

GRAZE & SPROUT FARM
G & S RESEARCH

EFFECTS OF MANAGED GRAZING ON THE LAND



INTRODUCTION

BENA PEGG & KYLE FISHER

Graze & Sprout Farm is a small 1 acre farm in Upcountry Maui. The Farm specializes in microgreens, tomatoes, pastured eggs, luxury sheep milk soaps, and flowers. New pasture plots are planted for new crops including squash, roses, and peppers.

G & S Research is an independent research entity dedicated to understanding how the soil can be regenerated through animal integration and stewardship. We see the farm as an ecosystem and a critical solution for climate change.



GOALS OF THIS STUDY

CAN ANIMALS BE MANAGED TO IMPROVE THE LAND?

Sheep and Chickens were managed in an Intensive Rotational Grazing fashion. Sheep were moved twice a day and managed using electric fence. Chickens followed behind in paddock, moved every 5 days.

MEASURED PARAMETERS INCLUDE:

Production (animals & forage/acre), animal health, carbon, nitrogen, pH, minerals, microbial life, and more.

SUMMARY:

Production, animal health, carbon, nitrogen, pH, minerals, and microbial life all improved; some across the board, others in specific cases.



The Soil Story by Kiss The Ground

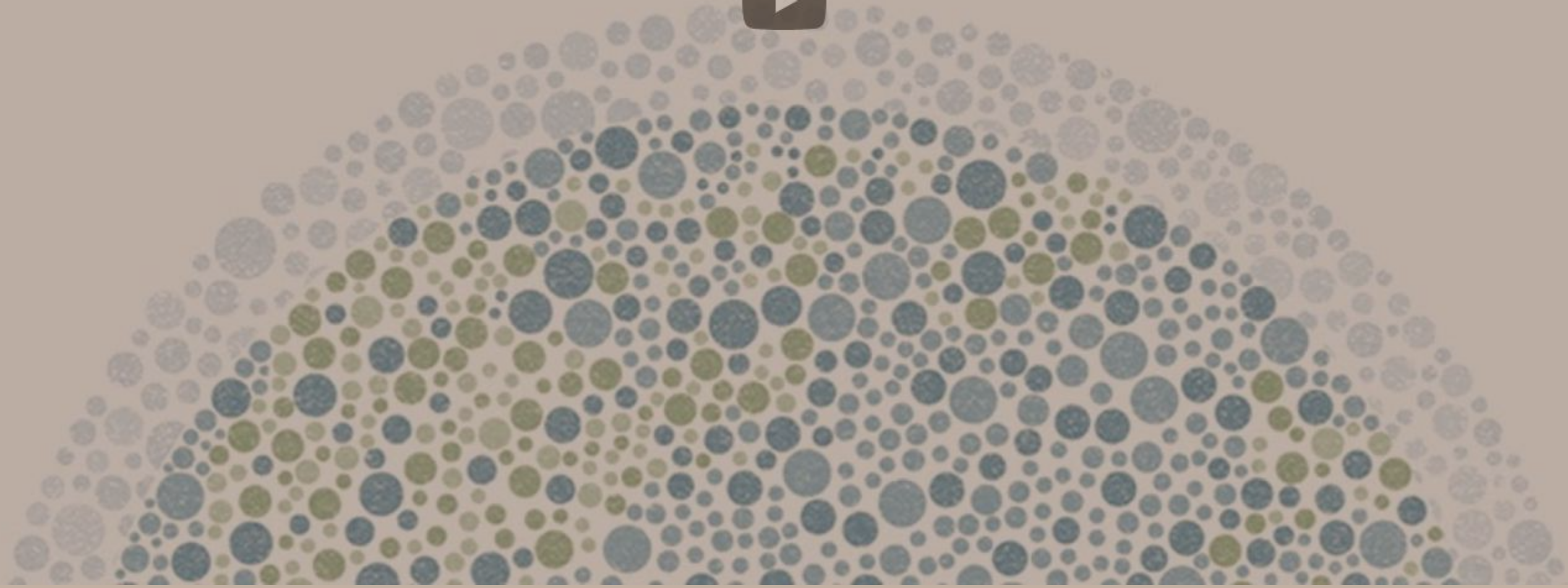


Watch later



Share

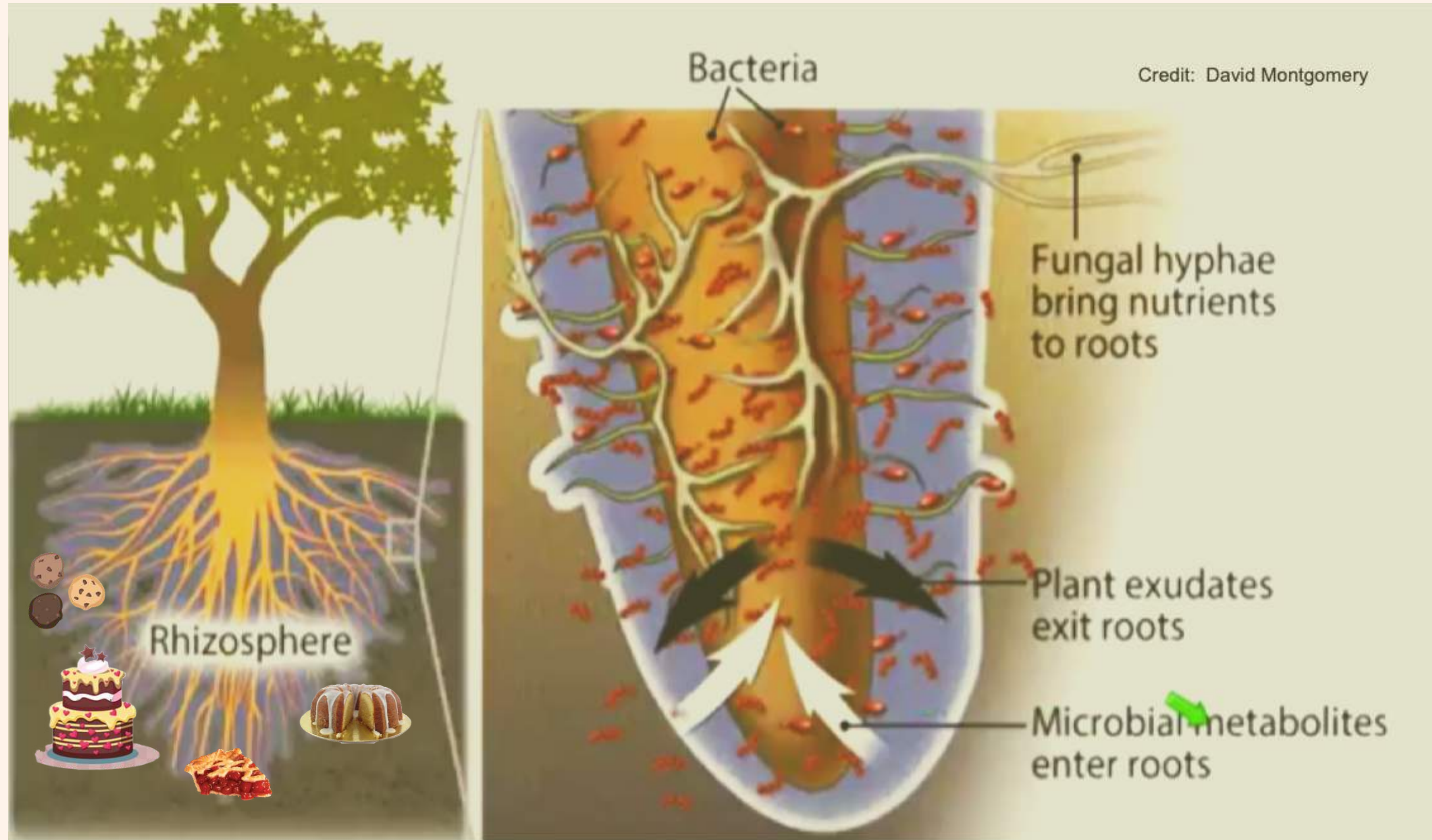
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SOIL STORY

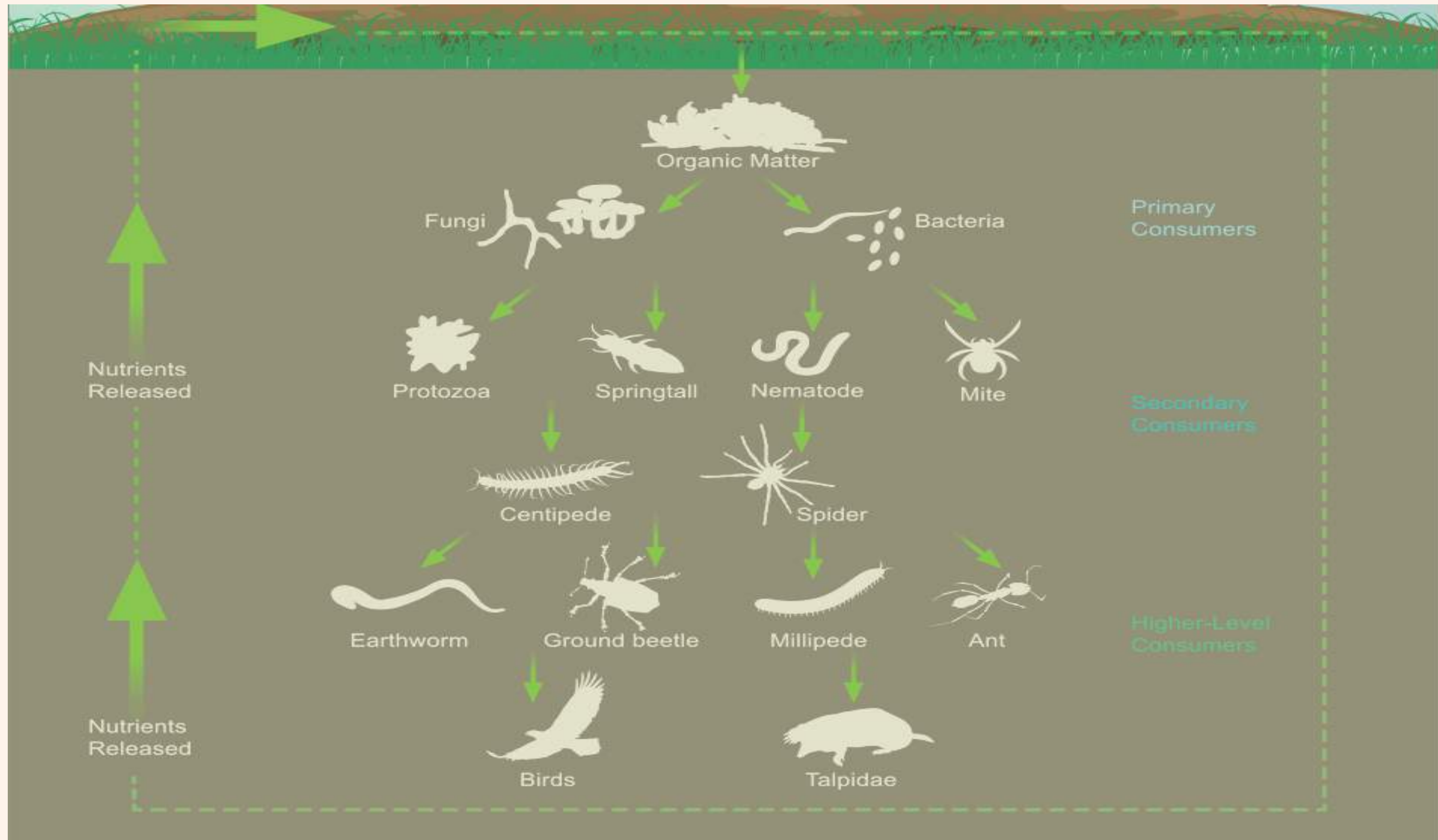








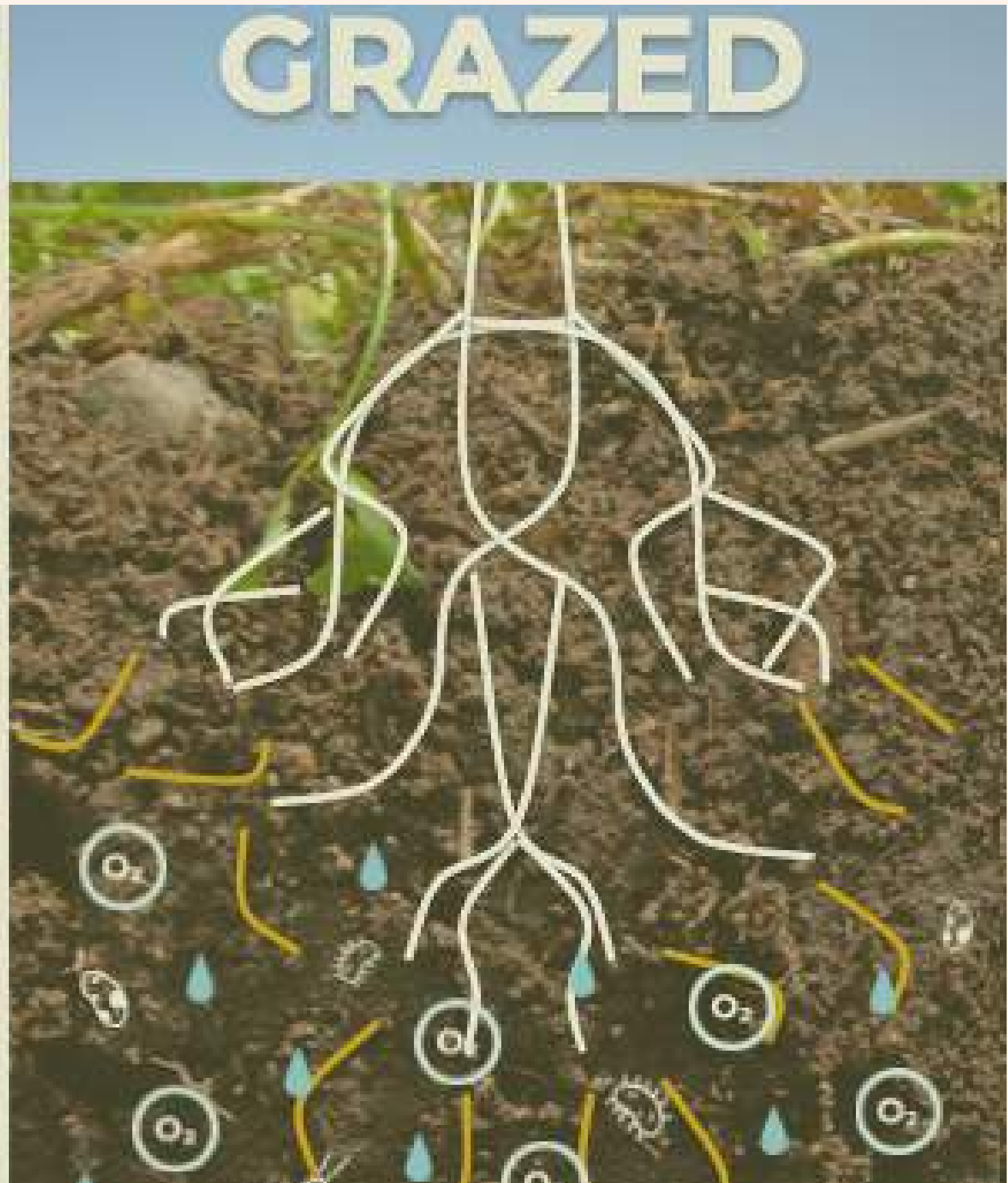
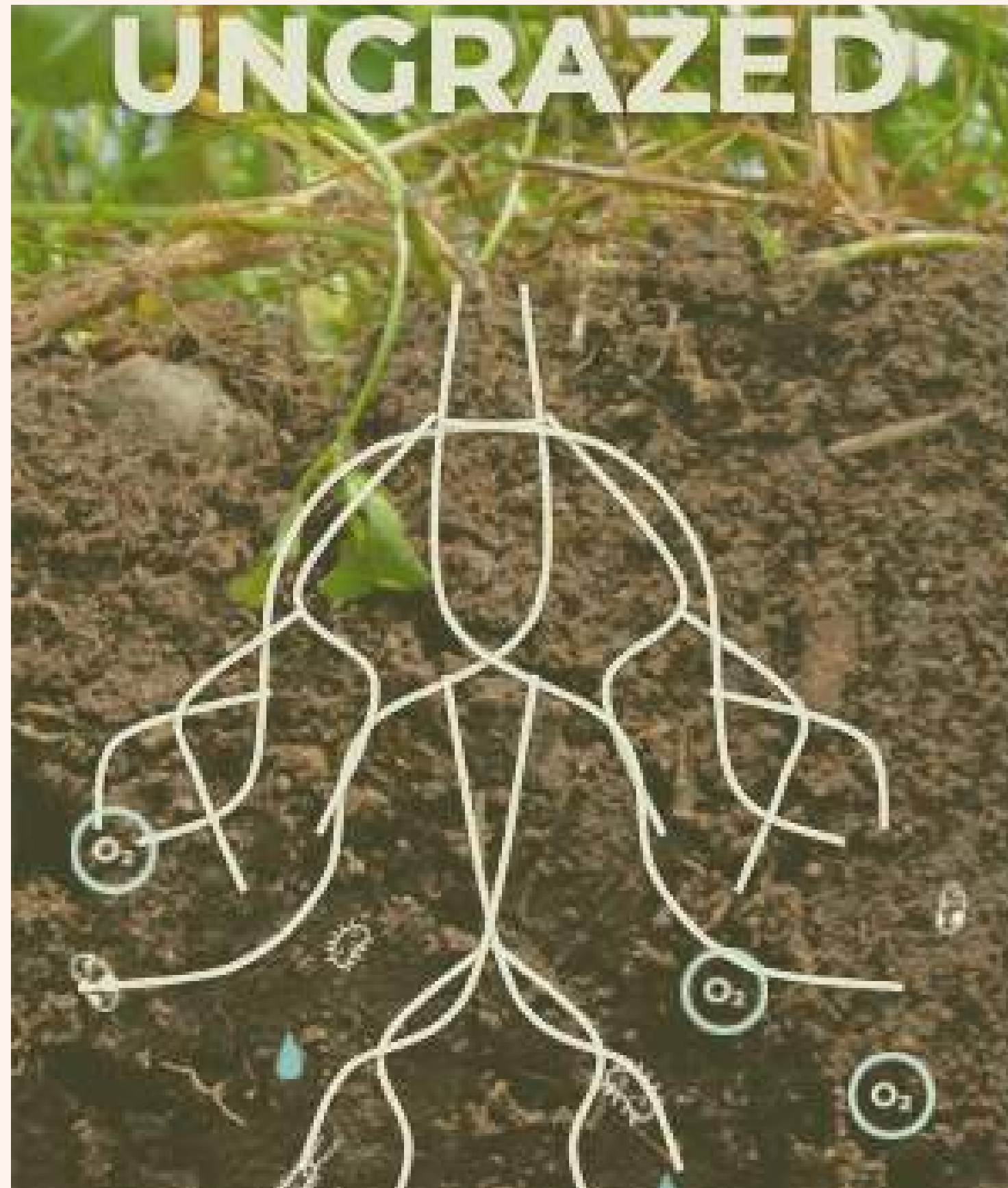




Sticky Carbon



+ Holds Minerals, H₂O,
Structure, and more



ATMOSPHERE

750 Billion tons of Carbon

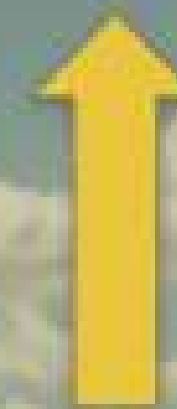
BIOSPHERE

550 Billion tons of Carbon

PEDOSPHERE


2300 Billion tons of Carbon

KISS
the
GROUND



*We've removed 136 Billion tons of Carbon from the soil since the industrial revolution

A GLOBAL EPIDEMIC

A world map with a light beige background. The continents are shown in shades of green and brown. Four red circles are drawn around the continents of North America, South America, Europe, and Australia. The text 'A GLOBAL EPIDEMIC' is written in large, white, bold, sans-serif capital letters across the top of the map.

We have lost $\frac{1}{3}$ of farmable land
in the past 40 years

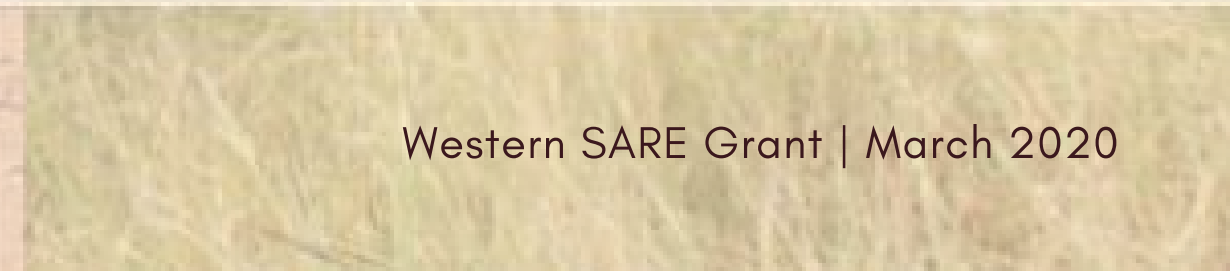


2004



2014

Land restored with Holistic Planned Grazing in Zimbabwe



THE EXPERIMENT

QUESTION

Can intensive grazing improve the soil: carbon, minerals, microbial life?

METHODS

Sheep + Chicken Managed Grazing

Korean Natural Farming - Indigenous Microorganisms

COMBINATIONS

Sheep only, chickens only, sheep + chicken, sheep + chicken + IMO,
Mowed Control, Rested Pasture

MEASURED

Photopoints, Production (Forage, Sheep/Acre), Carbon, Nitrogen, pH,
Minerals, Microbial Life, Soil Compaction.

Rest IMO

S+C

S+C+I

C Only

S Only

TIMELINE OF EXPERIMENT

FEBRUARY 2017: BEGIN GRAZING

Start: 5 Sheep, 20 Chks
Grazing Area: 0.9 acre
AU: 1.22 AU/Acre
Photopoints taken.

SEPTEMBER 2018: BASELINE

Seven (7) treatment
groups were set-up. Soil
Samples were taken from
each group to establish a
baseline. Animal body
condition and FAMACHA
scores taken.

DECEMBER 2019: FINAL SOIL SAMPLES

Soil Samples from each
group were taken and sent
to Midwest Labs for
Analysis. Animal scores
taken. Photopoints,
compaction, forage
samples taken.

MARCH 2020: FINAL PRESENTATION

Online presentation
available through Graze &
Sprout Farm Page.
Demonstrations and in
person presentation could
not be completed because
of Corona Virus.

PHOTOPOINT: PANORAMA

r



PHOTOPOINT: 1



Western SARE Grant | March 2020

2018



2019

PHOTOPOINT: 2



2018



2019

PHOTOPOINT: 3



Western SARE Grant | March 2020

2018



2019

PHOTOPOINT: 4



Western SARE Grant | March 2020

2018



2019

PHOTOPOINT: 5



Western SARE Grant | March 2020

2018

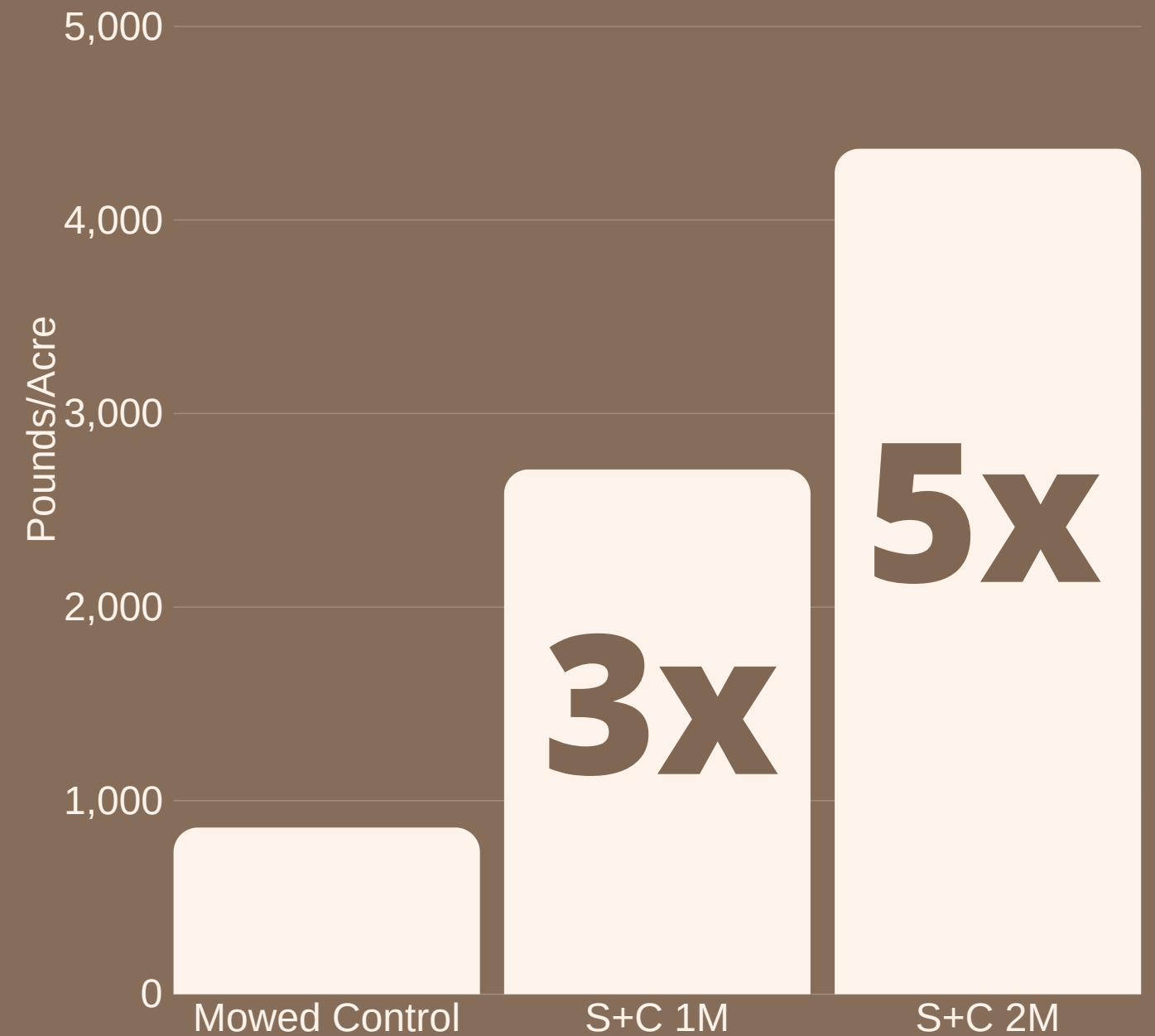
2020

FORAGE GRAZED VS. MOWED

FORAGE PRODUCTION

Forage production was measured using the hoop collection method. A hoop of known size is randomly thrown in the field and grass samples are collected. Total pound per acre production are determined from these samples.

Forage production was 3x higher than the mowed control at one month. Forage production was 5x times higher than mowed at 2 months. Increasing grass production, results in an increased number of animals that can be supported on the land.



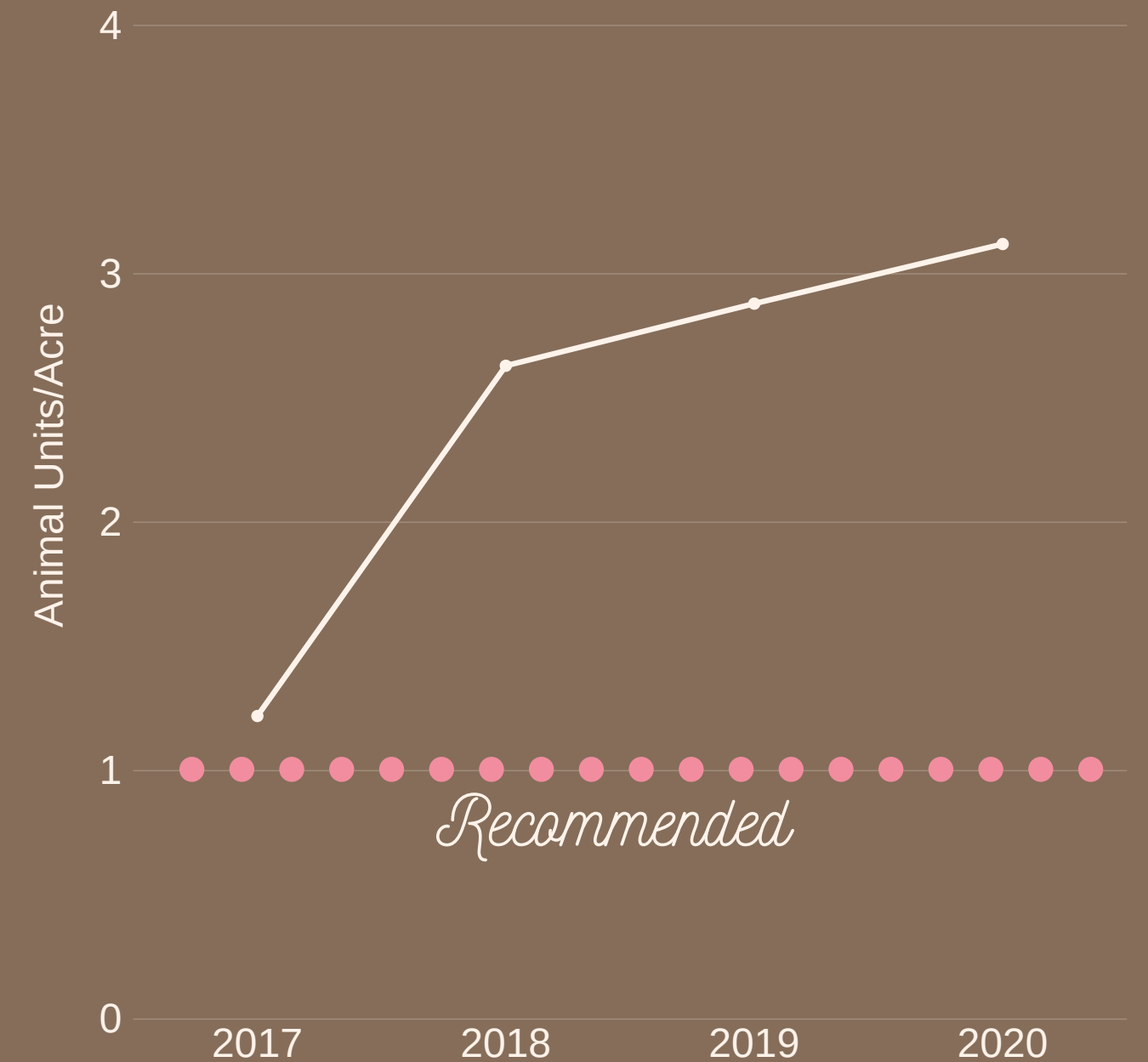
ANIMAL UNITS

CARRYING CAPACITY

We monitored our carrying capacity on the land throughout the experiment. The carry capacity accounts for acres of land in use, number of animals (including chickens) and supplementation.

One animal unit is defined as 1000 pounds. Chickens are included in the calculation because they have a high impact on the grass, even if they do not get their total diet from the forage.

Carrying capacity increased by 2.6 times from 2017 to 2020. In 2020 carrying capacity reached 3.12 animal units per acre. This is approximately 3 times the recommended of 1 animal unit per acre.

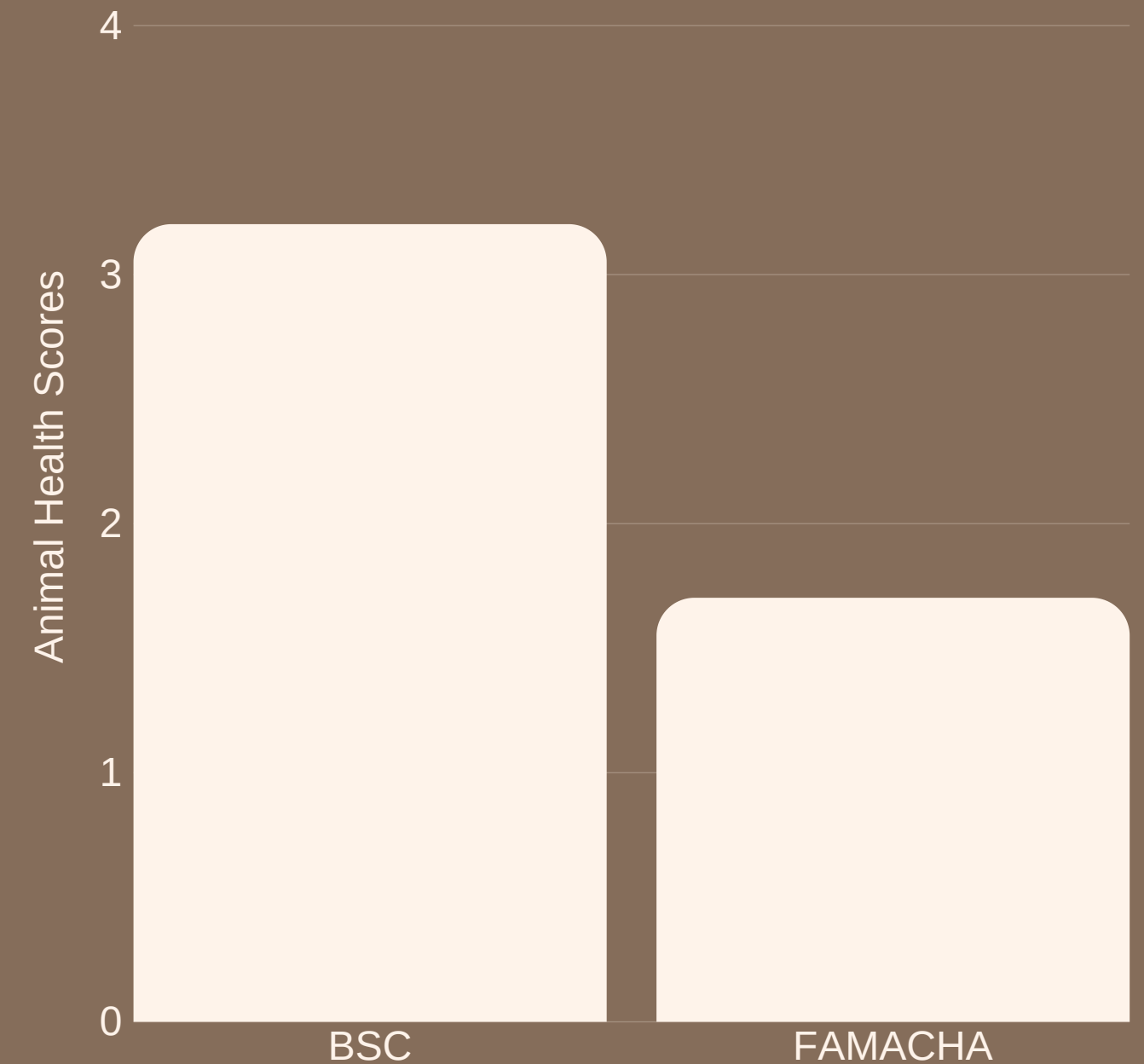


ANIMAL HEALTH

FAMACHA AND BODY CONDITION

We monitored Body Condition Score (BCS) and FAMACHA. BCS is a measure of health indicated observation of the hip-buttocks on the animal. The lower the score the skinnier the animal. Between 3-4 is ideal on the BCS. FAMACHA is a method of estimating worm load in the animal. The lower the score the less worm load.

The BCS scores were 3.2 which is within the range of ideal. FAMACHA scores were 1.7 and were "very low" for our region according to the vet that collected the data. These baseline figures were taken after a year of grazing and demonstrate that animal health is not sacrificed in this grazing program.



LAND THRIVING & IMPROVED

r



2018



Western SARE Grant | March 2020

2020

CARBON %

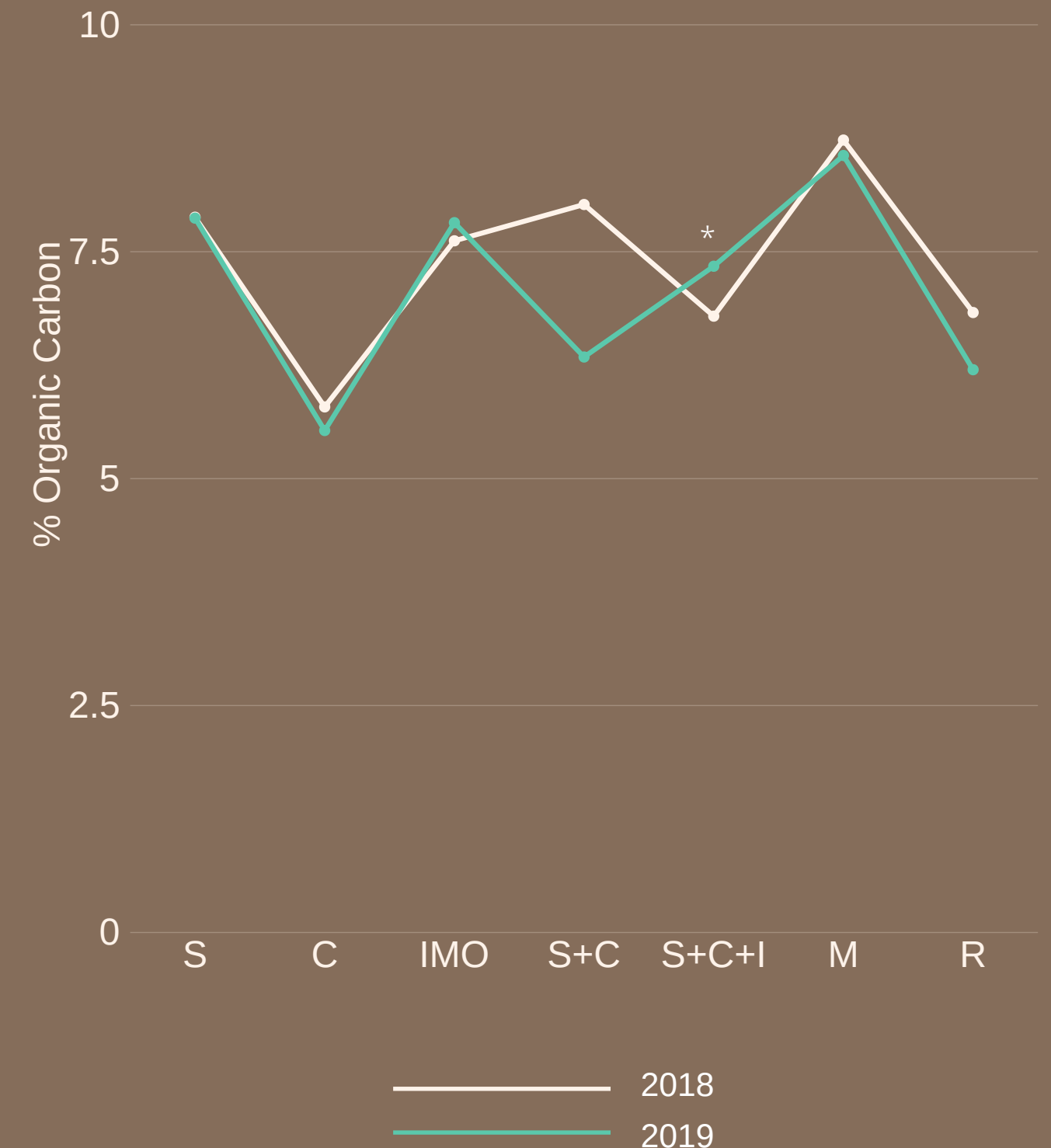
TOTAL ORGANIC CARBON (TOC)

Total organic carbon (TOC) is a measure of the organic carbon in the soil after inorganic is removed. It is an indicator of living, once-living, or natural debris. Bulk density ratio (O:N) was included in calculations.

Change in carbon was only significant in one group: Sheep + Chicken + IMO. The increase in 2019 was 0.54% above 2018 ($p < 0.05$).

A decrease in TOC was observed in the S+C, but the decrease was not significant. However, the trend may be considered. In this case, we placed the S+C zone in the shade. During the raining season, the high impact and low light resulted in area of bare ground. Bare ground is one of the fastest ways to lose carbon from the soil.

Western SARE Grant | March 2020



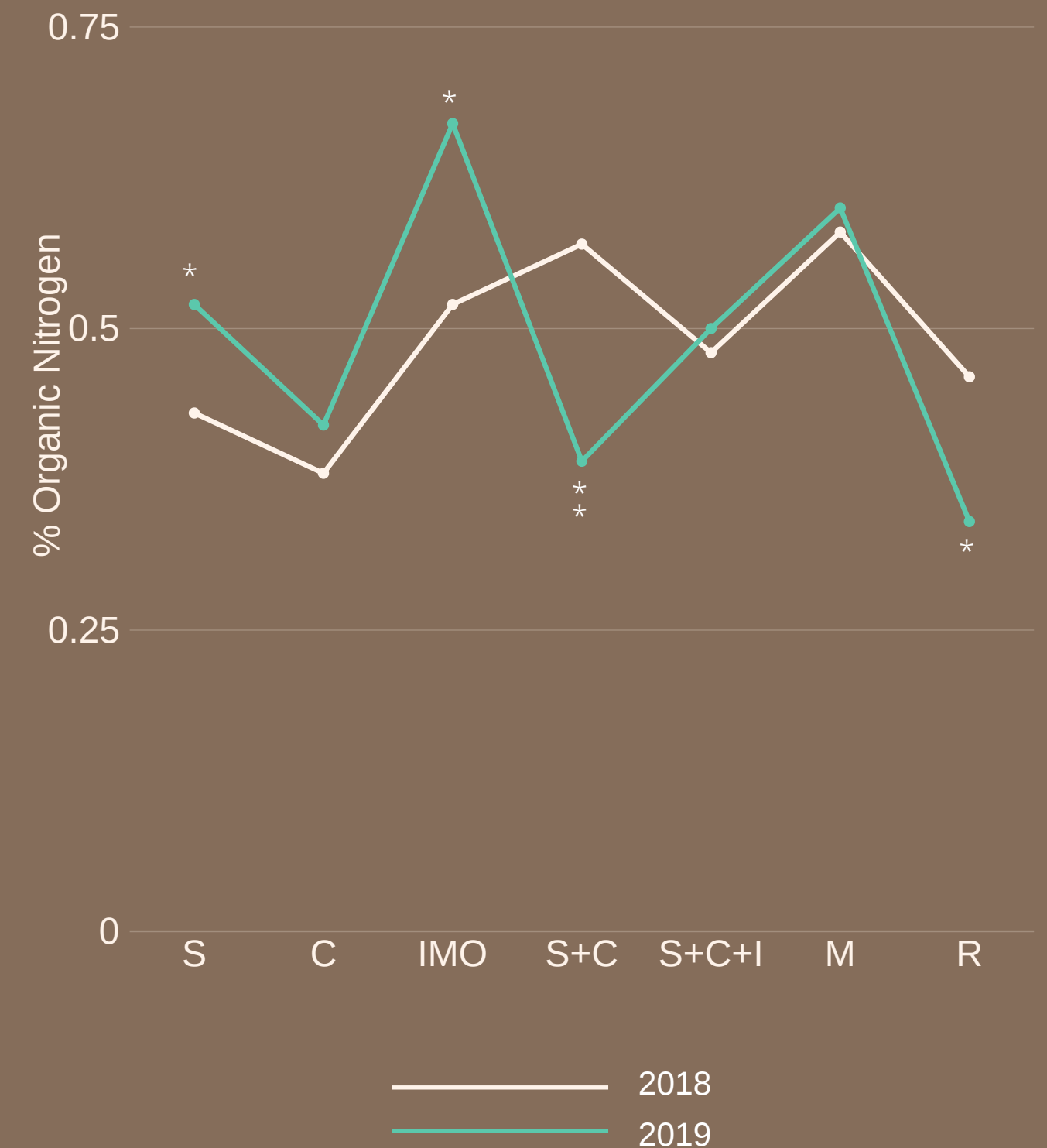
NITROGEN %

TOTAL ORGANIC NITROGEN (TOC)

Total organic nitrogen (TOC) is a measure of the organic nitrogen in the soil after inorganic is removed. It is an indicator of living, once-living, or natural debris. Bulk density ratio (O:N) was included in calculations.

There was a significant increase in nitrogen in the S and S+C group. S increased by 0.1% Organic Nitrogen. The S+C group increased by 0.15% Organic Nitrogen.

There was a decrease in the S+C group (-0.18% N) and in the Rested pasture (-0.12% N). In the S+C group the ground was bare twice in the winter due to high shade, and high rain.



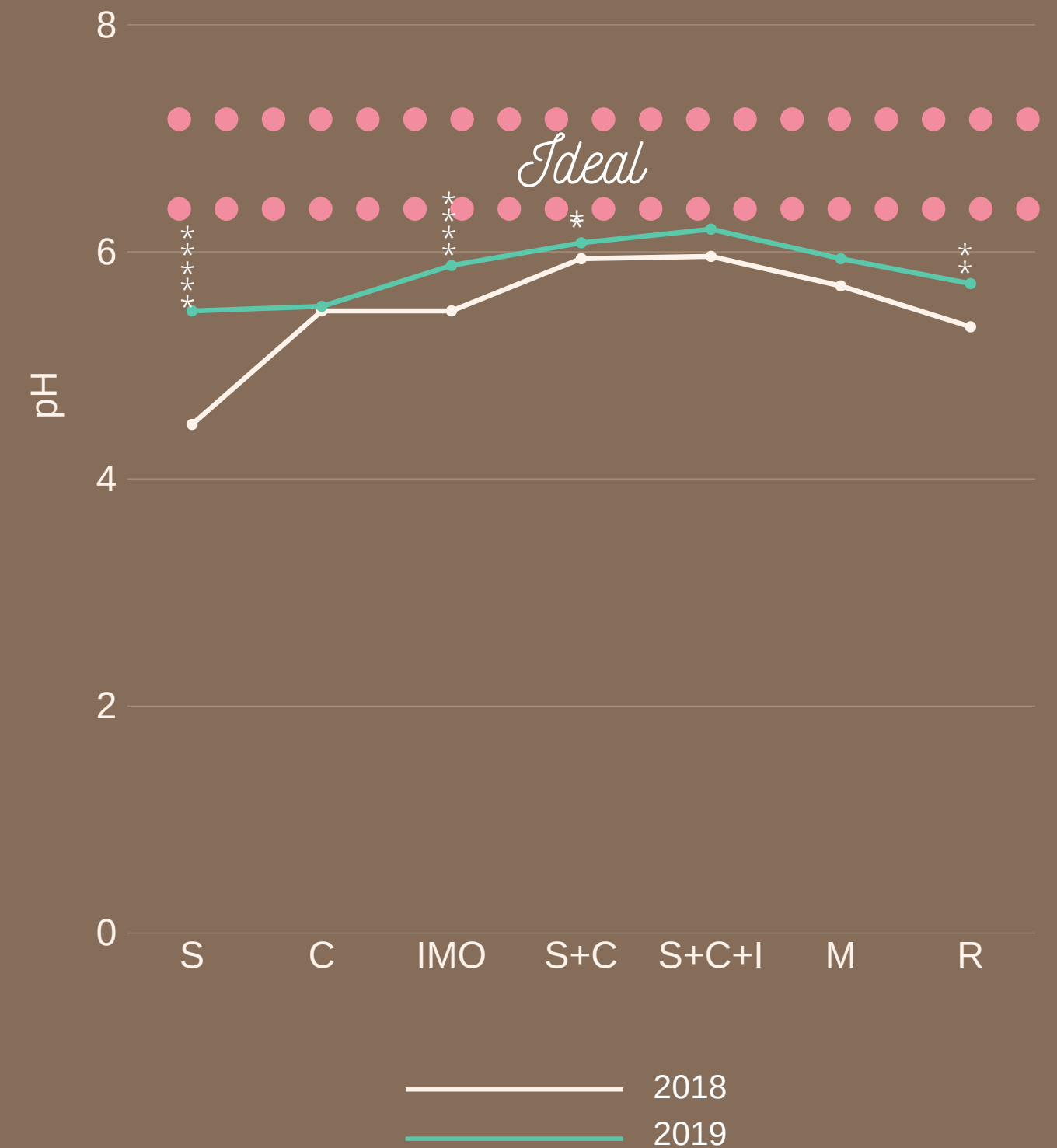
PH

ACIDITY OF THE SOIL

pH is a measure of the hydrogen ions in the soil. This number determine how acidic the soil is (less than 7 is acidic, more than 7 is basic).

For pastureland pH is ideal between 6.2-7. Conventional wisdom state that in this region (pH 6.2-7) mineral availability increases and is at its best for the plant.

In 2019, pH increases across the board, though it is only significant in the S, IMO, S+C, and R pasture groups. Increasing microbial life and organic matter may be a factor in increasing/restoring pH.



MICROBIAL LIFE

SOLVITA - CO2 BURST

Microbial life was measured using the Solvita CO2 Burst test. The amount of CO2 given off was measured. CO2 indicates active respiration of microorganisms and can be used as a measure of microbial life in the soil.

Microbial life was increased in all treatment groups, indicating an increase of life in the soil. Increasing life in the soil is an indication of a healthy Soil Food Web.

Data was not collected by the Lab for S+C and R, so conclusions cannot be made for these groups.



MINERALS

IT'S A BIT MUCH.

Minerals were also measured... but the data is still very unclear.

Because this is a general presentation and I don't want to bore you with seven graphs of inconclusive data, we'll just skip this one.



CONCLUSIONS & SUMMARY

WHAT CAN BE LEARNED FROM THIS STUDY?

TAKE AWAYS...

1

MORE FORAGE & ANIMALS

We increased production of grass by 5x over the span of a few years. We increase animals by 3x. More production/acre overall.

2

SOIL COVERAGE

Carbon and Nitrogen improved in groups with good grass coverage. Both decreased when soil was uncovered. Soil coverage is a must!

3

SOIL CARBON

Carbon holds many functions in soil system. Improving carbon can improve the soil and climate.

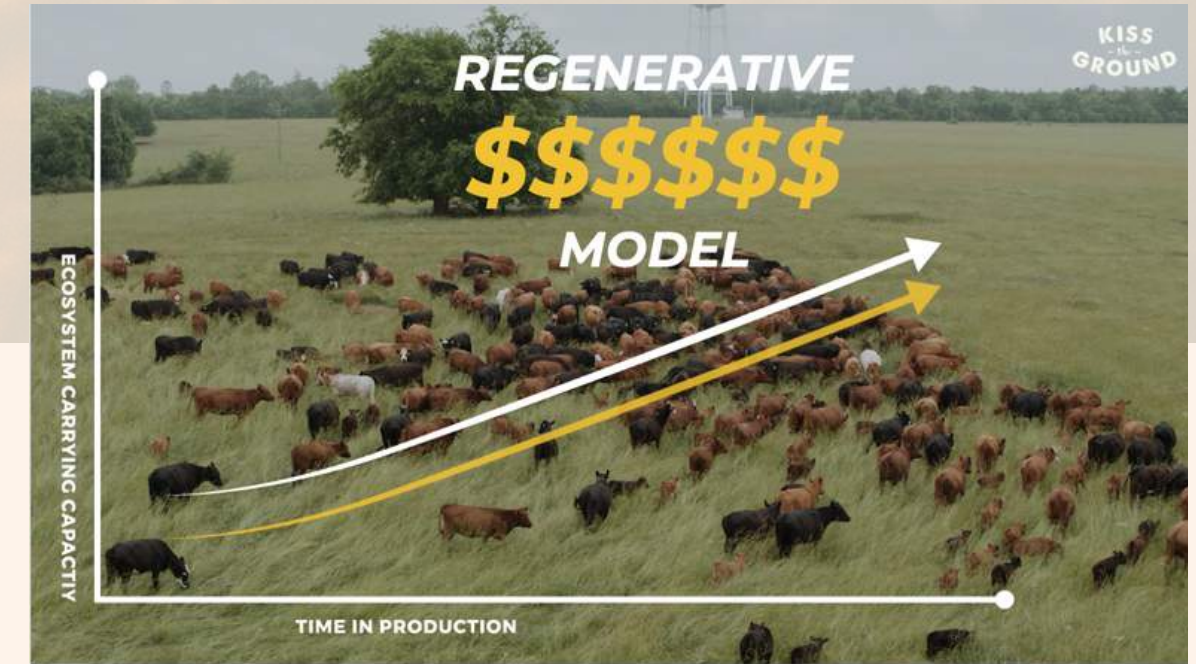
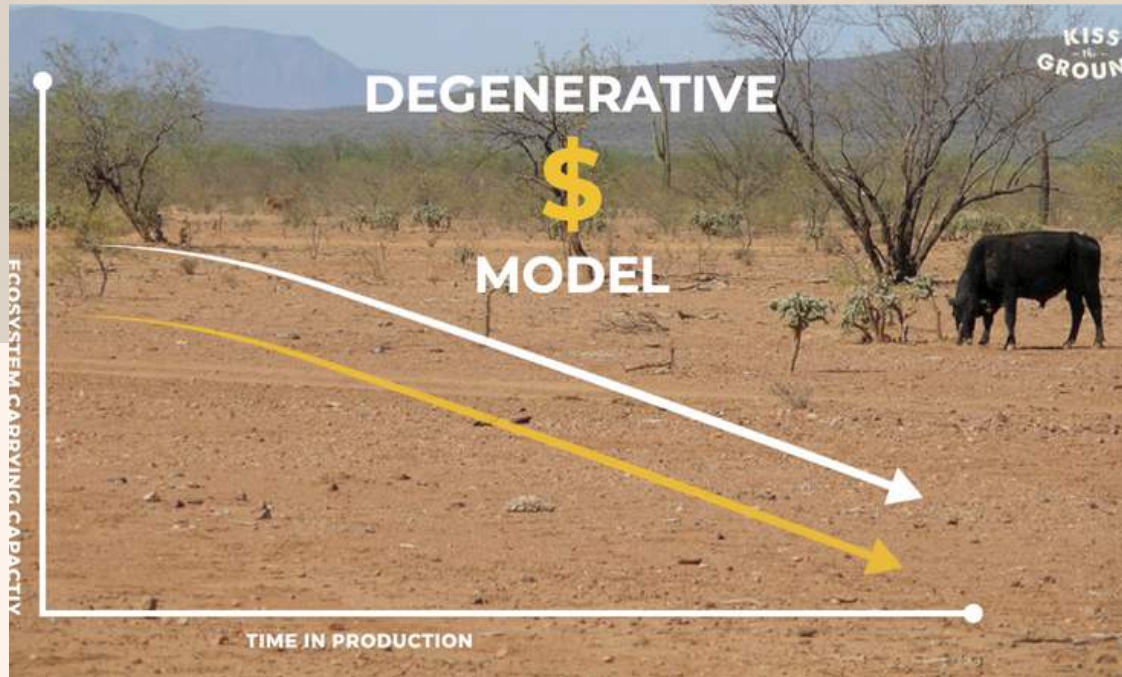
4

SOIL LIFE INCREASED

We saw an increase in soil life in animal groups. Animal manure is natural way to add microbial life to the soil.

1

MORE ANIMALS = HIGHER PRODUCTION



DEGENERATIVE

- Inputs increase
- Output decrease
- Degrade land
- Degrade water
- Chemicals - More

SUSTAINABLE

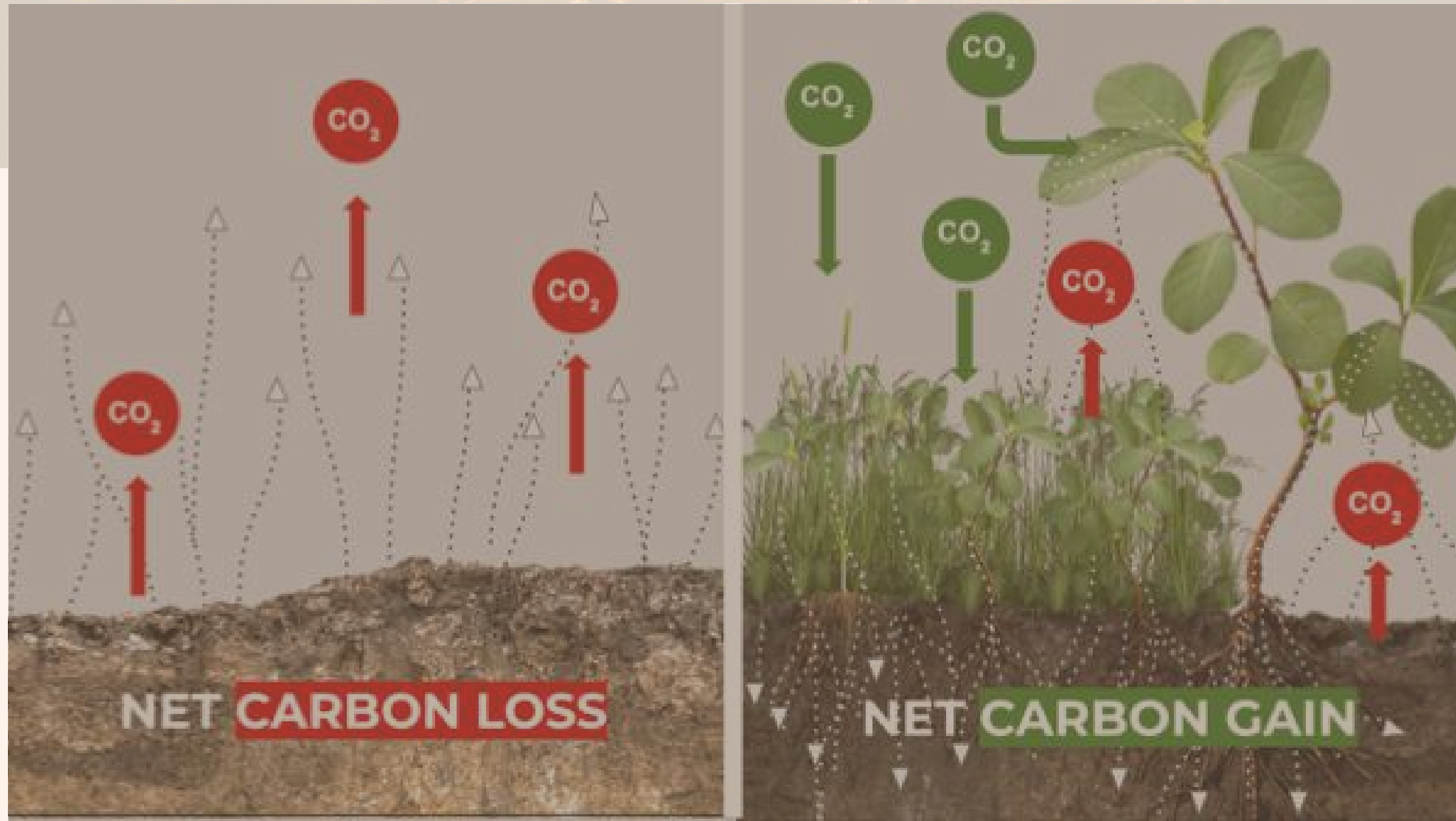
- Inputs Stable
- Output Stable
- Land Stable
- Water Stable
- Chemicals - Less

REGENERATIVE

- Low to no inputs
- Output increase
- Land Productivity Increase
- Water Cycle Restored, Cleaned
- Chemicals - None

2

SOIL COVERAGE = CRITICAL



3

SOIL CARBON

FOOD WEB

The Soil Food Web needs to be fed. Organic Carbon is the food that feeds the Soil Food Web. The sugars and debris exuded by grass results in food sources for below ground animals that in turn feed your plants.

WATER

For every 1% of C stored in the soil, there is an increase of 25,000 gallons of water that can be held per Acre. The soil begins to act more like a sponge, absorbing more water in rainy times, and holding it in drought.

MINERALS

Organic matter (organic carbon) helps hold and integrate minerals into the soil structure. This helps minerals be more available and decreases the washing away of minerals in rain events.

DRAW DOWN

The soil has the potential to store giga tonnes of carbon. Drawing carbon from the air into the soil results in Healthier plants and less CO₂ in the air.

3

OUR DATA

FOOD WEB

With future work, we would like to investigate the Soil Food Web directly. Elaine Ingham has developed microscope methods to do this.

WATER

Carbon Increased by 0.54%. This translates into 13,500 more water that can be held per acre.

MINERALS

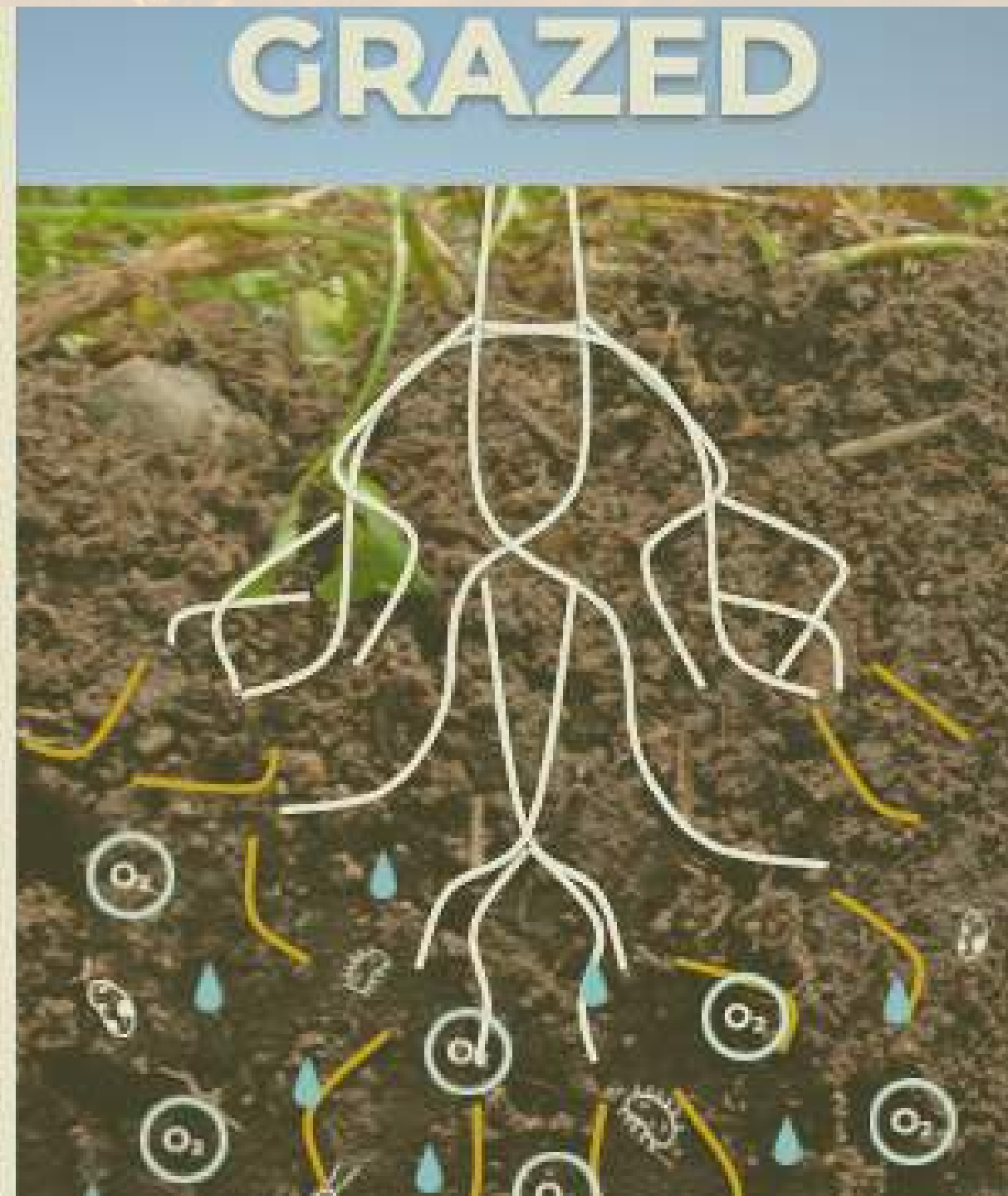
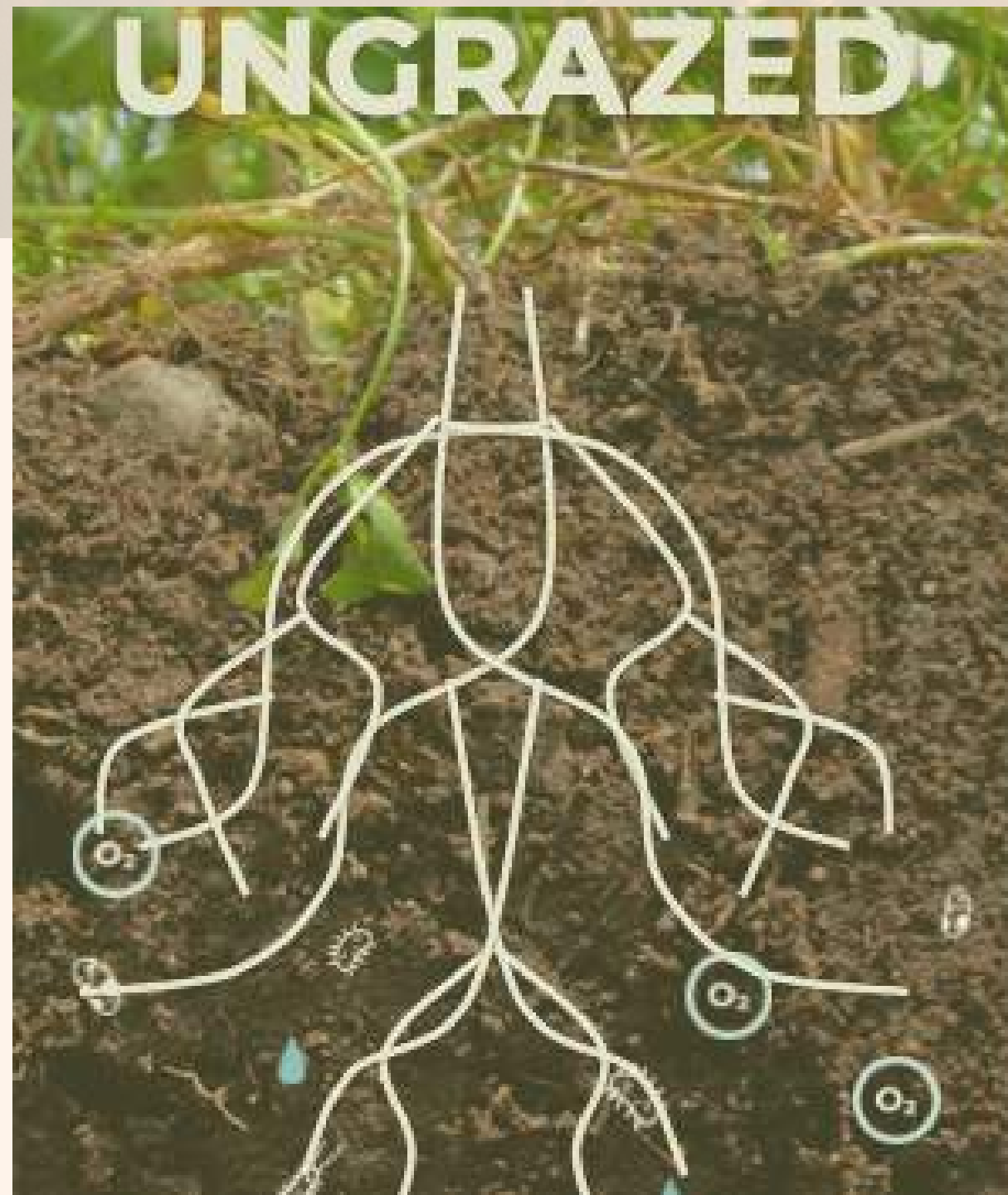
Minerals do appear in some cases to be approaching ideal, but the data is complex and more work needs to be done.

DRAW DOWN

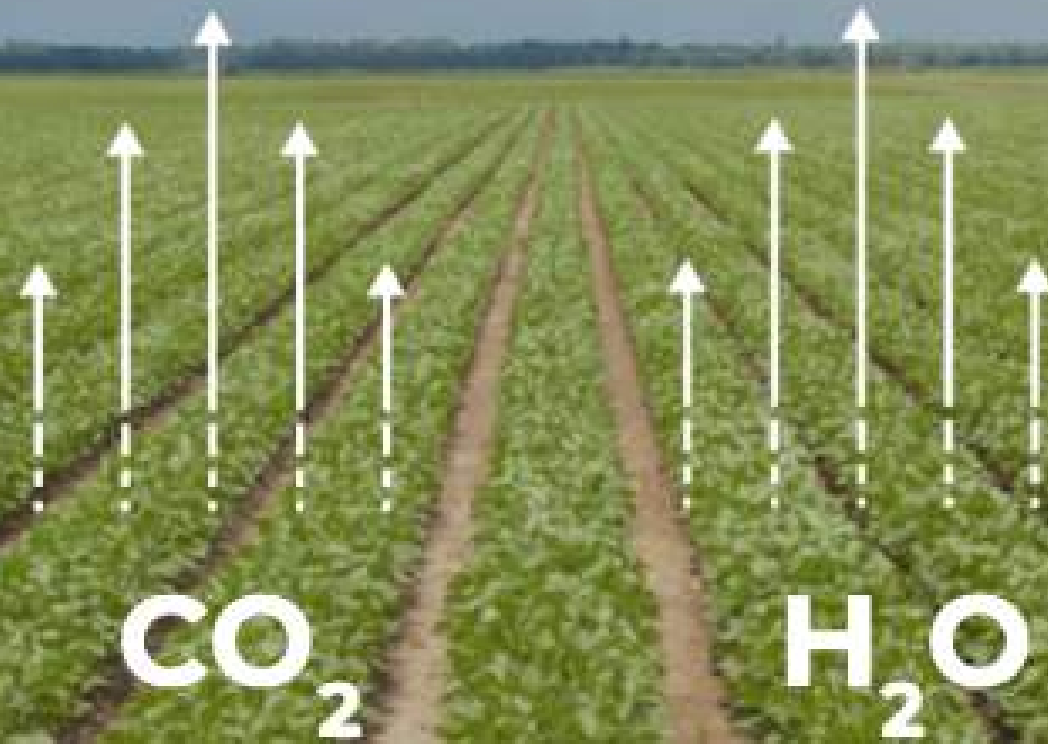
Covercropping increases carbon by about 0.2% per year. We showed an increase of just over double that. Covercropping the pasture will be next.

4

SOIL LIFE IMPROVED



Degenerative*



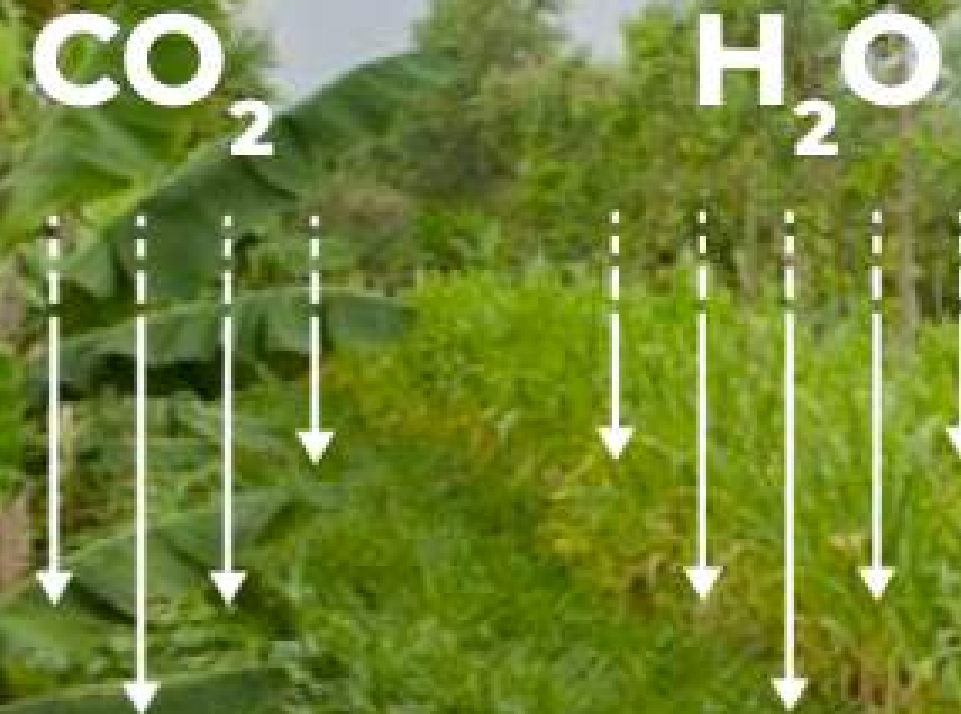
Annual

- Living root
- Diversity
- Minimal Disturbance
- Animal Integration
- Armored Soil

Regenerative*



KISS
-the-
GROUND



Perennial

- Living root
- Diversity
- Minimal Disturbance
- Animal Integration
- Armored Soil

OUR COMMON GROUND

**The Earth is what we
all have in common.**

WENDELL BERRY

