

Sultanate of Oman



Modeling Evaporation Dynamics and Water Quality in Metal Tanks and Their Impact on Bio-Sustainability: An Applied Study from the "Al-Naqaa'a School Observatory" (September – December 2025)

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The Documented Drought Journey: A Scientific Expedition by the Al-Naqaa'a School GLOBE Team

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Research Abstract

This investigative research, conducted by the GLOBE team at the Al-Naqaa School Observatory, aims to model and estimate weekly evaporation rates and analyze water quality dynamics within an open metallic tank in Sohar, Oman. It further investigates the extended impact of these factors on agricultural biodiversity, focusing on tomato, eggplant, and onion crops.

The research journey commenced with the students adopting the role of "Problem Solvers," identifying the knowledge gap regarding metallic tanks as thermal accelerators. Through the Al-Naqaa School Observatory, they established a roadmap linking climate conditions to biological sustainability. To activate this path, their role as "Collaborators" was realized through managing the observatory's field operations, utilizing precise instruments for daily air quality monitoring (7-in-1 device). The team tracked particulate matter levels (and), correlating them with water transparency via a transparency tube (120cm) to determine the impact of settled dust.

Meanwhile, the students excelled as "Data Scientists" by implementing the weekly monitoring protocol at the observatory. They accurately recorded physical evaporation rates and monitored rising Electrical Conductivity () values, which revealed salt concentration resulting from the "Drought Journey." The team also conducted in-depth chemical analyses of levels and Dissolved Oxygen (), innovating a "Capture Net" to analyze suspended dust and its alkaline effect.

Statistical results from the Al-Naqaa School Observatory showed that evaporation peaked in September and October due to the high thermal conductivity of the tank. This created environmental stress that weakened tomato vitality compared to the resilience of onions and eggplants. With the stabilization of weather in December, the observatory documented a recovery in biological indicators and water clarity.

In conclusion, the students acted as "Influencers," presenting predictive models and scientific recommendations from the Al-Naqaa School Observatory. These contributions assist in planning effective strategies for water sustainability and biodiversity in the Sultanate of Oman, confirming that this observatory serves as a cornerstone for understanding local environmental changes.

Scientific Competency & Badges Statement

(Al-Naqaa School Observatory Team)

"At the Al-Naqaa School Observatory, our journey was embodied through four core values. It began as (Problem Solvers), where we diagnosed the effect of metallic tanks as thermal accelerators and innovated the 'Capture Net' to overcome dust challenges and ensure research accuracy. To achieve reliability, our spirit as (Collaborators) emerged through a harmonious division of field tasks; while one monitored air purity, the other measured water transparency to link dust impact instantaneously. Here, our role as (Data Scientists) became prominent; we did not merely collect numbers but designed statistical models to analyze the 'Thermal Decay Curve' and discovered a direct correlation between evaporation and salinity (), transforming thermal tables into charts that defined the environmental 'Tipping Point' in November with digital precision. Finally, we exercise our role as (Influencers) by transferring these findings to the farmers of Al-Afifa with practical recommendations for thermal insulation of tanks. Crowning the eggplant as the 'Hero Crop' and the tomato as the 'Bio-indicator' has turned our research into a guided manual, proving that science at Al-Naqaa School is a message of change that transcends laboratory walls."

Scientific Terminology

First: Meteorology & Air Quality

- **Class A Pan:** The reference tool used by the (Data Collector) to measure the millimetric decrease in water level; it serves as the primary physical indicator of the onset of the "drought journey."
- **Vapor Pressure Deficit (VPD):** The mechanical force monitored by the (Explorer) representing the "atmospheric thirst" for moisture, which drives water molecules to escape the surface of the metallic tank.
- **Air Purity (Air Quality Index - AQI):** A comprehensive indicator monitored by the (Researcher) using a (7-in-1) device. This index tracks fine particulate matter (and), which act as pollutant nuclei when deposited into water. The concept of air purity is intrinsically linked to the degree of atmospheric freedom from suspended solids and gases that degrade ecosystem quality [Al-Nimrawi \(2020\)](#) demonstrated that the disruption of air purity results from increased emissions and suspended particles that settle into the surrounding environment. This findings align with the observations of the GLOBE team at Al-Naqaa School in Sohar, where deposited atmospheric dust significantly affected water transparency and chemical properties in open reservoirs." **Metallic Thermal Conductivity:** The physical property analyzed by the (Analyst) to explain how the tank walls transferred solar energy to the water, effectively transforming the tank into an "evaporation accelerator."

Micro-Weather Station: The integrated monitoring unit at Al-Naqaa School that enabled the team to collect precise climatic data geographically linked to the Al-Afifa site in Sohar.

Second: Water Quality Parameters

- **Electrical Conductivity (EC):** The indicator tracked meticulously by the (Data Collector); it measures the increased concentration of salt ions in the water as a direct side effect of the evaporation process.
- **Dissolved Oxygen (DO):** The amount of vital gas measured by the (Researcher), documenting the inverse relationship between the rising temperature of the tank and the water's capacity to retain oxygen.
- **pH Level:** A measure of chemical balance influenced by the deposition of suspended dust; the team monitored the shift of the tank water toward "alkalinity" as evaporation increased.
- **Transparency:** The metric used by the (Explorer) via a transparency tube to demonstrate water turbidity resulting from the accumulation of atmospheric aerosols and settled soil particles.

Third: Biodiversity & Agriculture

- **Salinity Stress:** The physiological challenge analyzed by the (Scientist), where high salt concentrations in the tank prevent the roots of (tomato plants) from effectively absorbing water.
- **Atmospheric Aerosols:** Solid particles captured by the (Researcher) using a micron-mesh net to study their chemical impact (carbonates) on plant health.
- **Bio-indicators:** The use of crops (Tomato, Eggplant, and Onion) as living tools to measure the biological system's response to climatic and chemical changes at the observatory.
- **Seasonal Transition:** The temporal variable covering the study period (September – December), which drives the change in evaporation rates from thermal peaks to winter stability.

Research Framework (Introduction)

The phenomenon of evaporation is one of the most significant challenges facing water resource management in arid regions. The Sultanate of Oman, and the city of Sohar in particular, stands out as an environment directly affected by seasonal thermal fluctuations. Maintaining water sustainability and quality requires a precise

understanding of how water is lost quantitatively and qualitatively under the influence of direct climatic factors and atmospheric purity.

This research, titled "The Documented Drought Journey," monitors weekly changes in an open metallic tank at the Al-Naqaa School Observatory during the seasonal transition period (September – December 2025). The choice of a metallic tank stems from its properties as a medium with high thermal conductivity, making the water inside vulnerable to rapid physical and chemical changes. This study aims to provide a predictive model that links meteorological observatory data with evaporation rates and water quality, ensuring effective water management that supports biodiversity in the surrounding environment.

Research Problem

- The problem lies in the imperceptible loss of water through evaporation, accompanied by a gradual degradation of the remaining water quality (increased salinity and decreased oxygen levels). In Sohar, this issue is intensified by the combined factors of heat and wind-borne dust (aerosols) monitored by the GLOBE team. Therefore, this research seeks to answer the following questions:
- **How do climatic changes and air purity from September to December affect the efficiency of metallic tanks?**
- **How do the chemical properties (Electrical Conductivity, Transparency, and pH) of water change as a result of this "Drought Journey"?**
- **To what extent are agricultural crops (Tomato, Eggplant, and Onion) affected by the chemical correlation between water and suspended soil particles?**

Research Objectives

- **Evaporation Modeling:** Estimating weekly evaporation rates using a Class A Evaporation Pan and correlating them with atmospheric variables.
- **Water Quality & Air Purity Analysis:** Monitoring changes in Electrical Conductivity (EC), pH levels, and Transparency, while linking them to air quality data recorded via the (7-in-1) device.
- **Chemical & Biological Documentation:** Conducting "Suspended Soil Carbonate" tests and tracking biological growth indicators of the plants.
- **Comparative Assessment:** Identifying significant differences in water loss rates and their impact on biodiversity across the study months.

Significance of the Research

- **Scientific:** Provides documented evidence of the close correlation between thermal fluctuations and water management efficiency in the Sultanate of Oman.
- **Environmental:** Contributes to understanding how to protect biodiversity by monitoring the negative impacts of atmospheric aerosols and concentrated salinity.
- **Educational:** Highlights the ability of GLOBE students to lead rigorous field research that serves the local agricultural community.

Literature Review

- **1. Evaporation Dynamics and Thermal Conductivity** Hydrological studies confirm that evaporation is an energy transformation influenced by vapor pressure and wind speed. In metallic tanks, the material of the tank plays a critical role in increasing the "Heat Budget" of the water; the metal transfers thermal energy to the water mass, accelerating evaporation compared to other types of reservoirs.

Studies have indicated that climatic elements, such as temperature and evaporation, are the primary drivers for increased water demand, whereas humidity and rainfall play an inverse role in consumption rates (Al-Fahdawi, 2024).

- **2. Correlation between Evaporation, Transparency, and Water Quality** Literature indicates that evaporation acts as "Reverse Distillation," leaving salts behind and thus increasing Electrical Conductivity (EC). Furthermore, the deposition of Atmospheric Aerosols reduces water transparency and alters its chemical reactions. High temperatures inevitably lead to a reduction in Dissolved Oxygen (DO), threatening the vitality of local biodiversity.

Accelerating climate changes lead to the disruption of precipitation patterns and increased evaporation rates, which directly affects the physical and chemical properties of water As Al-Damen (2023) pointed out, changes in climatic element trends impact not only water quantities and surface runoff but also extend to water quality due to the accumulation of pollutants. This explains the close correlation between increased evaporation and the rising concentration of salts (Electrical Conductivity) in open water sources

- **3. Seasonal Changes and Air Purity in Sohar** The transition period in Sohar (September–December) is characterized by sharp changes in air purity. Studies indicate that particles increase during dry months, affecting light permeability and irrigation water quality—a premise upon which the GLOBE team based its hypotheses regarding the stress levels of tomato and eggplant crops.

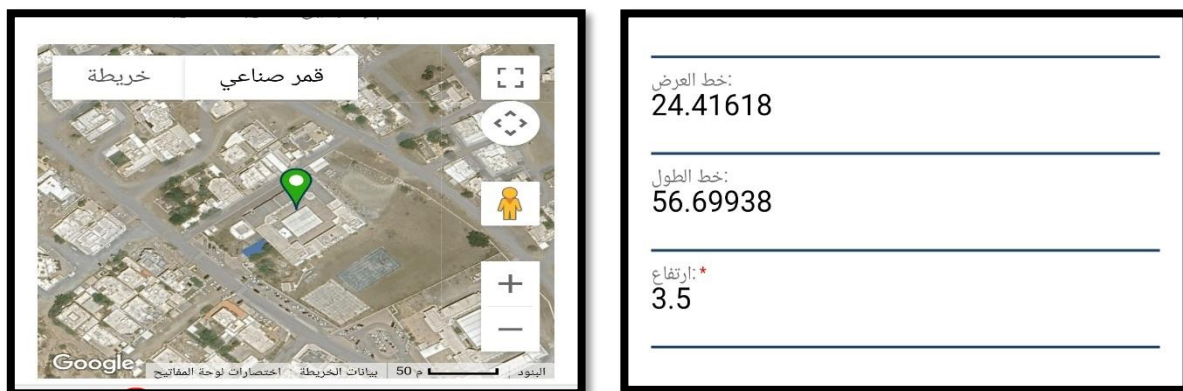
Climate change and the consequences of global warming pose a significant challenge to the sustainability of water and environmental resources in cities **As Al-Rahaifeh (2023)** emphasized, the quality of these resources is intrinsically linked to ensuring environmental sustainability and atmospheric purity from emissions. This aligns with the findings of the GLOBE team in Sohar regarding the impact of air quality and suspended dust particles on the physical characteristics of open water, necessitating the adoption of local strategies to address these climatic repercussions

Research Methodology

- This research adopts an Experimental-Descriptive approach to monitor the impact of climatic changes on the water quality of open metallic tanks and its subsequent reflection on the biological growth of crops at Al-Naqaa School in Sohar.
- **Research Tools:** Previous studies were reviewed, research protocols were defined, and the following site-specific preparations were made:

Climatic Characteristics and Study Site:

- **Area Description:** The study is located in the Al-Afifa area of Sohar (Al-Naqaa School for Basic Education). It is a coastal area within North Al Batinah, characterized by a hot and humid climate.
- **Site Environment:** The vegetation at the study site consists of grass and small stones. The soil contains low salt levels due to the school's proximity to the coastline, which influences the physical and chemical characteristics of the area.



Picture (1): School Location

Work Methodology (Preparation of Tools, Data Collection, and Sample Processing):(Instrumentation)The study relied on a professional mix of modern technical devices and simple manual innovations designed by the students, distributed as follows:

1-Air Quality and Meteorological Monitoring Devices (Problem Solvers & Collaborators)

- **7-in-1 Comprehensive Monitor:** A smart device used by the "Explorer" to measure temperature, humidity, pressure, air quality, particulate matter (and), and gas.
- **Digital Anemometer:** Used to measure wind speed, which is the primary driver of the evaporation process.
- **GLOBE Max/Min Thermometer:** To monitor the daily maximum and minimum temperatures at the observatory.



Picture (2): Measurement Tools Used in the Observatory

2- Water Physics and Evaporation Monitoring Devices (Data Scientists & Analysts Team)

- **Class A Evaporation Pan:** The metallic tank that serves as the "Drought Lab" and the focal point of all water measurements.
- **Transparency Tube:** The tool used by the "Explorer" to determine water turbidity caused by dust.
- **Electrical Conductivity (EC) Meter:** A digital sensor tracked by the "Data Collector" to monitor salt concentration rise alongside evaporation.



Picture (3): Water Measurement Instruments and Evaporation Pan

3- Chemical Laboratory and Manual Innovations (Data Scientists)

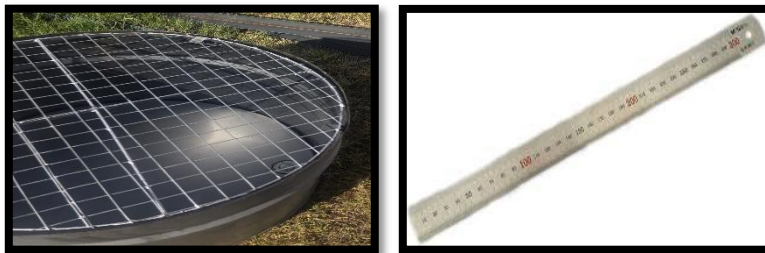
- **Innovative Manual Net (Aerosol Catcher):** A simplified manual tool (similar to a fly catcher) designed by students with ultra-fine mesh to capture atmospheric aerosols before they fall into the tank.
- **Digital pH Meter:** To measure water alkalinity and the impact of suspended dust.
- **Dissolved Oxygen (DO) Kit:** Chemical reagents used to measure the water's capacity to support plant life.
- **Electronic Scale and Acid:** Used for weighing dust particles and conducting the "Effervescence Test" using vinegar to detect carbonates.



Picture (4): Innovative Manual Dust Collection Net

4- Monitoring Tools (Data Scientist)

- **Metric Graduated Ruler:** To measure the stem elongation of (Tomato, Eggplant, and Onion) crops.
- **Mesh Protection System:** A manual cover placed by students over the tanks to prevent bird interference and isolate water loss strictly to evaporation.



Picture (5): Metric Ruler and Mesh Protection System

Research Protocols

The GLOBE team at Al-Naqaa School designed a rigorous experimental protocol to ensure data accuracy:

1- Identifying Research Variables (Problem Solvers)

The variables were classified to ensure the isolation of the direct impact of the "Drought Journey":

- **Independent Variables:** Ambient temperatures, wind speed, air purity (via the 7-in-1 device), and weekly evaporation.
- **Dependent Variables:** Electrical Conductivity (EC), pH levels, water transparency, Dissolved Oxygen (DO) levels, suspended soil mass, and plant vegetative height.
- **Controlled Variables:** Type and size of the tank, type of agricultural soil, and initial irrigation water volume.

2. - Preparation of Tanks and the Innovative Protection System (Collaborators)

Open metallic tanks of fixed diameters were prepared, implementing an advanced protection protocol innovated by the team. This consists of a mesh with ultra-fine openings. This system aims to:

- **Ensure Physical Reading Accuracy:** By preventing external factors (such as birds drinking or leaves falling) from affecting water levels.
- **Isolate Water Loss:** Ensuring that loss occurs through "Evaporation" only.
- **Aerosol Capture Tool:** Serving as a mechanism to collect atmospheric dust for weighing and chemical analysis by the "Researcher."



Picture (6): Preparing the Metal Tank and the Innovative Protection System

3- Water Source and Chemical Protocol (Data Scientist)

Standardizing the water source to ensure a consistent baseline for analysis, while adhering to the following:

- **Volume Standardization:** Allocating exactly 45 L of water per tank weekly.
- **Periodic Water Exchange:** Committing to regular water changes from a stable source (Government Municipal Water) to prevent prior salt accumulation.
- **Weekly Sampling:** Taking water samples before and after evaporation to measure Conductivity and Transparency, documenting the extent of water quality degradation under atmospheric pressure.

4- Crop Selection and Bio-indicators (Collaborator)

The "Scientist" selected three strategic seeds (Omani Onion, Eggplant, and Tomato) based on their varying physiological responses:

- **Omani Onion:** Representing local crops with high tolerance for harsh environmental conditions.
- **Eggplant:** To monitor the resilience of biodiversity in the face of climatic shifts.
- **Tomato:** Acting as a sensitive Bio-indicator to detect the impact of salinity stress and oxygen deficiency resulting from the "Drought Journey."

Experiment Execution (Procedural Timeline: September – December 2025)

- **Fieldwork Protocol (Execution Plan)**

The research was conducted through a series of sequential steps to ensure data accuracy. A volume of **one and a half gallons** of water was allocated weekly to each tank. The tanks were covered with **fine-mesh netting** to ensure precise readings and prevent birds from consuming the water. Furthermore, the water was replaced weekly from a **standardized source** to maintain a consistent measurement baseline.

No.	Phase	Field Activity	Time Period	Execution Team
1	Preparatory	Identifying the evaporation problem, formulating hypotheses, and setting up meteorological observatory devices on-site.	September 2025	All Team Members
2	Operational	Weekly monitoring of evaporation rates, and periodic collection and testing of water and soil samples.	Oct – Nov 2025	Explorer, Researcher & Data Collector
3	Analytical	Statistical data processing, analyzing growth indicators, and conducting the final annual comparison.	December 2025	Analyst & Scientist

Table (1): Distribution of Roles and Research Phases

Methodological Conclusion

The work plan ensures the continuity of weekly monitoring. The use of protective netting and the standardized replacement of 1.5 gallons from a fixed source significantly reduces the margin of human or animal error. This ensures that the "Drought Journey" is documented based solely on pure climatic factors (evaporation)

The fieldwork was divided into overlapping phases to ensure the integration of the four research tracks, as follows:

1- Cultivation and Biological Operations (Collaborator)

- **Soil Preparation:** Equal plots of land with identical characteristics were prepared within the observatory area. Seedlings of (Tomato, Eggplant, and Onion) were planted under standardized environmental conditions.



Picture (7): Soil Preparation and Biological Operation

- **Experimental Irrigation System:** The team adopted a "Targeted Irrigation" protocol, where crops were irrigated weekly exclusively using water from the metallic tanks that had undergone the evaporation process. This was done to ensure the chemical impact of the "Drought Journey" was transferred to the plants.

2- Atmosphere and Air Purity Monitoring Protocol (Data Scientist)

- **Integrated Meteorological Monitoring:** The (7-in-1) device was activated to monitor air purity in real-time, while wind speed was recorded using the Anemometer.
- **Physical Evaporation Measurement:** The "Data Collector" measured the weekly decrease in the Class A Evaporation Pan, documenting the impact of the metallic tank walls' thermal conductivity on the rate of water loss.
- **Aerosol Capture:** The innovative net was used to capture suspended atmospheric soil throughout the week, in preparation for chemical analysis.



Picture (8): Complete Installation of the Observation

3- Water Protocol: Periodic Monitoring of Water Quality (Data Scientist)

- **Chemical Analysis:** Weekly samples were drawn from the tanks to measure Electrical Conductivity (EC) to track salt concentration, and pH levels to monitor alkalinity. In addition, Water Transparency and Dissolved Oxygen (DO) were measured.
- **Carbonate Testing:** The "Researcher" conducted the vinegar (acid) test on the soil collected from the netting to determine its contribution to increasing the alkalinity of both the water and the soil.



Picture (9): Applying the Hydrology Protocol

Growth Measurement and Data Analysis

1. Growth Standards and Bio-indicators: The team adopted precise weekly measurements for the three crops to document their biological response, including:

- **Plant Height (cm):** Using a metric ruler to monitor the rate of vegetative elongation.
- **Leaf Count:** Used as an indicator of photosynthetic efficiency and the plant's ability to build tissue under salinity stress.

- **Air Purity and its Vegetative Impact:** Monitoring the extent of dust accumulation on the leaves and its effect on clogging respiratory stomata.
- **General Health Status:** Documenting stress symptoms, such as the yellowing of leaves in Tomatoes, dry leaf edges in Onions, and the overall resilience of Eggplants.



Picture (10): Growth Indicators and Biological Measurements

2. Statistical Analysis and Causal Linkage :

The "Analyst" processed the data for the period from September to December using the following methods:

- **Seasonal Correlation:** Linking the gradual decrease in temperatures and improvement in air purity (atmospheric variables) with the decline in evaporation rates.
- **Chemo-Biological Correlation:** Analyzing the relationship between the rise in conductivity and alkalinity (resulting from evaporation and dust) and the decrease in the growth height of Tomato and Eggplant plants.
- **Transparency Modeling:** Studying the impact of atmospheric aerosols on water transparency and their role in altering the characteristics of irrigation water.

3. Scientific Conclusions of the Team:

Final results will be derived based on analyzing the correlation between the "Breaking of the Drought Intensity" (improved air and water quality in December) and the "Recovery of Bio-indicators" compared to the "Peak Drought" phase in September and October. This analysis aims to prove that protecting tanks from evaporation and aerosols is the primary key to sustaining agricultural biodiversity in the Sohar environment.

Study Results and Data Analysis

(Documented Data of the Drought Journey)

The First Track: Correlation Analysis Between Meteorological Variables and Weekly Evaporation Rates

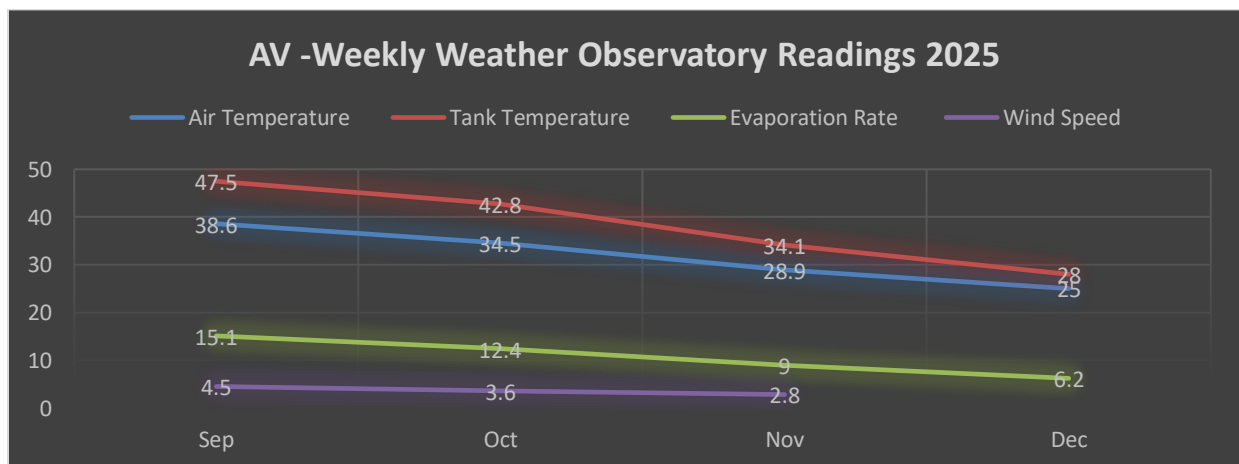
- **Team Efforts:** The (Environmental Explorer and Problem Solver) monitored temperature and wind patterns on a daily basis, while the (Data Scientist) accurately measured the levels of water loss in the evaporation pan to the nearest millimeter.
- **Methodology:** Daily measurements were conducted throughout each month. Detailed tables are provided in the appendices, while only the weekly and monthly averages have been included within the main body of the research

Month •	Week	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
September	1	40.0	49.5	43.5	5.2	16.2
	2	39.2	48.2	42.4	5.0	15.5
	3	38.5	47.0	41.2	4.8	14.8
	4	37.0	45.5	38.9	4.5	13.9
September Avg.		38.6	47.5	41.5	4.8	15.1
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October	1	36.5	45.0	39.8	4.2	13.5
	2	35.2	43.8	38.5	3.8	12.8
	3	34.0	42.5	37.5	3.5	12.1
	4	32.5	40.0	35.8	3.2	11.2
October Avg.		34.5	42.8	37.9	3.6	12.4
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November	1	31.0	37.0	33.5	3.0	10.5

Month •	Week	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
	2	29.5	35.2	32.0	2.9	9.4
	3	28.2	33.0	30.7	2.8	8.4
	4	27.0	31.5	29.5	2.6	7.8
November Avg.		28.9	34.1	31.4	2.8	9.0
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December	1	26.5	30.0	28.5	2.4	7.2
	2	25.5	29.2	27.5	2.1	6.5
	3	24.5	28.0	26.5	1.9	5.9
	4	23.8	27.0	25.5	1.8	5.2
December Avg.		25.0	28.5	27.0	2.0	6.2

Table (2): Average Weekly Meteorological Observatory Readings for 2025

Note: Detailed daily reading tables for each month regarding the meteorological observatory parameters are available in the Appendices.



Graphical(1) AV -Weekly Weather Observatory Readings 2025

Based on the table and graphical analysis, we have reached the following conclusions: Statistical Conclusion Based on Averages:

- **Thermal Descent Curve:** The average temperature of the metallic tank dropped from 47.5°C in September to 28.5°C in December. This 19-degree decrease is the primary driver behind the decline in evaporation rates and the subsequent improvement in irrigation water quality.
- **Evaporation Efficiency:** We observe that evaporation gradually lost its intensity; water loss averaged 15.1 mm per week in September, whereas it stabilized at 6.2 mm in December. This indicates that the "Drought Journey" reached its peak during the first two months of the study.
- **Correlation with Wind Speed:** The averages show that wind speeds in Al-Afifa (Sohar) decreased at a rate of 0.8 m/s per month. This significantly contributed to reducing the Vapor Pressure Deficit (VPD) over the surface of the metallic tank.

Evaporation Analysis Conclusion: The data demonstrates a direct correlation between wind speed and the surface temperature of the metallic tank. September recorded the highest water loss rate (15.1 mm). This spike is attributed to the metallic thermal conductivity, which allows the tank to absorb and transfer heat rapidly, thereby accelerating the "Drought Journey" before the water is even utilized for weekly crop irrigation.



Picture (11): Measuring Atmospheric Variables and Weekly



Picture (12): Data Entry and Using the GLOBE Visualization System (ADAT) for the School Site

Track Two: Air Quality Analysis (Using the 7-in-1 Atmospheric Purity Detector)

Team Efforts: The "Explorer" installed the device next to the metallic tank, while the "Researcher" recorded the readings displayed on the screen (as shown in the image) to monitor how dust contaminates our water.

Month	Dust Levels ()	Screen Air Temp	Air Condition	Impact on the Tank & Research
September	110.5 (High)	40.0°C	Dusty & Hot	Dust settling in water, increasing salinity and turbidity.
October	95.2 (Moderate)	36.5°C	Moderately Dusty	Continued water evaporation; dust settling at the bottom.
November	55.0 (Low)	31.0°C	Relatively Pure	Dust deposition ceased; water began to clear.
December	30.2 (Very Low)	26.5°C	Very Pure	Water became very clear (High Transparency).

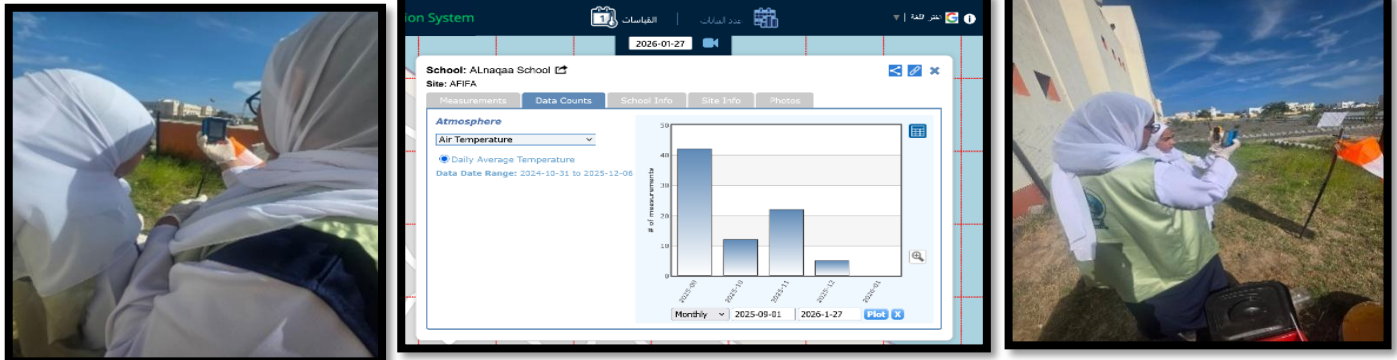
Table (3): Air Quality Analysis (Via 7-in-1 Detector)

Based on monitoring the device screen over the four months, the GLOBE team reached the following findings:

- **Dust and Water Interaction:** We observed that in September, when the dust figures were high on the device, the water in the tank turned murky. Explanation: The dust detected by the device fell into the water, increasing its salinity and pH alkalinity.
- **Metallic Heat Impact:** The device initially showed us high temperatures. Explanation: This heat caused the walls of the metallic tank to heat up intensely, making the water evaporate rapidly and leaving salts behind—a process we titled the "Drought Journey."
- **Plant Respiration:** We discovered that the dust recorded by the device clogged the "respiratory stomata" on the tomato leaves. Because tomato plants are delicate, they struggled and their leaves turned yellow, while the Eggplant was resilient and withstood the dust.

- **Final Result:** When we saw the numbers on the device decrease to small values in December, we knew the "Drought Journey" had ended. The Omani Onion began to grow rapidly because the water became purer and the air became cleaner.

Conclusion: The 7-in-1 Detector served as the "Eye" through which we saw how the air affects both water and plants. We learned that protecting tanks from dust and heat is essential for successful agriculture at our school.



Picture (13): Air Quality Analysis and Recording On-site

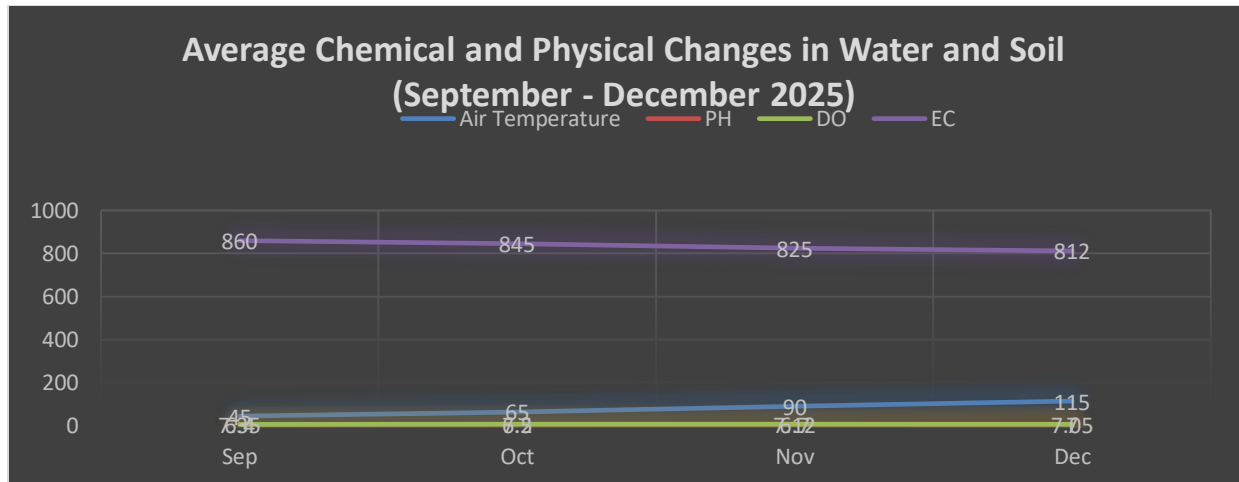
Integrated Track Three: Chemistry of the "Drought Journey" and Secrets of Atmospheric Aerosols

Team Efforts: The "Researcher" and the "Analyst" integrated the water measurement results with the findings from the manual netting (Aerosol Catcher) to map out exactly what occurred inside the metallic tank.

Month	Evaporation Rate	Conductivity (EC) ()	Oxygen (DO) ()	Alkalinity (pH)	Transparency (120cm tube)	Atmospheric Soil (Netting)
September	15.1 mm	860	6.4	7.35	45 cm	Dense Carbonate Dust
October	12.4 mm	845	6.5	7.20	65 cm	Moderate Soil Aerosols
November	9.0 mm	825	6.7	7.12	90 cm	Light Dust Particles
December	6.2 mm	812	7.0	7.05	115 cm	Very Pure Air

Table (4): Average Chemical and Physical Changes in Water and Soil (September – December)

Note: Weekly data tables for chemical and physical variables for each month are included in the **Annendices2025**



Graphical(2)Average Chemical and Physical Changes in Water and Soil (September - December 2025)

Based on the table and graphical analysis, we have reached the following conclusions:

Comprehensive Scientific Analysis (Impact of the "Drought Journey" on Water Chemistry): By integrating all readings, the Al-Naqaa School team concluded the following:

- **Conductivity and Evaporation:** We observed a direct correlation; as evaporation in the metallic tank increased, electrical conductivity rose, reaching its peak in September (860)
- ***Explanation:** Extreme heat evaporated the pure water, leaving salts concentrated in the remaining water. This increased the water's ability to conduct electricity, which is a clear indicator of rising salinity.
- **Dissolved Oxygen (DO) and Temperature:** We recorded the lowest oxygen levels in September (6.4 mg/L).
 - ***Explanation: We applied the scientific principle:** *"As water temperature rises, its capacity to hold dissolved oxygen decreases."* The high temperature of the metallic tank drove oxygen out of the water, making it difficult for plant roots (especially Tomatoes) to "breathe" effectively.
- **Transparency and Suspended Soil (Aerosols):** Transparency dropped to 45 cm due to the dust monitored by the 7-in-1 device and captured by the manual netting.
 - ***Explanation:** The deposition of carbonaceous soil into the water did not just cause turbidity; it reacted chemically to raise the pH to 7.35, making the water "harder" and more difficult for plants to absorb.

- **Environmental Stability in December:** As evaporation decreased and dust settled, transparency rose to 115 cm and dissolved oxygen increased to 7.0 mg/L.

***Explanation:** Cooler temperatures helped the water absorb more oxygen from the air. The lack of atmospheric dust made the water clear, which led to a decrease in conductivity and stabilized the pH at an ideal neutral point for plant growth.

Research Summary: The "Drought Journey" in open metallic tanks in Sohar leads to a "cocktail of environmental stressors": high salinity, low dissolved oxygen, extreme turbidity, and elevated alkalinity. This explains why biodiversity is significantly hindered at the onset of the agricultural season.



Picture (14): Water Quality Testing and the Influence of Dust Accumulation on the Mesh



Picture (15): Data Entry into the Official Website

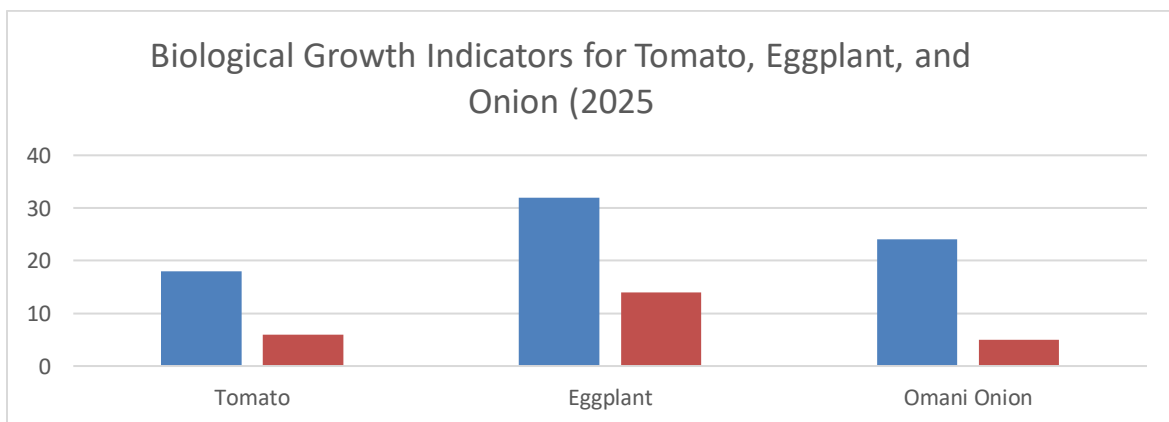
Track Four: Biodiversity Analysis (Crop Response to Drought Variables)

Team Efforts: The "Scientist" and the "Explorer" monitored plant growth weekly, linking the health status of each plant to the data recorded by the (7-in-1) device and the results of the water quality tests.

Crop	Plant Height (cm)	Leaf Count	Health Status	Observed Drought Impact	Scientific Explanation
Tomato	18	6	Weak	Wilting of edges and yellowing of the tops.	High sensitivity to increased salinity and alkalinity (pH 7.35) resulting from evaporation.
Eggplant	32	14	Excellent	Stable growth and vegetative expansion.	High physiological capacity to tolerate temperature fluctuations and decreased Dissolved Oxygen (DO).
Omani Onion	24	5	Good	Significant improvement towards the end of the season.	Recovery of vital activity after the decline in evaporation intensity and the clearing of water in December.

Table (5): Biological Growth Indicators for Tomato, Eggplant, and Onion (2025)

Note: Detailed growth data tables for each plant throughout the four-month period are available in the Appendices



Graphical(3)Biological Growth Indicators for Tomato, Eggplant, and Onion (2025)

Based on the table and graphical analysis, we have reached the following conclusions :Accurate Scientific Analysis of Biodiversity Results Based on the readings recorded in the Al-Afifa area, our team concluded that the "Drought Journey" left varying impacts on the three selected crops:

- **Tomato Crop (Bio-indicator of Stress):** The Tomato recorded the lowest growth rate (18 cm), attributed to the phenomenon of "Osmotic Stress." When the tank water salinity peaked in September (860), the roots struggled to extract water, leading to "tip burn" and wilting of the extremities, especially with the deficiency in Dissolved Oxygen recorded by the "Researcher."
- **Eggplant Crop (The Resilient Champion):** The Eggplant proved to be the most robust in the Sohar environment, reaching a height of 32 cm. We observed that it was not negatively affected by water turbidity or high alkalinity; instead, it maintained its photosynthetic efficiency, making it the top choice for cultivation using open metallic tanks.
- **Omani Onion Crop (Seasonal Response):** The Onion reached 24 cm, but its growth was significantly stunted during the peak evaporation period (September and October). As soon as the 7-in-1 air detector indicated a pure and cool atmosphere in December, the onion's growth accelerated. This confirms that it requires clear water and high Dissolved Oxygen (7.0 mg/L) to thrive.

Final Methodological Synthesis:

The team proved that the "Drought Journey" is not just a loss of water volume, but a complex chemical transformation. Protecting water from metallic heat and atmospheric dust is the decisive factor in determining the success or failure of crop growth in local agricultural environments.



Picture (16): Analyzing Biological Diversity in the Study Area

Integrated Summary of Research Results

The study conducted by the GLOBE team at Al-Naqaa School proved that protecting the tanks with manual netting and adhering to a structured irrigation schedule did not entirely eliminate the chemical impact of the "Drought Journey," but it was sufficient to sustain the crops.

- **Eggplant:** The successful and resilient crop under all conditions.
- **Tomato:** The sensitive crop that alerts us to poor water quality.
- **Onion:** The crop that waits for atmospheric and water clarity to thrive.

Discussion and Team Vision

This discussion represents the "Scientific Synthesis," illustrating how the Al-Naqaa School team successfully integrated the four environmental spheres (Atmosphere, Hydrosphere, Pedosphere, and Biosphere) into one cohesive study.

1. Challenges and Scientific Confrontations During the "Drought Journey," the team encountered challenges that were transformed into learning opportunities:

- **The Metallic Tank Challenge:** We discovered that metal absorbs solar heat, raising water temperatures significantly above ambient air levels, which accelerated the evaporation of the "1.5 gallons" allocated for irrigation.
- **The Aerosol Challenge:** Despite using netting, the 7-in-1 detector showed that fine particles still entered the tank, altering water chemistry and increasing alkalinity.
- **Tomato Sensitivity:** Witnessing the tomatoes suffer from "Osmotic Stress" due to high salinity in September was difficult, requiring rigorous monitoring of Oxygen and Conductivity.

2. Personal Experiences (What did we learn as students?) This experiment was more than just numbers; it was a journey to build our skills as young researchers:

- **Data Correlation Skill:** We learned that a value on a screen (like dust levels) is a message predicting the health of the plant the following day.
- **The Power of Simple Innovation:** We realized that a cleverly designed manual net can collect aerosol samples comparable to complex devices.
- **The Language of Plants:** We learned that plants communicate; the yellowing of tomatoes was an "alarm signal" for water quality, while the eggplant's strength was a "message of reassurance."

3. Study Findings (The Integrated Conclusion) Our study in the Al-Afifa area successfully proved the following:

- **Air Purity is the Key to Water Purity:** There is a direct correlation between clear air and clear water; as air purity improved in December, water transparency reached 115 cm.
- **Eggplant is the "Champion Crop":** It proved to be the ideal model for drought-condition farming due to its resilience against salinity and low oxygen.
- **Onion and the Stability Season:** We confirmed that the Omani Onion is a "smart crop" that waits for improved water quality and increased Dissolved Oxygen to declare its true growth phase.

4- Commercial Scope and Future Development (The Influencer)

- **Smart Insulated Tanks:** Developing irrigation tanks lined with thermal insulation to prevent heat conduction and mineral concentration.
- **Cooling and Oxygenation Systems:** Adding small solar-powered cooling fans to increase Dissolved Oxygen during peak heat months.
- **Sohar Farmer's Guide:** Issuing a simplified guide for local farmers showing the best crops for each month based on air purity and evaporation tables.

5-The Collaborator Badge: Community Engagement & Scientific Partnership

"At the Al-Naqa'a School Observatory, our spirit as **Collaborators** extended beyond the school walls to create a bridge between science and society. This phase was achieved through several strategic actions:

- **Field Readiness & Instrumentation:** We successfully prepared and calibrated all GLOBE program tools, ensuring our observatory was fully operational for high-precision data collection.
- **Community Outreach & Home Water Testing:** To foster local cooperation, the team conducted field visits to the local community. Using **Mobile Water Testers**, we measured water quality parameters directly in residents' homes, raising awareness about safe water storage.
- **Industrial Partnership & Expert Consultation:** To ensure our methods align with global standards, we visited a local water bottling plant. We engaged in professional dialogue with specialists to explore their most advanced analytical instruments, gaining deeper insights into industrial-grade water safety protocols.

- **Effective Communication:** Through these visits, the **GLOBE team** acted as a vital link between academic research and real-world application, proving that scientific collaboration is the key to local environmental sustainability."



Picture (17): Collaborator Badge: Community Engagement & Scientific Partnership

General Research Conclusion

GLOBE Team – Al-Naqaa School This study stands as a unique scientific model linking atmospheric and physical variables to biodiversity in Sohar (Al-Afifa). The journey began by monitoring the "Drought Journey" inside an open metallic tank, tracking the impact of solar heat on irrigation quality. Through Track One, the team documented how water loss concentrates salts and raises Electrical Conductivity (EC). In Track Two, the 7-in-1 detector revealed that air purity plays a hidden role; September dust not only polluted the air but settled in the tanks to alter water chemistry. Track Three proved that these carbonate aerosols, captured by our manual netting, raised the pH and lowered water transparency to critical levels. This "chemical cocktail" led to a deficiency in Dissolved Oxygen (DO), putting the plants to the ultimate test. In Track Four, the results were clear: Tomatoes acted as the "Bio-indicator" of stress, while Eggplants emerged as the "Champion Crop," thriving despite the harsh conditions. The Omani Onion proved its "intelligence" by recovering as environmental conditions stabilized in December. The final conclusion is decisive: Protecting tanks from heat and dust is not a luxury, but a necessity for food sustainability. This research paves the way for developing thermally insulated smart tanks to protect sensitive crops, marking a confident scientific footprint by our team in the global GLOBE Program protocols.

Dedication and Acknowledgments

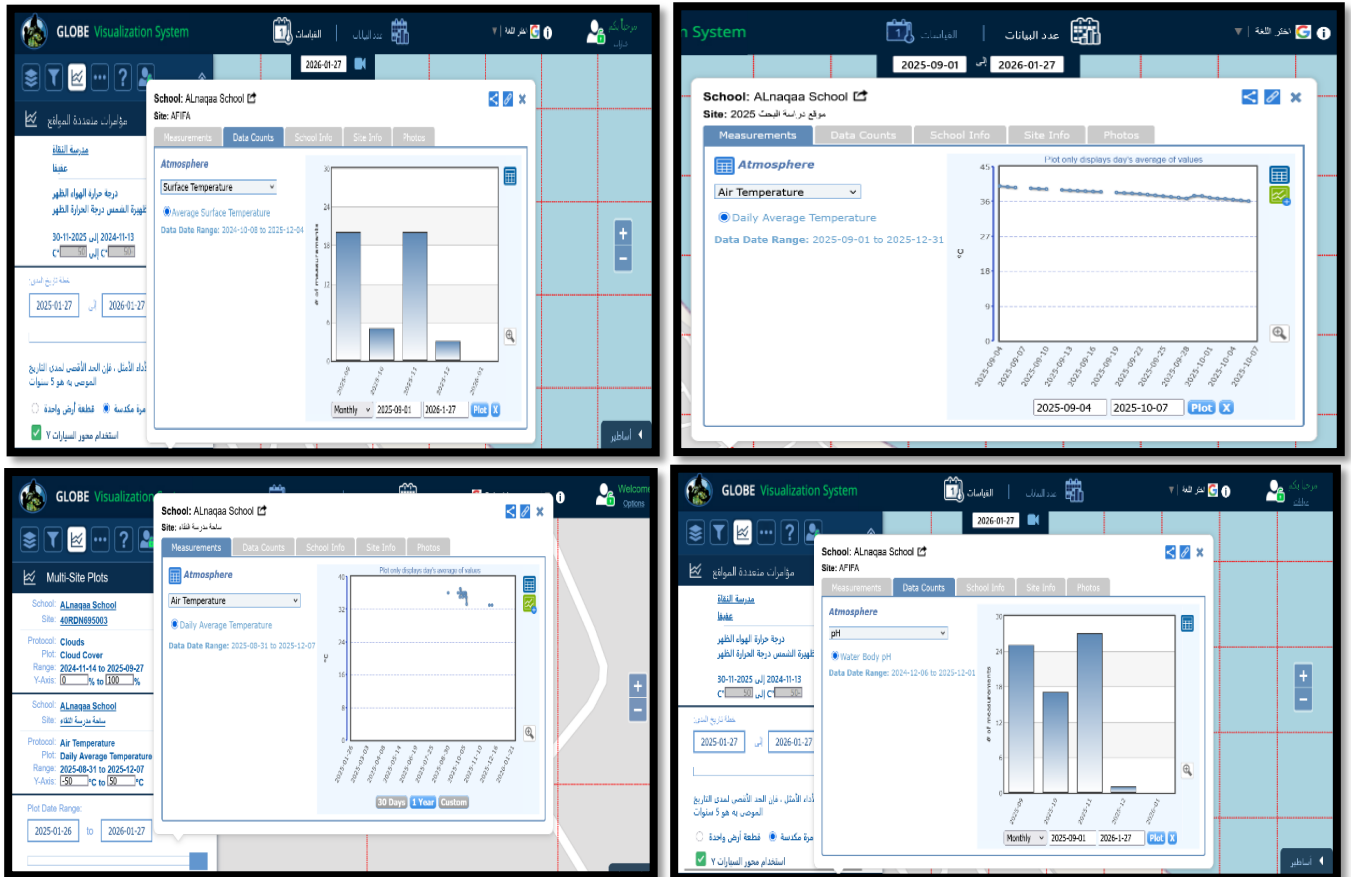
With feelings of immense gratitude, the GLOBE Team at Al-Naqaa School extends its deepest thanks to those who supported us throughout the "Drought Journey" research:

- **Ms. Haifa Al-Kaabi:** Our project supervisor; we deeply appreciate her meticulous guidance in teaching us scientific experimentation and professional research methodology.
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- **Dr. Jamal Al-Subhi:** For his fruitful scientific cooperation and valuable notes that ensured our research met high scientific standards.
- **Mr. Yusuf (School Guard):** Our "unsung hero" for his constant assistance during the fieldwork.
- **We thank Engineer Al-Rushdi** at the water factory for introducing the GLOBE team to water characteristics and the scientific methods for analyzing them.
- **The School Staff & Workers:** Who helped prepare the plots and standardize the soil, providing us with an ideal experimental environment.

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Appendices



The GLOBE Visualization System was utilized to visualize surface area data for Al-Naqaa's School from September to December 2025



Photo Gallery: Team field activities and data collection

Appendices

Detailed daily reading tables for each month regarding the meteorological observatory parameters

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
1	40.5	49.8	43.5	5.3	16.5
2	40.3	49.6	43.3	5.2	16.3
3	40.2	49.5	43.2	5.2	16.2
4	40.0	49.2	43.0	5.1	16.1
5	39.8	49.0	42.8	5.1	16.0
6	39.6	48.8	42.6	5.1	15.9
7	39.5	48.6	42.5	5.0	15.8
8	39.4	48.5	42.4	5.0	15.7
9	39.3	48.4	42.3	5.0	15.6
10	39.2	48.2	42.1	4.9	15.5
11	39.1	48.1	42.0	4.9	15.4
12	39.0	48.0	41.9	4.9	15.3
13	38.9	47.9	41.8	4.9	15.2
14	38.8	47.7	41.7	4.8	15.1
15	38.7	47.6	41.6	4.8	15.1
16	38.6	47.5	41.5	4.8	15.1
17	38.5	47.4	41.4	4.8	15.1
18	38.4	47.2	41.3	4.8	15.0

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
19	38.3	47.0	41.2	4.7	14.9
20	38.2	46.9	41.1	4.7	14.8
21	38.1	46.7	41.0	4.7	14.7
22	38.0	46.6	40.9	4.7	14.6
23	37.8	46.4	40.7	4.6	14.4
24	37.6	46.2	40.5	4.6	14.2
25	37.4	46.0	40.3	4.5	14.0
26	37.2	45.8	40.1	4.5	13.9
27	37.0	45.5	39.9	4.4	13.7
28	36.8	45.3	39.7	4.4	13.5
29	36.5	45.0	39.4	4.3	13.2
30	36.3	44.5	38.3	4.3	12.8

September 2025 Data Table

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
1	37.0	46.5	40.5	4.8	14.5
2	36.8	46.2	40.3	4.8	14.3
3	36.7	46.0	40.2	4.7	14.2
4	36.5	45.8	40.0	4.7	14.1
5	36.3	45.5	39.8	4.6	13.9
6	36.1	45.3	39.6	4.6	13.8

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
7	36.0	45.0	39.5	4.5	13.7
8	35.8	44.8	39.3	4.5	13.6
9	35.6	44.5	39.1	4.4	13.4
10	35.4	44.3	38.9	4.4	13.3
11	35.2	44.0	38.7	4.3	13.1
12	35.0	43.8	38.5	4.3	13.0
13	34.8	43.5	38.3	4.2	12.8
14	34.6	43.2	38.1	4.2	12.7
15	34.4	43.0	37.9	4.1	12.6
16	34.2	42.8	37.7	4.1	12.5
17	34.0	42.5	37.5	4.0	12.4
18	33.8	42.2	37.3	4.0	12.2
19	33.6	42.0	37.1	3.9	12.1
20	33.4	41.8	36.9	3.9	12.0
21	33.2	41.5	36.7	3.8	11.8
22	33.0	41.2	36.5	3.8	11.7
23	32.8	41.0	36.3	3.7	11.6
24	32.6	40.8	36.1	3.7	11.5
25	32.4	40.5	35.9	3.6	11.3
26	32.2	40.2	35.7	3.6	11.2

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
27	32.0	40.0	35.5	3.5	11.1
28	31.8	39.8	35.3	3.5	11.0
29	31.6	39.5	35.1	3.4	10.8
30	31.4	39.2	34.9	3.4	10.7
31	31.2	39.0	34.7	3.3	10.5

October 2025 Data Table

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
1	31.0	37.0	33.5	3.0	10.5
2	30.7	36.6	33.2	3.0	10.2
3	30.5	36.2	33.0	2.9	10.0
4	30.3	35.9	32.8	2.9	9.8
5	30.1	35.6	32.6	2.9	9.6
6	29.9	35.3	32.4	2.9	9.5
7	29.7	35.1	32.2	2.9	9.4
8	29.5	35.0	32.0	2.8	9.3
9	29.4	34.8	31.8	2.8	9.2
10	29.3	34.6	31.7	2.8	9.1
11	29.2	34.5	31.6	2.8	9.1
12	29.1	34.4	31.5	2.8	9.0
13	29.0	34.3	31.4	2.8	9.0

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
14	28.9	34.1	31.3	2.8	9.0
15	28.9	34.1	31.3	2.8	9.0
16	28.9	34.1	31.3	2.8	9.0
17	28.9	34.1	31.3	2.8	9.0
18	28.8	34.0	31.2	2.8	8.9
19	28.7	33.8	31.1	2.8	8.8
20	28.6	33.6	31.0	2.7	8.7
21	28.5	33.4	30.9	2.7	8.6
22	28.4	33.2	30.8	2.7	8.5
23	28.2	33.0	30.7	2.7	8.4
24	28.0	32.7	30.5	2.7	8.3
25	27.8	32.4	30.3	2.7	8.2
26	27.6	32.1	30.1	2.6	8.1
27	27.4	31.8	29.9	2.6	8.0
28	27.2	31.6	29.7	2.6	7.9
29	27.0	31.5	29.5	2.6	7.8
30	26.8	31.0	29.2	2.6	7.3

November 2025 Data Table

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
1	26.5	30.0	28.5	2.4	7.2
2	26.2	29.8	28.2	2.3	7.0
3	26.0	29.5	28.0	2.3	6.8
4	25.8	29.3	27.8	2.2	6.7
5	25.7	29.2	27.7	2.2	6.6
6	25.6	29.1	27.6	2.1	6.5
7	25.5	29.0	27.5	2.1	6.5
8	25.4	28.9	27.4	2.1	6.4
9	25.3	28.8	27.3	2.0	6.3
10	25.2	28.7	27.2	2.0	6.3
11	25.2	28.7	27.2	2.0	6.3
12	25.1	28.6	27.1	2.0	6.2
13	25.1	28.6	27.1	2.0	6.2
14	25.0	28.5	27.0	2.0	6.2
15	25.0	28.5	27.0	2.0	6.2
16	25.0	28.5	27.0	2.0	6.2
17	25.0	28.5	27.0	2.0	6.2
18	24.9	28.4	26.9	2.0	6.1
19	24.8	28.3	26.8	1.9	6.1
20	24.7	28.2	26.7	1.9	6.0

Day	Air Temp (°C)	Tank Temp (°C)	Soil Temp (°C)	Wind Speed (m/s)	Evaporation Rate (mm)
21	24.6	28.1	26.6	1.9	5.9
22	24.5	28.0	26.5	1.9	5.9
23	24.4	27.8	26.4	1.9	5.8
24	24.3	27.7	26.3	1.9	5.7
25	24.2	27.5	26.2	1.8	5.6
26	24.1	27.4	26.1	1.8	5.5
27	24.0	27.2	26.0	1.8	5.4
28	23.9	27.1	25.9	1.8	5.3
29	23.8	27.0	25.8	1.8	5.2
30	23.7	26.8	25.7	1.7	5.1
31	23.5	26.5	25.5	1.7	5.0

December 2025 Data Table

Weekly data tables for chemical and physical variables for each month

Week	Evaporation Rate (mm)	Conductivity (EC)	Dissolved Oxygen (DO)	Alkalinity (pH)	Transparency (cm)	Suspended Matter
Week 1	15.8	865	6.2	7.45	40	Very Dense
Week 2	15.4	862	6.3	7.40	42	Dense
Week 3	14.9	858	6.5	7.30	48	Dense
Week 4	14.3	855	6.6	7.25	50	Moderate/Dense
Average	15.1	860	6.4	7.35	45	Heavy Carbonaceous Dust

September Weekly Environmental Parameters 2025 Data Table

Week	Evaporation Rate (mm)	Conductivity (EC)	Dissolved Oxygen (DO)	Alkalinity (pH)	Transparency (cm)	Suspended Matter
Week 1	13.5	852	6.4	7.28	55	Moderate
Week 2	12.8	848	6.5	7.22	62	Moderate
Week 3	12.1	842	6.5	7.18	68	Moderate
Week 4	11.2	838	6.6	7.12	75	Light/Moderate
Average	12.4	845	6.5	7.20	65	Moderate Suspended Dust

Weekly Environmental Parameters Table (October 2025)

Week	Evaporation Rate (mm)	Conductivity (EC)	Dissolved Oxygen (DO)	Alkalinity (pH)	Transparency (cm)	Suspended Matter
Week 1	10.2	832	6.6	7.18	82	Light
Week 2	9.5	828	6.7	7.15	88	Light
Week 3	8.6	822	6.7	7.10	92	Very Light
Week 4	7.7	818	6.8	7.05	98	Trace / Nil
Average	9.0	825	6.7	7.12	90	Light Dust Particles

Weekly Environmental Parameters Table (November 2025)

Week	Evaporation Rate (mm)	Conductivity (EC)	Dissolved Oxygen (DO)	Alkalinity (pH)	Transparency (cm)	Suspended Matter / Air Quality
Week 1	6.8	816	6.9	7.08	105	Clear Air
Week 2	6.4	814	7.0	7.06	112	Very Pure Air
Week 3	6.0	810	7.0	7.04	118	Very Pure Air
Week 4	5.6	808	7.1	7.02	125	Very Pure Air
Average	6.2	812	7.0	7.05	115	Very Pure Air

Weekly Environmental Parameters Table (December 2025)

Detailed growth data tables for each plant throughout the four-month

Month	Plant Height (cm)	Number of Leaves	Health Status	Observed Impact
September	10	3	Very Weak	Severe wilting and leaf margin burn
October	13	4	Weak	Persistent yellowing of growing tips
November	16	5	Weak/Moderate	Slight improvement in leaf texture
December	18	6	Weak/Stable	Stoppage of deterioration due to lower alkalinity

Tomato Growth Indicators Table (2025)

Month	Plant Height (cm)	Number of Leaves	Health Status	Observed Impact
September	15	6	Good	Resilience against high temperatures
October	22	9	Excellent	Vegetative expansion and new leaf growth
November	28	12	Excellent	Stem strength and lateral branching
December	32	14	Excellent	Maximum growth rate and full adaptation

Eggplant Growth Indicators Table (2025)

Month	Plant Height (cm)	Number of Leaves	Health Status	Observed Impact
September	8	2	Dormant	Highly affected by evaporation and dust
October	12	3	Moderate	Very slow growth rate
November	17	4	Good	Beginning of biological activity recovery
December	24	5	Very Good	Growth acceleration with water clarity

Omani Onion Growth Indicators Table (2025)