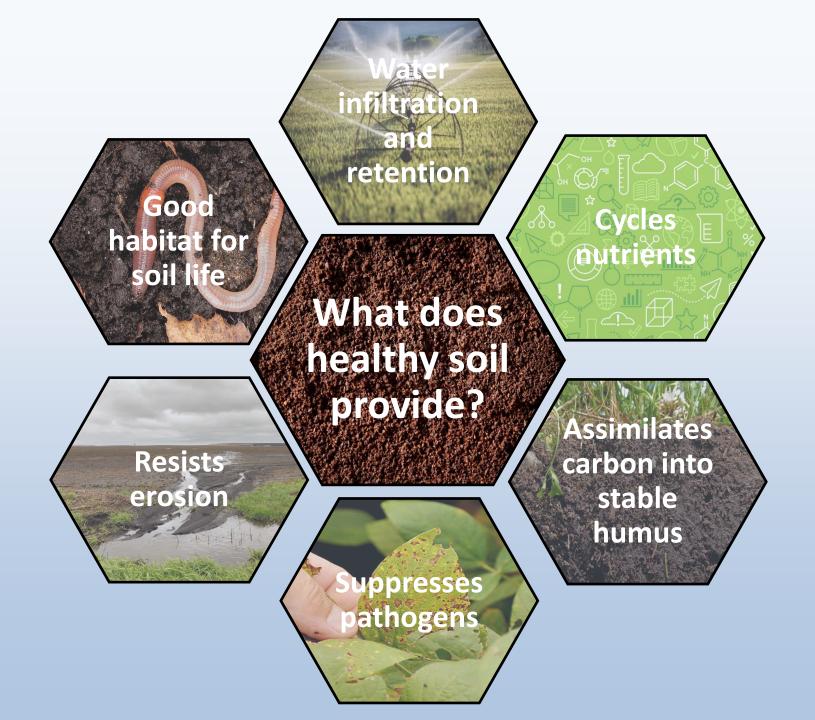
# A brief overview- how nature functions

Sale Contraction

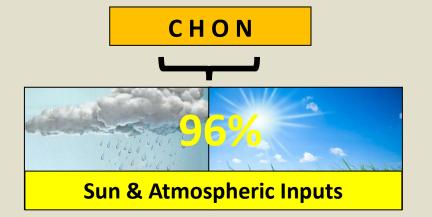
# Willie Pretorius, Patrick Freeze & Zach Wright



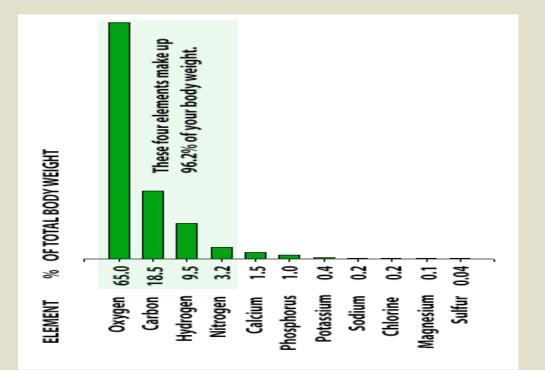




#### Sources from nature's non-living building blocks



# S P K Ca Mg Fe Mn Zn Cu B Mo Na Cl Si Cr



Manganese, Iron, Copper,
Zinc, Boron, Molybdenum,
Selenium, Chromium,
Cobalt, Vanadium, Tin,
Nickel, Rubidium,
Strontium and more.

# How does nature put this growth model together?

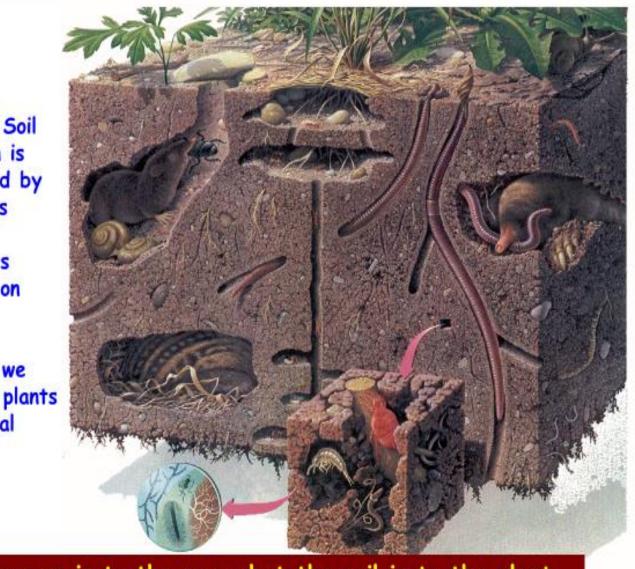
# WITH LIFE !

- Bacteria
- fungi
- protozoa
- nematodes
- arthropods
   earthworms
- and more!



Microbes depend on plants

So how we manage plants is critical



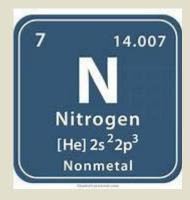
The rumen is to the cow what the soil is to the plant

### Soil provides infrastructure linking building blocks and resources

# Soil as provider of mineral building block resources

P, K, S, Ca, Mg, Na, Fe, Zn, Cu, Mn, Mo, B, Cl, Cr and more

# Facilitates nitrogen infiltration from the atmosphere

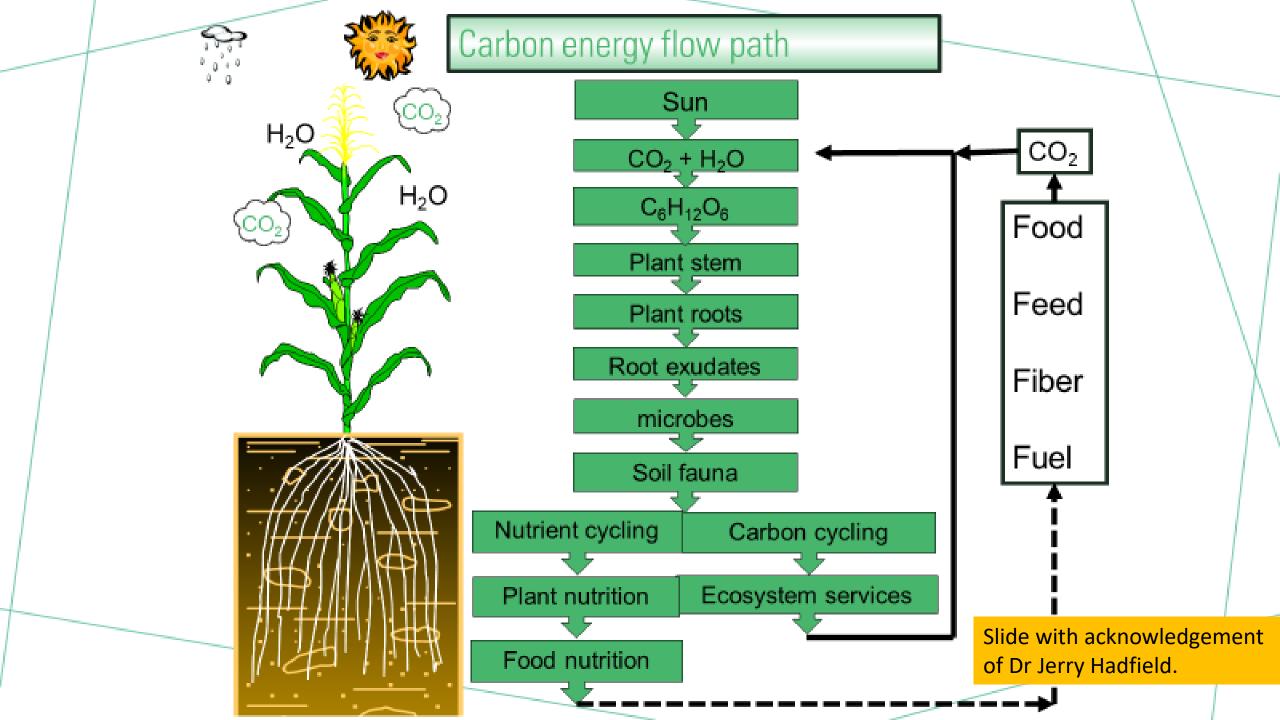


## Soil as habitat for soil life



# Soil as a provider for water infiltration and storage





The plant-soil-microbial association is facilitated by root exudates

# Soil health relevance?

Microbial and plant (or root) diversity is required to maintain soil functional services

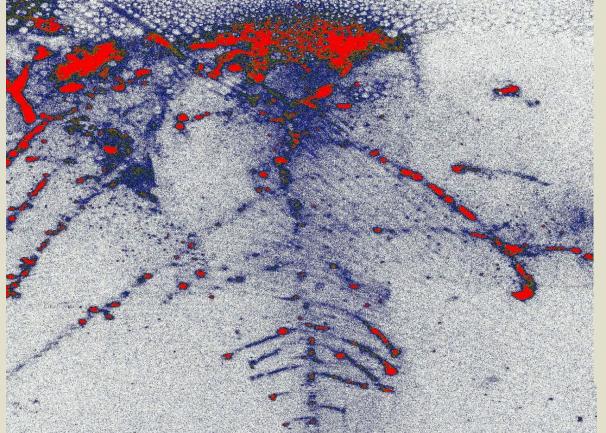
Root exudates • Organic acids • Small molecules • Hormones Competition & colonization Recognition & recruitment Chemical signalling ·))) Rhizosphere Rhizosphere microbiome Soil environment • Geography Bulk soil microbiome Moisture conditions

• Climate

• Soil type

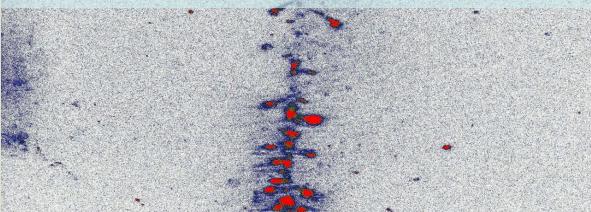
Localisation of root exudates by <sup>14</sup>C imaging

Root exudates in red

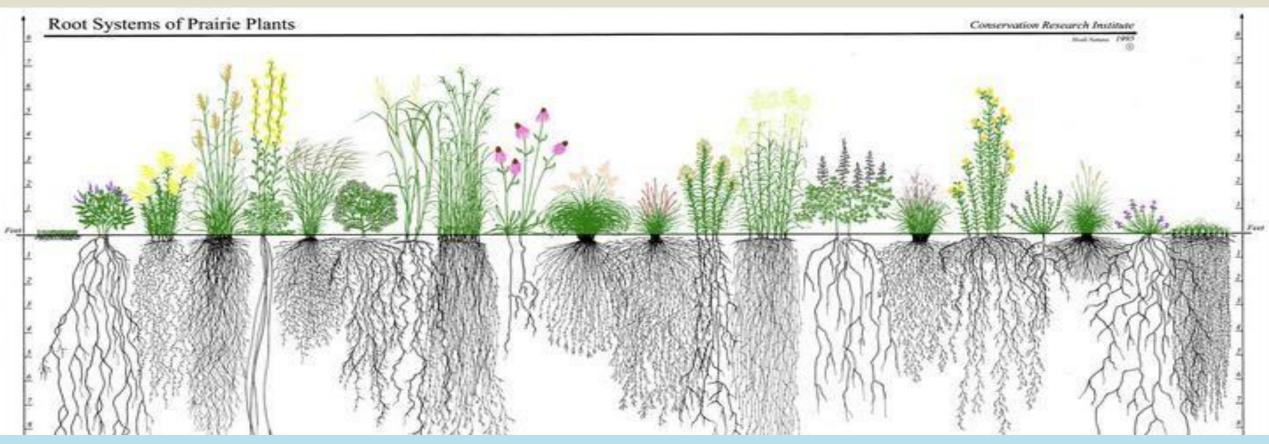


Corn plant grown in CO<sub>2</sub> enriched environment

# Illustrating root exudates that feed the microbes



#### Establishing a diversity of soil *microbial teams* of Saprophytic and Mycorrhizal fungi and helper bacteria.



Different plant species have different root configurations and different microbial fingerprints maintained by a unique combination of sugars and other root signaling exudates attracting their unique consortium of microbiology.

2 2 2	}			Y														1	15	Ņ	12 12 12
D Kontection Proceedings Proceedings	Laad Paat Asseylas categorits	Minut Goldenrud Solalage Ritsoprices	ladian Gran Jarghastun misu	Company Plant Xiphany Accessory	Percepine Gram Sign sporter	Hoath Aster Aster	Prointe Corel Gran Sportino portinato	Ng Ular Sam Jadapapan generali	Pale Perple Coardioever Echinaces pullida	Prairie Drogosod Sporoholas Accordigat	Side Outs Gramm Anteline cortipodele	False Baseset Eshnar espatierteshn	Switch Grass Possium Virgatum	White Wild hedge Bayrinte Bayrinte	Little Blac Stem Endropegon Scipartist	Rasia Wred Jojshan Inspifiika	Pargin Producto Classer Productorem pargurant	Jane Grass Koeleria cristate	Canada and	Buffalo Gram Starkfor darphälor	15

## MINERAL NUTRIENT CYCLING

Veramungszone

THE MYCORRHIZAE SIGNALING SYSTEM connects to soil mineral resources via hyphae

0

**GLOMALIN** 

**RELEASE TO** 

FORM

AGGREGATES

H.0

Nutrient rich minerals.

Ca, Mg, Fe, Mn, Zn,Cu, B, Mo

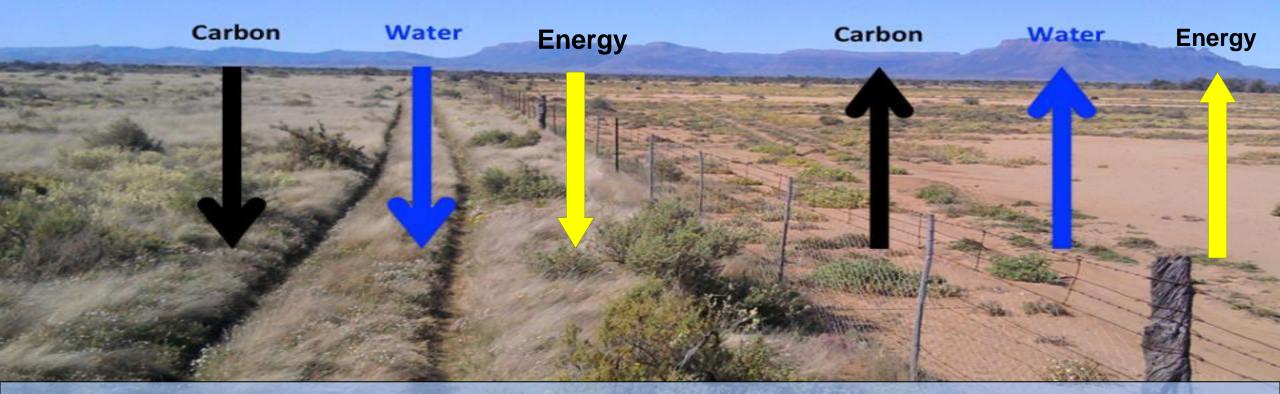
#### Comparisons of Total Soil Nutrients stored to 1 foot depth: World survey (left) versus 45 farms in ND and Canada (right) to 1 ft depth.

	Mineral	World Survey (Sparks, 2003) lbs /acre	45 ND & Canada farms (Gabe Brown) Ibs/acre	
	N	4000	9000	
	Р	1600	2300	
N. C. S.	К	28000	11000	and the second second
	Са	30000	40000	
	S	1400	2000	
States and	Mg	10000	20000	
	Zn	180	240	
	Fe	80000	60000	
	Mn	2000	2400	STATES STATES
	Cu	60	40	
SS & Constant And Assessed	В	Not done	40	
	Мо	2.4	3	and the second second

A AND

18

#### Karoo, South Africa Grassland Desert



Carbon not stored in *living biomass* or *stable soil carbon* will return to the atmosphere. *The Result: Stable farming system* with *minimal inputs* and *functioning carbon, water, nitrogen* and *mineral nutrient cycles*.

#### The water cycle working in the desert

## **Fence Line Comparison**

 Palmitas Ranch, Chihuahua, Mexico on the left side of the photo. *Courtesy: Jose Fernandez* Use Adaptive Grazing Practices

- Neighbor's ranch on the right side of the photo
  - Conventional grazing practices

Slide with thanks from Dr Allen Williams

