From Dirt to Life:

Investigating and Improving Soil Health

STUDENTS

Soraya Yvonne Firth
Raiya Suleiman Abdallah
Gunita Harendra Patel
Prayosha Amit Budhdeo
Maliha Karimbaksh Gulam

TEACHERS

Ms. Dorcas Neema
Mr. Bernard Mabele

Shree Swaminarayan Academy
Teach Through Expounding of Themes

COUNTRY

KENYA

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ABSTRACT

Despite its fundamental importance to life, soil comprises only 25 percent of the Earth's surface, of which only 10 percent can be used to grow crops. Soil is the foundation of life, providing essential nutrients and support for plant growth, biodiversity, and ecosystem resilience. "From Dirt to Life" is a comprehensive project aimed at investigating and enhancing soil health to promote sustainable agriculture, environmental conservation, and community well-being.

Key words: sustainable, enhancing soil health

Research Questions

1.What are the key indicators of soil health, and how do they vary across different ecosystems and soil types

2. What are the primary factors influencing soil degradation, and how do they impact soil health on a global scale?

3. What microbial communities exist within healthy soils, and how do they contribute to soil fertility, nutrient cycling, and overall ecosystem resilience?

4. What are the long-term effects of climate change on soil health, including alterations in temperature, precipitation patterns, and carbon sequestration rates

5. What are the economic implications of soil degradation and the potential benefits of investing in soil conservation and restoration efforts?

6. How do soil health management practices impact other environmental factors such as water quality, biodiversity, and greenhouse gas emissions?

7. What role can regenerative agriculture play in enhancing soil health, mitigating climate change, and promoting sustainable food production systems?

Hypothesis

1. **The key indicators of soil health is the pH level and the nitrate level in the soil.**
2. **The long term effects of climate change can lead to losses of soil carbon that also affects other soil functions like poorer soil structure, stability, topsoil water holding capacity, nutrient availability and erosion. The loss of soil carbon is also accelerated by the increase in temperature.**
3. **Reduced soil fertility,decreased crop yields and increased water usage which aacn take a huge toll on the economy lowering its GDP.**

Introduction

The SRA (Strategy for Revitalising Agriculture) identified low and declining soil fertility of land as one of the factors that continues to constrain the growth of agriculture in Kenya. Our project is focused on investigating and improving soil health in Mombasa, Kenya, initiated by the Shree Swaminarayan Academy. Situated on the vibrant coast of East Africa, Mombasa is not only a hub of cultural diversity but also a vital agricultural centre sustaining local communities.

In this endeavour, we aim to delve into the unique challenges facing soil health in Mombasa and explore innovative solutions to revitalise agricultural landscapes. By combining scientific inquiry with community engagement, our project seeks to empower farmers and stakeholders with the knowledge and tools needed to nurture the very foundation of our food systems – the soil.

We demonstrate the importances of soil elements and how it impacts the health of crops and the way that soil constitution affects the environment

Join us as we embark on a journey to safeguard Mombasa's precious soils, ensuring a sustainable and prosperous future for generations to come.

IMPORTANCE OF OUR PROJECT

Through an approach, this project delves into the intricate mechanisms and factors influencing soil health, including soil composition, microbial activity, nutrient cycling, and physical properties. Utilising advanced analytical techniques and field experiments, we assess the current state of soil health in diverse ecosystems and agricultural landscapes.

Furthermore, "From Dirt to Life" seeks to identify and implement effective strategies for improving soil health. This includes the application of organic amendments, cover cropping, crop rotation, and reduced tillage practices to enhance soil structure, fertility, and microbial diversity. Additionally, innovative technologies such as microbial inoculants and biochar incorporation are explored for their potential in soil remediation and carbon sequestration.

Community engagement and education are integral components of the project, fostering awareness and stewardship of soil resources among farmers, land managers, and the general public. Collaborative partnerships with local stakeholders and institutions facilitate knowledge sharing and the adoption of sustainable soil management practices.

Ultimately, "From Dirt to Life" aims to empower individuals and communities to prioritise soil health as a cornerstone of sustainable development. By nurturing healthy soils, we cultivate resilience, productivity, and vitality in our agricultural systems and natural environments, ensuring a brighter future for generations to come.

RESEARCH METHODS

We collected soil samples from various areas, in order to compare with a larger sample size for accurate assessments . In order to determine the soil pH, light intensity, moisture content and temperature we used a pH metre and a universal indicator. We also measured the Nitrates using a Vernier Nitrate metre. Our results were recorded on a table.

MATERIALS AND EQUIPMENTS USED

EQUIPMENTS

- **pH Meter (measuring pH level and light intensity)**
- **Weighing scale**
- **Test tube**
- **Pipette**
- **Beaker**
- **Vernier Nitrate scale**
- **Universal pH Indicator**

MATERIALS

- **Soil samples from different areas in our school**
- **Distilled water**

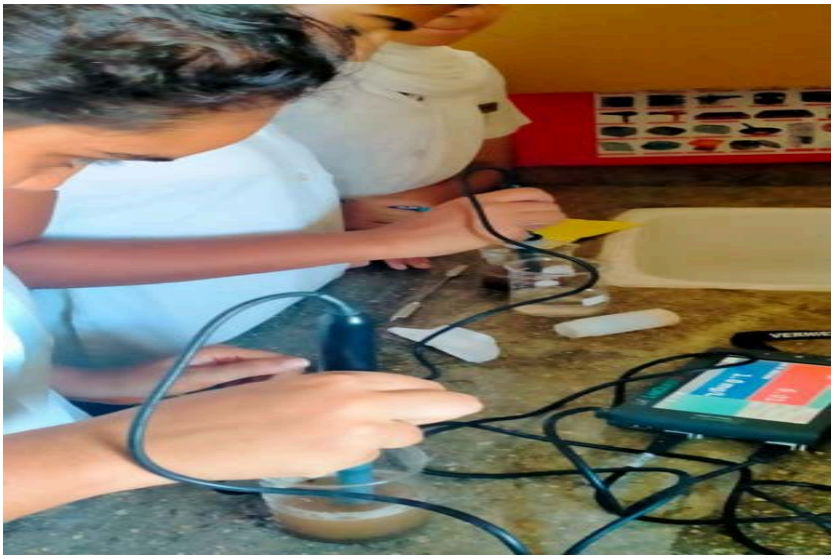
PROCEDURE

- **Step 1:** collect sample

- **Step 2:** *Samples collected weighed into 10g using a weighing scale. The sample then dissolved in 60 mls of distilled water*

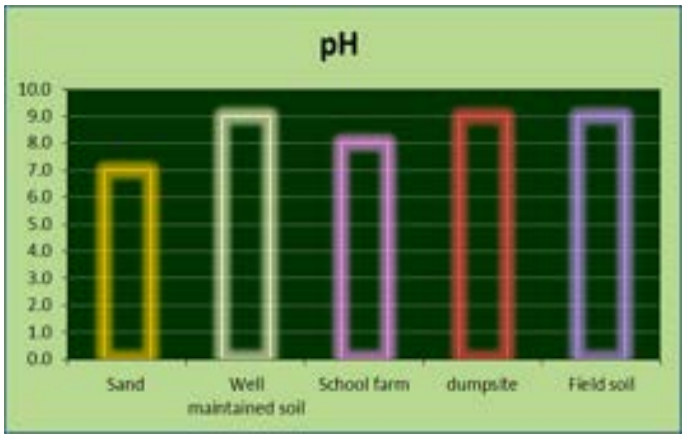
- **Step 3**: *Dissolved samples are then filtered. Then 5 mls of the filtrate is put in a test tube where 3 to 4 drops of universal indicator are added and the pH was measured.*

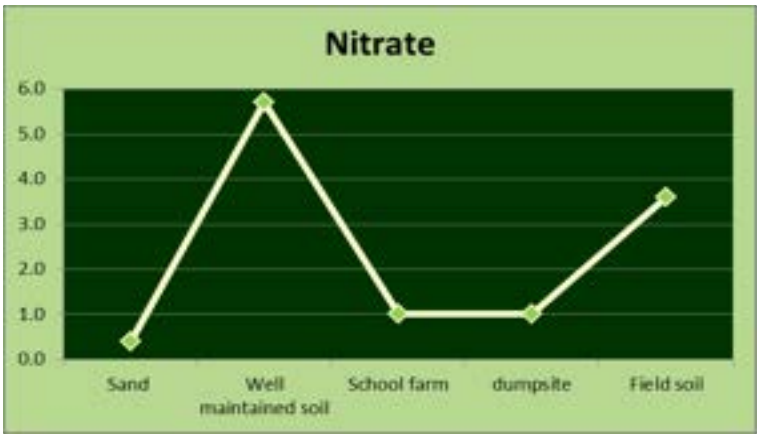
- **Step 4:** *we measured the levels of nitrates*



RESULTS

SOILS	PH	NITRATES
Sand	**7.0**	**0.40**
Well maintained soil	**9.0**	**5.7**
School farm	**8.0**	**1.0**
School dumpsite	**9.0**	**1.0**
Field soil	**9.0**	**3.6**





DISCUSSION

The pH of a soil influences nutrient ability, toxicity, microbial populations and activity of certain pesticides. Soils with a pH less than 7 are referred to as acidic and ph levels greater than 7 are considered alkaline or basic. The primary function of nitrates – is to serve as a source of nitrogen for the nutrition and growth of plants and soil microorganisms.

Here is a breakdown of each area of research according to the results above;

- **Soil degradation is influenced by a variety of factors both natural and anthropogenic.Some of the primary factors include: erosion, deforestation, over**

diverse microbial communities that contribute to soil fertility, nutrient cycling and ecosystem resilience.

- **The long-term effect of climate change on health can have far-reaching consequences for ecosystem functioning, agriculture, agroforestry, and soil conservation measures, can help mitigate these effects and enhance soil resilience to climate change.**

Investing in soil conservation and restoration efforts can bring a range of economic benefits, including: Improved agricultural productivity, Cost savings, Enhanced ecosystem services, Job creation, Climate change mitigation.

- **Nutrient Management: Proper fertiliser use and nutrient management practices can prevent nutrient leaching into groundwater, reducing the risk of water pollution.**
- **Microbial diversity : Soil management practices promote larger numbers of microorganisms.**
- **Crop Diversity: Crop rotation and intercropping promote biodiversity by providing diverse habitats and food sources for different species.**
- **Carbon Sequestration: Certain soil management practices, like no-till farming and cover cropping, can increase the sequestration of carbon in the soil, helping to mitigate greenhouse gas emissions.**

- **Sequestration, Water Conservation, Biodiversity Conservation, Reduced Input Dependency, Resilience to Climate Change,**

Overall, regenerative agriculture offers a promising approach to addressing the challenges of soil degradation, climate change, and food insecurity, while promoting more sustainable and resilient food production systems.

SOLUTION

- **In order to mitigate the effects of lack of healthy microbiol colonies, we can supplement the soil with acid or base where appropriate. This is**

necessary to combate drastic changes in alkalinity. This promotes greater variation for microbial growth that is beneficial for plants.

- **We can also add nitrates based salts onto the soil in order to make them more nutritious allowing plants to make protein in order to improve health and quality.**

Note; The improvement of soil health directly correlated to improvement in plant health and biodiversity. This increases uptake of CO2 and produces more oxygen as a result. Therefore aids in biodiversity of both plants and animals creating a thriving ecosystem.
However the use of pH altercation techniques and nitrates base salt may wreak havoc on river system. Problems such as eutrophication, may occur if these supplements are carried out by rain water. Use of supplements need to be highly monitored and should be as precise as possible to reduce any environmental damages that it may cause.

CONCLUSION

Our findings emphasise the urgent need for concerted efforts to address soil degradation and promote sustainable land management practices. By implementing tailored solutions such as organic farming methods, soil conservation techniques, and appropriate nutrient management strategies, we can enhance soil fertility, mitigate erosion, and safeguard the long-term productivity of agricultural lands in Mombasa and beyond

In conclusion, the project "From Dirt to Life: Investigating and Improving Soil Health in Mombasa, Kenya" has shed light on the critical importance of soil health in agricultural sustainability and food security within the region. Through meticulous investigation and targeted interventions, we have uncovered the intricate dynamics of soil composition, fertility, and the impact of various agricultural practices on its health.

BADGES.

The initiative focuses on conducting comprehensive research to understand the current state of soil health in the region and implementing targeted interventions to enhance soil fertility and sustainability. Through collaboration with local communities, agricultural experts, and environmental organisations, the project aims to address soil degradation challenges and promote sustainable land management practices. By fostering awareness and engagement, Badge IVSS seeks to make a meaningful impact on soil health, agricultural productivity, and environmental sustainability in Mombasa and beyond.

I AM A PROBLEM SOLVER

While we were working on this project, we learnt that we are part of possible solutions to the problem we are investigating as soil health is a big problem in our country affecting a large majority of the population as most of Kenya's GDP is based on agriculture.

I AM A STUDENT RESEARCHER

Through this project, we are conducting research to understand the current state of soil health in Mombasa and identifying strategies to enhance it. By addressing soil health issues, the project aims to improve agricultural productivity, protect the environment, and enhance the overall well-being of the community in Mombasa.

I MAKE AN IMPACT

The project aims to address soil degradation challenges and promote sustainable land management practices. By fostering awareness and engagement, we seek to make a meaningful impact on soil health, agricultural productivity, and environmental sustainability in Mombasa and beyond.

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