundwater, as the salinity of groundwater is very high, unlike the salinity of Al-Masarat water, which was less high, and the acidity of both types of water was close and moderate.

We note that the most suitable water for agricultural consumption is Al-Masarat water at the present time, until found a solution for the high salinity of groundwater.

Some external factors surrounding the well area (weeds)

Conclusion:

n this research, we tried to identify the salinity and acidity characteristics of both types of water in the village, their suitability for agriculture, and the reasons that may have led to the current high salinity of groundwater. We conducted a practical experiment in the school laboratory. So, we took water samples to examine them with different devices in the Sahara Al-Masarat store, as well as field visits to the farms in the village.

We concluded that:

External factors affecting the depletion of large quantities of water during consumption, which is a factor that greatly affects the increasing of water salinity, and there are may be some other human factors that have affected the changing of water properties.

From this, we conclude that the properties of well water differ from the properties of groundwater, as:

- Properties of Al-Masarat water: Moderate salinity and moderate (acidity (alkaline water.

- Properties of groundwater: Very high salinity and moderate acidity (alkaline water).

Based on these results, the researchers recommend:
- All segments of society are working hard to find solutions to the problem of high groundwater salinity in the village.
- Requesting the concerned authorities in each governorate to follow up on the water characteristics in the villages from time to time, and to provide the farmers' requirements for following up on the water characteristics.
- Conduct other research in different places to compare the results which have been obtained.

Thanks and appreciation:

We extend our sincere thanks and appreciation to:

1- The supervisor of GLOBE program at school: Ms. Fakhriya Al Balushi; for giving us the opportunity to conduct this research.

2- The village farmers and parents: To clarify the problem.

3- Ms. Kholoud Al-Hana'i: For providing us with useful information that helped us in completing this research.

4- Mr. Bader Al-Maamari: For his continuous support for the team and his backing for us.

5- Dr. Ahmed Moussa: The National Coordinator of the GLOBE Program in Oman.

6- The team members of GLOBE at the school.

7- We extend our deepest thanks and appreciation to everyone who gave us advice and assistance and helped us in answering the questions and overcome obstacles in implementing this research.

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