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Studying the impact of certain agricultural experiments on soil health and biodiversity

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Studying the impact of certain agricultural experiments on soil health and biodiversity

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Umm Hani Basic Education School (8-12) – Sultanate of Oman/Al Dakhiliyah

Abstract

The aim of this research is to study the impact of agricultural practices on soil health and biodiversity. This will be achieved by answering the following questions:

1. What is the impact of agricultural practices on soil health in the farms of the Wilayat of Samail?
2. What impact do agricultural practices have on biodiversity?

Four farms in the state were selected (Al Mazraa – Siya 1 – Siya 2 Al Nabhaia) and the ground cover protocol was applied and data was – collected. The soil protocol was also applied to soil samples from the farms studied and studied to assess soil quality and record observations on biodiversity and biological diversity on site.

The study results indicated that the soil was generally healthy at the studied sites. The farms (Siya 2 and Al-Nabha) were considered the best in terms of soil quality indicators related to ground cover density, as they recorded higher values for green ground cover density (85%), while Al Mazraa recorded the lowest value (50%)

The acidity values of the soil samples indicated a very slight alkalinity level that did not exceed a pH of (8.3) and the pH of ,Al MAZRAA was ideal (7.98).

The salinity values indicated ideal non-saline values for all studied samples, as they ranged only between (500–800 ppm).

The observation of the presence of different types of plants (herbs, , shrubs, trees), that the plants are bright green and have strong growth , the diversity of crops, the presence of decaying leaves on the surface the movement of different worms and insects in the soil, and the use of organic fertilizers by the locals all gave a positive indication of soil quality and biodiversity.

Key terms:

Agricultural practices: It is the set of methods and standards used in ,agriculture to produce safe and high-quality food in an environmentally ,economically, and socially sustainable manner. It includes tilling the soil using organic fertilizers, efficient irrigation (such as drip irrigation), safe pest control methods, crop rotation, and precision agriculture using modern technologies, with the aim of increasing productivity, reducing environmental damage, and ensuring product safety from farm to consumer. (Des, 2023)

Soil health: Soil health is the ability of soil to function as a living, vital ecosystem that supports its functions. (Des, 2023)

Biodiversity: It is the sum total of the diversity of life forms on Earth, including the variation between organisms (from bacteria to humans), the

diversity within species themselves (genetic differences), and how all these organisms interact with each other and with their environment, and it is the basis for supporting life and human well-being. (Des, 2023)

Research questions:

:The current study sought to answer two fundamental questions

1. What is the impact of agricultural practices on soil health in the farms of the Wilayat of Samail?
2. What is the impact of agricultural practices on biodiversity in the farms of the Wilayat of Samail?

Introduction:

Agricultural practices:

The agricultural practices followed by farmers and farm managers are important in preserving the soil and ensuring its health. These practices include

- Soil management: Timely tilling, use of organic fertilizers to improve soil properties and supply it with nutrients, and solar sterilization of the soil.
- Fertilization: The use of organic and mineral fertilizers to improve soil fertility and increase its ability to retain water.
- Irrigation: Using modern and efficient irrigation systems such as drip irrigation to increase water use efficiency.

- Pest control: Applying safe methods to reduce the use of chemical pesticides, and relying on biological control and crop rotation.
- Crop rotation: Growing different crops in rotation to maintain soil health and avoid depletion

Agricultural practices)<https://openaccesspub.org/journal/agronomy-research> ,
(retrieved on December 30, 2025

The study of soil health is a combination of three key soil properties:

- Physical properties: Visual indicators, which include soil structure, stability of aggregated soil particles, flaking and compaction, etc, permeability, texture, porosity
- Chemical properties: These represent the chemical processes that take place in the soil, for example, the availability of nutrients, pH, etc, salinity
- Biological characteristics: These include visual indicators such as visible organisms like earthworms, insects, their activity and by-products.

All these aspects interact dynamically and together can promote soil health. For example, soil structure affects water retention, creating a favorable environment for microorganisms.

Vegetation cover characteristics (as an indicator of good soil):

1. **Density and diversity:** Dense vegetation covers most of the soil surface, with various plant species (grasses, shrubs, trees) indicating a healthy environment.

2. **Color and vibrancy:** Bright green plants with vigorous growth are evidence of sufficient nutrient availability, as seen in soil rich in [humus](#) .
3. **Organic soil:** The presence of decaying leaves and organic matter([mulch](#)) on the surface nourishes the soil and improves its structure.
4. **Soil stabilization:** The intertwined roots of plants hold soil particles together, preventing them from being eroded by wind and rain.

(Soil quality indicators, <https://metergroup.com/education-guides/ndvi-and-pri-the-researchers-complete-guide/> Retrieved 12/30/2025)

Biodiversity, also known as " biodiversity," is the diverse collection of life forms on Earth. It includes all living organisms such as bacteria, plants, fungi, insects, animals, and humans. However, it is not simply the number of species in a given area; it also encompasses the number of individuals within each species and the balance between the populations of different species.

Why is biodiversity important?

Biodiversity is the life support system of our planet. We depend on it for food, energy, medicine, fresh water, soil purification, waste decomposition, and much more. Without it, the environment cannot provide us with the things we need to survive.

Areas with high biodiversity are also better equipped to cope with change. They are more resilient to natural or human-induced disturbances, such

as climate change, and can recover more quickly after major disasters like wildfires. (Greene , 2024)

Research methods: First: Research plan:

- Set the timeline for the research plan

Table (1) Research Plan Timeline

workplan	month
Formulating the research problem and identifying the tools	October 2025
Visiting study sites and collecting data	November 2025
Analyzing data and drawing conclusions	December 2025
Writing the research Translate the research into English and participate in the international virtual exhibition	January 2026

- The work roles were distributed among the research team, consisting of preparing the tools and carrying out the field application.

Table (2) Distribution of work roles

Applying the water protocol to the samples	female students
Applying the ground cover protocol and collecting data	Azza and Sundus in collaboration with the team
Soil protocol application	Azza and Sundus
Photographing the steps of the search	Azza
Data analysis and research writing under the supervision of the teacher	Sundus

- Identifying, reviewing, and documenting some sources of information related to the research topic
- Selecting and identifying study sites in preparation for starting data collection
- Identifying the appropriate protocols for collecting research data, which mainly consisted of the soil protocol and the land cover protocol
- Identify the appropriate devices and tools to carry out the research plan (GPS ,cups, water, vinegar, pH meter, paper, pen , ,smartphone, stirring rod, ruler, sieve, tree density meter, slope meter metric tape, camera).
- Implementing the protocols at the designated study sites
- Collecting and organizing data into tables
- Record observations related to biodiversity and the level of attention given to the farm on **the observation card**
- Enter the newly collected data on GLOBE program's website (www.GLOBE.gov)
- Analyzing the data and arriving at conclusions and recommendations

Second: Study location:

This research plan was implemented in a number of farms near in the Wilayat of Samail in the Umm Hani Basic Education School (8–12) .Al Dakhiliyah Governorate

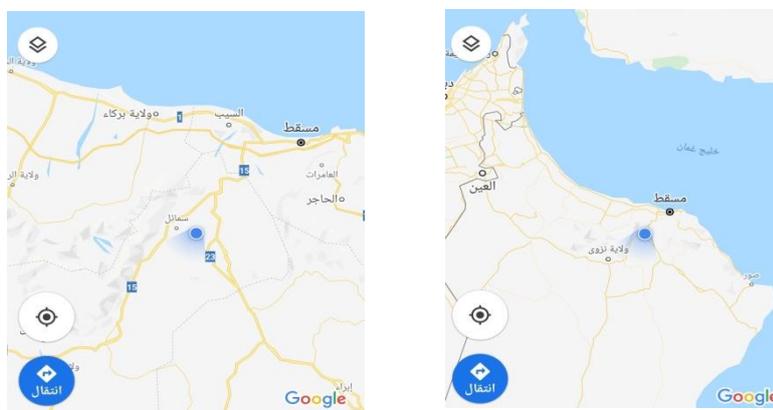
(,Sultanate of Oman, Al Dakhiliyah Governorate, Wilayat of Samail November 2025 – January 2026, weather is moderate, soil protocols and ground cover have been implemented).

The following table shows the location coordinates

Table (3) Coordinates of the study site

Location coordinates viaGPS	Site name
23.02 N 58.01 E	Al Mazraa
23.17 N 58.02 E	Siya 1
23.17 N 58.48 E	Siya 2
23.18 N 58.23 E	Al-Nabhiyya

The images below show site maps



Images (1) Geographic maps to determine the search location

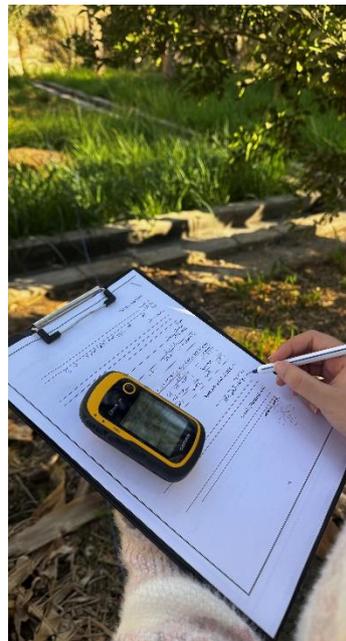
Third: Data collection and analysis:

Data for the first question were collected by applying the ground cover protocol to several farms and the soil protocol to soil samples collected from those farms. Soil texture, cohesion, and the amount of present were examined. Carbonate levels, acidity, and and rocks roots .salinity were also measured in the soil within the school grounds

The data related to the second question was collected through The **observation card** details the farms under .recording observations ,study, the different types of organisms that can be observed in the soil and their comparison between different locations. It also records observations related to the use of fertilizers, tilling the land, and trimming weeds.



protocol activities to study soil health soil



protocol activities to the study site the ground cover

Results:

– To answer the research questions:

1. What is the impact of agricultural practices on soil health?

The following table shows the land cover data for the study sites

Table (4) Land cover data for the study sites

Sky cover		ground cover			the site
Without (-)	+	Without a cover	brown	green	
81/27	81/54	81/27	81/14	81/40	Al Mazraa
93/31	93/62	93/19	93/4	93/70	Siya 1
100/47	100/53	100/8	100/7	100/85	Siya 2
87/29	87/58	87/10	87/3	87/74	Al-Nabhiyya

Based on the data in the previous table, the land cover indicators for the farms studied can be summarized in the following table:

Table (5) Indicators and data on land cover for the studied farms

Soil health indicators from ground cover	the site
<p>Dense vegetation cover (67% sky cover and 50% green ground cover) with the presence of different plant species .(herbs, shrubs, trees) Bright green plants with vigorous growth Presence of decaying leaves on the surface</p>	<p>Al Mazraa</p>
<p>Very dense vegetation cover (67% sky cover and 75% green ground cover), with the presence of different plant .species (herbs, shrubs, trees) Bright green plants with vigorous growth Presence of decaying leaves on the surface</p>	<p>Siya 1</p>
<p>Very dense vegetation cover (sky cover 53% and green ground cover 85%) with the presence of different plant .species (herbs, shrubs, trees) Bright green plants with vigorous growth Presence of decaying leaves on the surface</p>	<p>Siya 2</p>
<p>Very dense vegetation cover (67% sky cover and 85% green ground cover), with the presence of different plant .species (herbs, shrubs, trees) Bright green plants with vigorous growth Presence of decaying leaves on the surface</p>	<p>Al-Nabhiyya</p>

shows soil protocol data from the study sites

Table(6)Soil data for the study sites

salinity	acidity pH	Carbonates	rocks	Roots	Soil texture	cohesion	the site
700 ppm	7.98	abundant	+	Many	sandy clay	fluid, soft	Al Mazraa
800 ppm	8.25	abundant	+	Many	sandy clay	fluid, soft	Siya 1
800 ppm	8.25	abundant	+	Many	sandy clay	fluid, soft	Siya 2
500 ppm	8.3	abundant	+	Many	clay Green	fluid, soft	Al– Nabhiyya

Gathering observations on biodiversity at study sites

Table(7) Observation card on biodiversity in the study sites

Notes	the site
The farm contains many worms and insects, as well as a number of livestock such as cows and sheep, and birds such .as chickens and ducks	Al Mazraa
Many worms and insects Livestock animals such as sheep .and cows are also present	Siya 1
are present, as well as livestock Many worms and insects .such as sheep and cows	Siya 2
Many worms and insects are present, and there are also .beehives on the farm	Al–Nabhiyya

Table (8) Observation card on the use of fertilizers, soil tillage and weed control

Notes	the site
<p>The use of organic fertilizer on the farm is evident</p> <p>Paying attention to tilling the soil and organizing crops</p> <p>Trimming the soil of weeds</p>	Al Mazraa
<p>The use of organic fertilizer on the farm is evident (the farm owner said that he uses organic fertilizer from sheep and cow waste, while he sometimes resorts to industrial urea .(fertilizer to combat harmful weeds</p> <p>Paying attention to tilling the soil and organizing crops</p> <p>Trimming the soil of weeds</p>	Siya 1
<p>The use of organic fertilizer on the farm is evident (the farm owner said that he uses organic fertilizer from sheep and cow waste, while he sometimes resorts to industrial urea .(fertilizer to combat harmful weeds</p> <p>Paying attention to tilling the soil and organizing crops</p> <p>Trimming the soil of weeds</p>	Siya 2
<p>The use of organic fertilizer on the farm is evident</p> <p>Neglecting soil tillage and crop management</p> <p>Failure to remove weeds from the soil</p>	Al-Nabhiyya

- The data was entered and submitted to the program's website (www.GLOBE.gov) where new work sites were added and the data , collected through the research was entered. (New sites Land Cover 2, 3, 4) :Old site (Samail Land)

Land cover 4 +
SITE_ID: 405188 م, ارتفاع 393.8, خط الطول 57.57, خط العرض 23.17
Land cover 5 +
SITE_ID: 405187 م, ارتفاع 411.8, خط الطول 57.56, خط العرض 23.18
Land cover 2 +
SITE_ID: 405185 م, ارتفاع 346, خط الطول 58.02, خط العرض 23.17
AL MARAYA FARM +
SITE_ID: 404948 م, ارتفاع 600, خط الطول 23.58, خط العرض 57.47
LAND COVER 3 +
SITE_ID: 404136 م, ارتفاع 357, خط الطول 58.48, خط العرض 23.17
land cover 4 +
SITE_ID: 404109 م, ارتفاع 367, خط الطول 58.23, خط العرض 23.18

إدخال البيانات العلوم		الغطاء الأرضي	
Canopy cover		الغطاء الأرضي	
Canopy Type	Canopy Observations	Ground Type	Ground Observations
شجرة (T)	شجرة (T)	الخشب (GD)	الخشب (G)
58	58	77	74
شجيرة (SB)	شجيرة (SB)	النباتات ذات الأوراق العريضة	النبات (B)
0	0	0	3
مجموع % الشجيرات	مجموع % الشجيرات	شجيرة اخرى	مجموع % الشجيرات
29	29	0	10
		شجيرة (SB)	
		0	
		الشجيرات الصغيرة (DS)	
		0	

Images (5) Data entry on the website

Discussion of the results:

- Answer to the first research question: **What is the effect of agricultural practices on soil quality in the farms of the state of Samail**

lead to changes in soil properties, causing dysfunction. The main objective of soil quality assessment is to predict, based on knowledge of its properties (Harris & Besdeck , 1994).

Table (5) on soil quality indicators shows that the data collected on ground cover indicated generally good ground cover for the studied farms although there were some variations from one farm to another. Farms (Siyya 2 and Al-Nabha) were considered the best in soil quality indicators due to their higher values for green ground cover density, while farm (Al-Mazra'a) recorded the lowest value (Table 4).

Suitable soil for agriculture is soil that provides the optimal environment for plant root growth and absorption of water and nutrients, serving as a supportive medium and source of nutrition for the plant.

The soil protocol data indicated a high degree of similarity in the physical properties of the soil samples studied from the four sites. All were described as loose , fluid clay soils containing numerous roots and rocks. Clay soils are heavy soils, rich in nutrients and minerals, and characterized by their high moisture retention capacity due to their fine texture. It is considered highly fertile and very suitable for field crops and fruit trees. This has been observed in farms in the presence of fruit-bearing palm trees, citrus trees such as lemons, quince, and others papaya and fig trees.

As for the chemical properties, there is a slight difference between the .samples

- **pH level:** Most plants prefer neutral soil (pH between 6.0 and 7.5) and as high acidity or alkalinity prevents the plant from absorbing nutrients even if they are present in the soil.

The acidity values of the soil samples indicated a very slight alkalinity level that did not exceed a pH of 8.3 , and the pH of the farm soil was ideal (7.98).

- **Salinity:** The percentage of dissolved salts must be low, as high salinity draws water from plant roots and causes salt stress.) Slightly saline soils are considered safe for most crops up to 4 dS/m (approximately 2000–3000 ppm.)

The salinity values indicated ideal non-saline values for all studied samples, as they ranged only between (500–800 ppm).

- It contributes to improving the availability of essential **Carbonates** nutrients such as nitrogen and phosphorus . Calcium carbonate helps reduce the toxicity of heavy metals in the soil , and organic carbon is a key indicator of soil quality, as it improves its water retention capacity and promotes microbial activity.

The data indicated that carbonates were abundant in all the .soil samples studied

- What is the impact of agricultural **:Answer to the second question** practices on biodiversity in the farms of the state of Samail?

Biological properties

- **The activity of living organisms:** Healthy soil teems with life such as beneficial bacteria, fungi, earthworms, and insects. These organisms break down organic matter and convert it into absorbable nutrients, and they also improve soil structure.

Observations indicated the presence of various worms and insects in the soil at all study sites, and a number of animals birds, and honeybees were also raised

- . have a significant impact on wild plant and animal species
The observations indicated a clear interest in **Al Mazraa**, Saya 1 and 2 by tilling the land, diversifying crops and pruning weeds. However, at the Al-Nabha farm , there was significant neglect in ,tilling the land and neglect in cleaning the soil of harmful weeds which could negatively affect the quality of the soil and the biodiversity of this farm.

Regarding fertilizers, the observations collected from the farms indicated that residents relied more on organic fertilizer made from sheep and cow manure than on manufactured chemical fertilizers. We are all aware of the negative environmental impacts associated with the use of fertilizers and pesticides.

The results of this review indicate the need to encourage local communities and farmers to improve the rational use of chemical fertilizers to ensure that local needs are not exceeded, and to minimize pesticide use. (Pierre and Allison, 1995)

Summary:

We reached the point of studying the impact of some agricultural practices on soil health and biodiversity in farms in the state of Samail.

Four farms were selected for study, and soil quality was assessed using data collected on the land cover and soil properties of each site. Biodiversity was also observed in the farms.

Soil quality indicators from the data collected on ground cover indicated generally healthy ground cover for the farms studied, although there were some minor variations from farm to other.

The soil protocol data indicated a high degree of similarity in the physical properties of the soil samples studied from the four sites. All were described as loose, fluid clay soils containing numerous roots and rocks. Clay soils are heavy soils, rich in nutrients and minerals, and characterized by their high moisture retention capacity due to their fine texture. It is considered highly fertile and very suitable for field crops and fruit trees. This has been observed in farms in the presence of fruit-bearing palm trees, citrus trees such as lemons, quince, and others papaya and fig trees.

Suitable soil for agriculture is soil that provides the optimal environment for plant roots to grow and absorb water and nutrients, to be a supportive medium and a source of nutrition for the plant. The data indicated the presence of roots and carbonates in abundance in the studied samples.

Healthy soil teems with life, including beneficial bacteria, fungi, earthworms, and insects. These organisms break down organic matter and convert it into absorbable nutrients, thus improving soil structure. Observations indicated the presence of various worms and insects in the

soil at all study sites, and a number of animals, birds, and honeybees were also raised there.

have a significant impact on wild plant and animal species . Farm owners have relied more on the use of organic fertilizers and attention to tillage and weed trimming, which has had a positive impact on soil quality and biodiversity on the farm.

Thanks and appreciation:

Praise be to God, and peace and blessings be upon the Messenger ...of God, and after that

On behalf of the current research team, we extend our deepest gratitude to our research supervisor, Ms. Nawar Al-Rawahi , and to ,Ms. Dalal Al-Nadabi , Principal of Umm Hani Basic Education School who stood by the researchers with encouragement and support. We also thank the centralGLOBE program team ,for their encouragement guidance, and support throughout the research, as well as the program supervisors in the Al-Dakhiliyah Governorate. Finally, we express our sincere appreciation to the owners of the farms studied for their cooperation and responsiveness in providing feedback related .to their farms

Description of badges

I am a collaborator (all members of the GLOBE at the program team school are collaborators) In collecting data related to land cover, because it requires a sufficient number of team members and more time , the

researchers also collaborated with farmers and local residents to record observations and facilitate data collection.

I am a scientist specializing in Earth system sciences (the project clearly demonstrates the interconnectedness of Earth's spheres in the context of research, and applies multiple GLOBE protocols. Researchers . applied the land cover protocol for four different farms, as well as the soil protocol to study land properties and attempt to assess soil quality).

I am a data scientist (The researchers conducted an in-depth analysis of the data collected through the application of GLOBE protocols. The researchers discussed this data and reached the conclusions they aimed to obtain).

the reviewer:

. Agricultural Practices. Journal of Ecology Research

<https://openaccesspub.org/journal/agronomy-research> Retrieved 30/12/2025

Al-Saleh, Aqaba. (2025). Journal of Agriculture and Ecosystems. **What are the ? characteristics of arable soil**altaleb blog

. Des, Fanny (2023). **Soil health: why it matters and how to protect it**BioProtection Portal

GLOBE .Programme Technical Office , (2012)**GLOBE Programme Teacher's Guide**

.Greeneage Middle East and North Africa (2024)**What is biodiversity and why is ? it important**

Harris and Bezidek (1994). **The impact of agricultural practices on soil and water .quality in the Mediterranean region and a proposed assessment method** . Vol No. 2 ,88

Madou -Bier and McLaughlin- Allison (1995) . **The impact of agricultural practices on biodiversity**. Vol. 55, No. 3

. **Soil quality indicators**<https://metergroup.com/education-guides/ndvi-and-pri-the-researchers-complete-guide/> Retrieved 30/12/2025

Technical Office of theGLOBE Environmental Programme, (2012). **Land Cover Research in theGLOBE Environmental Programme**

Technical Office of theGLOBE **research in Soil** .Environmental Programme, (2012) **theGLOBE Environmental Programme**