



RESEARCH PROPOSAL:

" ENVIRONMENTAL CHANGES IN COASTAL AREAS (AL DAHARIZ – AL HAFFA) AND MORINGA'S ROLE IN SUSTAINABLE AGRICULTURE "

MANBA AL-HIKMA SCHOOL FOR BASIC EDUCATION (5-8)

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مدرسة منبأ الحكمة للتعليم الأساسي (5-8)
Manba Al-Hikma School for Basic Education (5-8)

ACADEMIC YEAR (2025-2026)

ABSTRACT :

This research aims to study environmental changes in the Al-Dahariz and Al-Haffa areas, which are among the most important coastal areas in the state of Salalah, and which have been affected in recent years by natural factors such as tropical cyclones and seasonal depressions, in addition to urban expansion and human activities.

Coastal areas play an important role in the carbon cycle, as their soils and plants absorb and store carbon from the atmosphere through photosynthesis and the accumulation of organic matter. However, the environmental changes witnessed in the Al-Daharis and Al-Haffa regions have affected the ability of coastal soils to retain carbon, and have also led to a decline in some components of local biodiversity.

From this standpoint, the importance of studying the impact of environmental changes on the properties of coastal soil and plant growth is highlighted. Environmental changes on the properties of the soil of the Al-Daharis area were analyzed in 2023 using the program protocols, and compared to the results for 2026. After that, the role of Moringa (the miracle plant) as a natural biostimulant will be evaluated, due to the high proportions of beneficial nutrient chemical elements in Moringa leaves, and it will be applied to the papaya plant in a comparative experiment.

This study contributes to raising environmental awareness among farmers and local residents in Salalah and introducing them to the benefits of Moringa (the miracle plant), and the importance of integrating natural solutions to promote sustainable agriculture in changing coastal environments.

RESEARCH QUESTIONS AND HYPOTHESES :

Will the water and soil properties in the Al-Daharis area change between 2023 and 2026?

We assume that the properties will change and salinity will increase, thus affecting the growth of local plants.

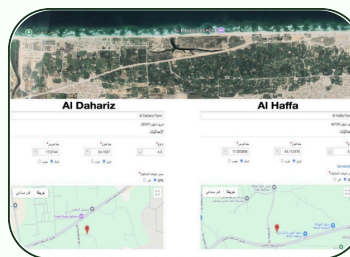
What are the most prominent environmental changes that have occurred in the coastal areas (Al-Dahariz and Al-Haffa) during the past years?

We assume that the environmental changes in these coastal areas are a result of hurricanes and urban expansion.

Does Moringa extract contribute to improving papaya plant growth in coastal soil?

We assume that Moringa extract will improve plant growth and could be a sustainable alternative to support plant growth in coastal environments.

DESCRIPTION OF STUDY SITE :



Sultanate of Oman – Dhofar Governorate – Salalah State – Al-Dahariz and Al-Haffa area:

Al-Dahariz (Latitude 17.0144, Longitude 54.1537, Height 4.3m) is a coastal area affected by waves, high humidity, and its proximity to Khor Al-Dahariz.

Al-Haffa (Latitude 17.003898, longitude 54.112476, elevation 5.2m) is an urban coastal area, experiencing urban expansion and environmental changes.

The climate in these regions is hot and humid in the summer, and mild during the autumn season. It is characterized by seasonal rains that increase in the tropical seasons. As for its soil, it suffers from high salinity due to its proximity to the sea and its exposure to winds laden with salts.

DATA COLLECTION PLAN :

A timeline was set for carrying out the work and distributing roles among team members:

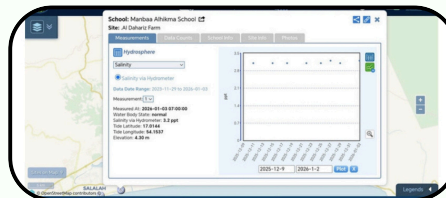
| GLOBE Team Members | Task | Execution Date |
|---|--|-------------------------|
| Team Supervisor + Alaa Saif + Rayan Salem | Conducting protocols, measurements, and sample collection | 30/11/2025 - 4/12/2025 |
| Alaa Saif + Rayan Salem | Interview with Vegetation Cover Specialist Ali Alkhaik and Agricultural Engineer from Parks & Afforestation Department | 7/12/2025 - 11/12/2025 |
| Team Supervisor + Alaa Saif + Rayan Salem | GLOBE team meeting, discussing the problem, and determining research title | 14/12/2025 - 18/12/2025 |
| Alaa Saif + Rayan Salem | Practical preparation of Moringa extract in the science laboratory | 21/12/2025 - 25/12/2025 |
| Team Supervisor + Rayan Salem + Alaa Saif | Sending samples and receiving analyses from Soil & Water Research Laboratories in Dhofar | 28/12/2025 - 1/1/2026 |
| Alaa Saif + Rayan Salem | Following up results, writing research and report | January 2026 |

Soil samples were taken from a depth of 0-20 cm and the soil properties in the two areas (Al-Daharis and Al-Haffa) were analyzed using the soil protocol and compared in terms of color, texture, quantity of rocks, roots and carbonates, as well as pH, salinity and conductivity with the help of the Soil and Water Research Laboratory in Dhofar Governorate.

The salinity of the Al-Dahariz soil reached (5.95 ppt), which is higher compared to the salinity of the Al-Haffa soil (1.70 ppt), indicating a clear difference in the level of salinity between the two sites. Readings of the salinity of the Al-Dahariz water were also entered for about a month, and the recorded values were observed to be close, with the overall average salinity reaching about (3.15 ppt).

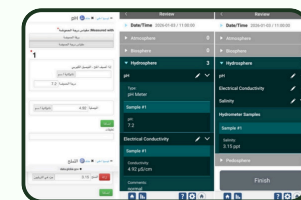


Images of GLOBE software protocols being used

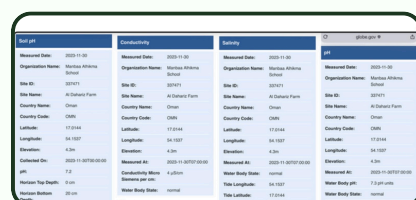


Graph of the salinity of the water in the estuaries from the GLOBE Visualization System

Environmental changes to coastal areas were analyzed in 2023. Data for this year for the Al-Daharis area were retrieved from the GLOBE Observer application and compared with the results for 2026, where areas were sampled and examined in the science laboratory using water protocols and soil protocols (pH, electrical conductivity, salinity).



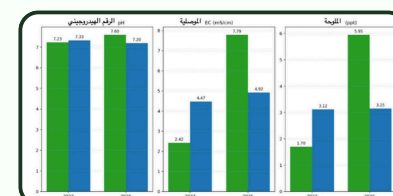
Images of data entry in GLOBE in 2026



Images of data recovery from the GLOBE Observer app for 2023

| خصائص ماء الدهاريز AL-DAHARIZ WATER | خصائص تربة الدهاريز AL-DAHARIZ SOIL | الخصائص |
|--|--|---------|
| 2026 | 2023 | 2026 |
| 7.20 | 7.33 | 7.60 |
| 4.92 | 4.47 | 7.79 |
| 3.15 | 3.12 | 5.95 |
| | | 1.70 |

Table (1) Soil and water characteristics in the trenches between the years 2023 and 2026



Comparison of soil and water properties in Al-Dahariz between 2023 and 2026



Satellite images of the Al-Dahariz area

Next, the role of Moringa (the miracle plant) as a natural biostimulant to support agricultural sustainability will be evaluated by applying it to the papaya plant in a comparative experiment, where we plan to prepare a liquid extract from Moringa leaves with a concentration not exceeding 10% so as not to negatively affect the growth of the papaya plant and use it in foliar spraying twice a week to achieve rapid results and compare the growth rates of the plant every week. Soil was collected from the two sites and prepared in four equal-sized planting pots. Papaya seedlings were planted in each pot and will be watered every two days with a fixed amount (200-250 ml per seedling). Moringa was sprayed twice a week on the leaves of only two seedlings (one from Al-Dahariz and one from Al-Haffa), while the other two seedlings were used as control groups that were watered only with water.



Measurements of length, number of leaves, and growth appearance will be recorded weekly for a month. At the end of the experiment, the average measurements will be calculated to analyze the effect of Moringa.

BASIC AND SUPPORTING INFORMATION :

As we know, farms near the shore suffer from soil salinity due to their proximity to the sea, which leads to slow plant growth and weak roots or their non-growth naturally. This is a nuisance for the owners of coastal farms, which makes them look for a solution to this problem. Therefore, we, as students participating in the GLOBE environmental competition, are encouraged to study these coastal areas with the aim of evaluating environmental changes and their impact on the soil properties in local farms and on the growth of natural plants, in addition to testing the possibility of using Moringa, which is rich in vitamins and minerals, as a sustainable solution to improve the growth of local plants by applying a foliar spray with Moringa extract, and comparing it to treatment with ordinary water.

Previous studies in this field include: the study by (Al-Kindi et al., 2023), which indicated that the Natural Vegetation Index (NDVI) in Dhofar Governorate was affected by cyclones and other climatic factors; the study by (Al-Mulla et al., 2022), which showed through the results that there is a significant impact of urban expansion on vegetation in Dhofar Governorate; and also the study by (Din et al., 2023), which indicates that spraying Moringa improves plant growth under salt stress by a significant percentage.

EXPECTED RESULTS :

The study shows that coastal areas such as Al-Daharis and Al-Haffa are clearly affected by environmental changes, which are reflected in soil characteristics and the growth of native plants. We hope that the agricultural experiment using Moringa will play a positive and effective role in supporting sustainable agriculture by improving plant growth and reducing the effects of environmental stress. This research is expected to benefit many community members interested in cultivating plants in coastal areas, as it represents an important step towards a better understanding of coastal soil behavior and providing environmentally friendly solutions to support sustainable agriculture and help farmers cope with environmental stress.

REFERENCES :

GLOBE protocol devices (Soil and Water Protocol)
GLOBE database
GLOBE Observer app
Satellite images from Google Earth

- Al-Kindi, K., Al Nadhairi, R., & Al Akhzami, S. (2023). Dynamic change in NDVI in Dhofar in response to climate change. Agriculture. https://www.ea.gov.om/media/iuqndmw/full_salalah_dynamic.pdf

- Al-Mulla, Y., et al. (2022). Assessment of urban expansion's impact on vegetation patterns in Dhofar. IEEE Access. <https://ieeexplore.ieee.org/document/9857886>

- Din, H. M., Anjum, M. A., Ahmad, R., & Ercisli, S. (2023). Foliar application of moringa leaf extracts enhances carnation growth and flower yield under saline conditions. Journal of Plant Growth Regulation. <https://rd.springer.com/article/10.1007/s00344-023-11129>

- Al-Bakri, A. N. (2023, March 7). Statement at the regional workshop on sustainable soil management in the Near East. Ministry of Agriculture, Fisheries and Water Resources. Retrieved from <https://halafm.om/12081/-/العمل-الإقليمية-الإدارة-المستدامة-للترية-في-منطقة-الشرق-الأدنى>

BADGE DESCRIPTIONS :

I WORK WITH SATELLITE DATA :
USING SATELLITE IMAGES FROM GOOGLE EARTH TO ANSWER SEARCH QUESTIONS.

I AM A PROBLEM-SOLVER :
BY FINDING A SUSTAINABLE SOLUTION FOR AGRICULTURAL SOIL IN COASTAL AREAS.

I WORK WITH A STEM PROFESSIONAL :
THROUGH COOPERATION WITH SOIL AND WATER RESEARCH LABORATORIES IN DHOFAR GOVERNORATE AND CONSULTATION WITH EXPERIENCED SPECIALISTS.

