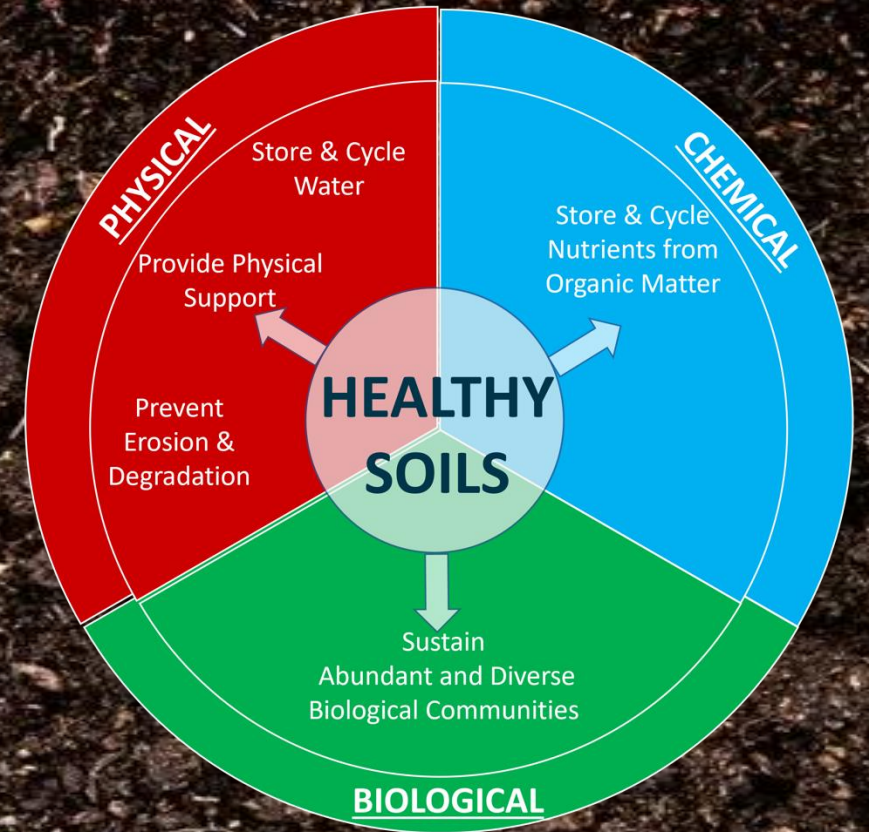# Nematodes as indicators of soil biological health

Katherine Linsell

Soil Health
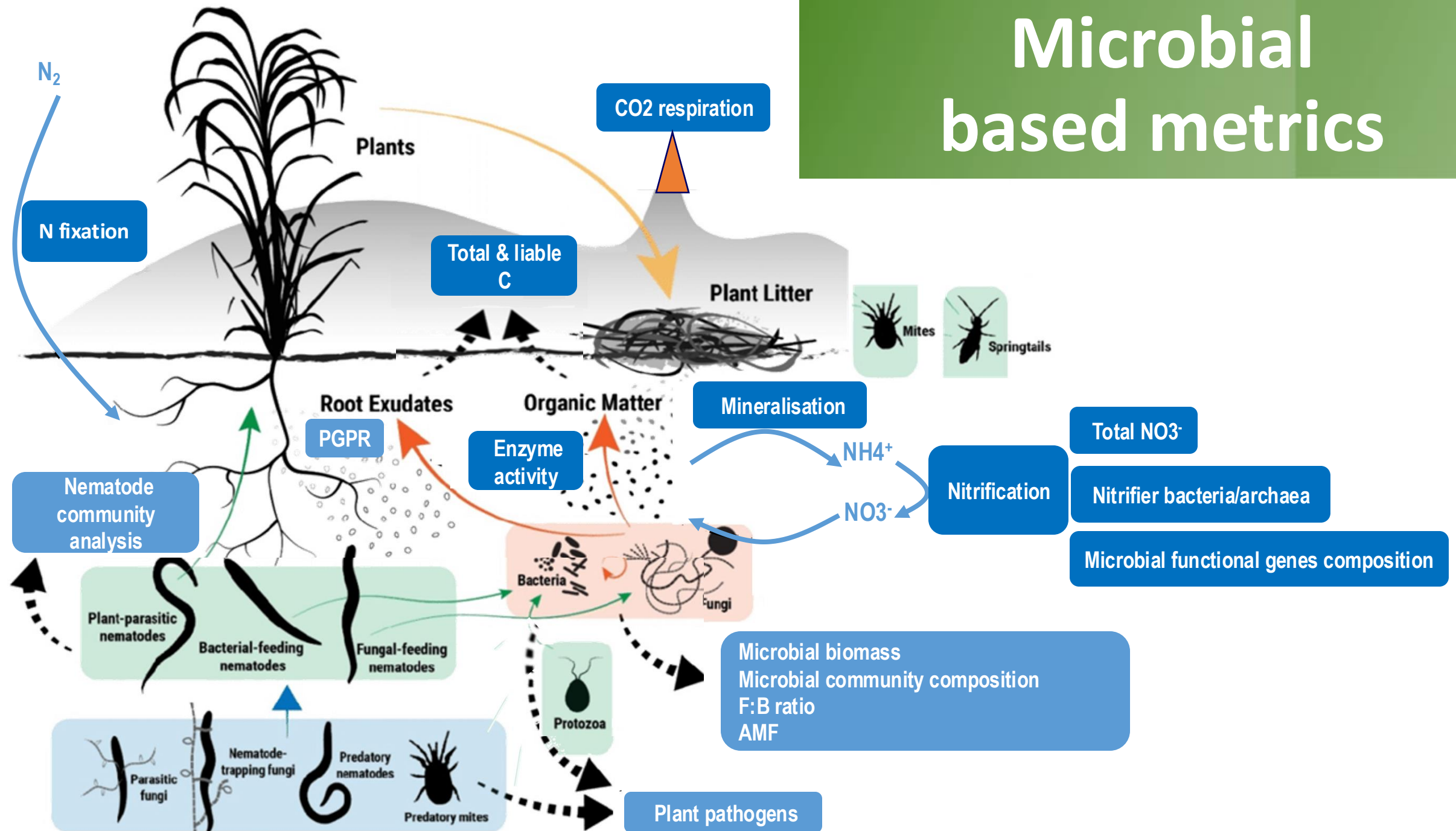
- Growers want to measure and monitor soil health
  - to enable sustainable soil management decisions

- How should soil health be measured?

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- **Soil biology is complex**

  - **used to characterize many aspects of the soil environment**

- **DNA technologies allowed characterisation**

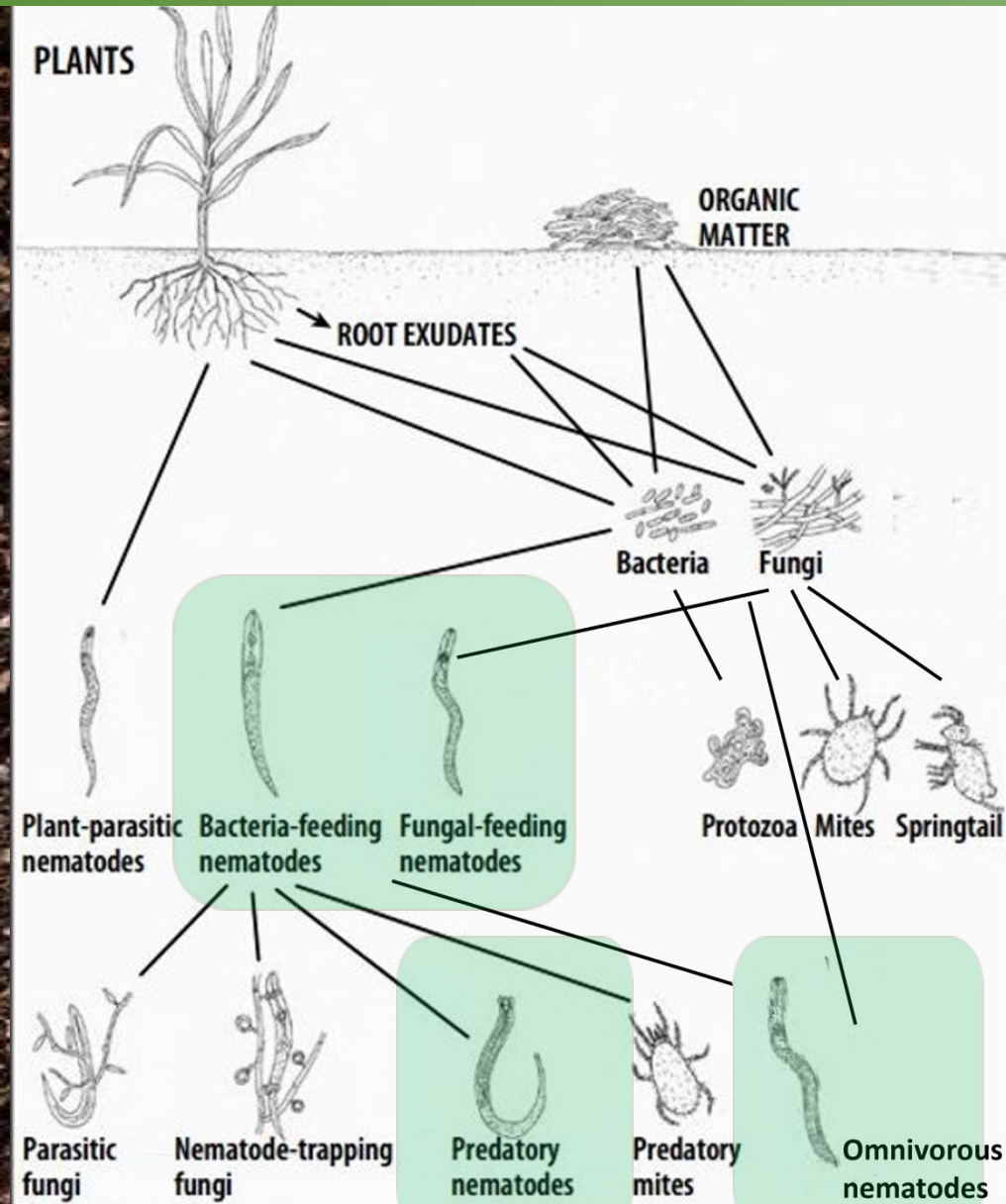- **Range of different microbe-based metrics**

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Microbial based metrics

N₂

N fixation

CO2 respiration

Plants

Total & liable C

Plant Litter

Mites   Springtails

Root Exudates   Organic Matter

Mineralisation

PGPR

Enzyme activity

NH4⁺

Total NO3⁻

Nematode community analysis

Nitrification

Nitrifier bacteria/archaea

NO3⁻

Microbial functional genes composition

Plant-parasitic nematodes   Bacterial-feeding nematodes   Fungal-feeding nematodes

Bacteria

Fungi

Microbial biomass
Microbial community composition
F:B ratio
AMF

Protozoa

Parasitic fungi   Nematode-trapping fungi   Predatory nematodes   Predatory mites

Plant pathogens

Brakin et al. 2017

Nematodes as Indicators

adapted from Graham Stirling

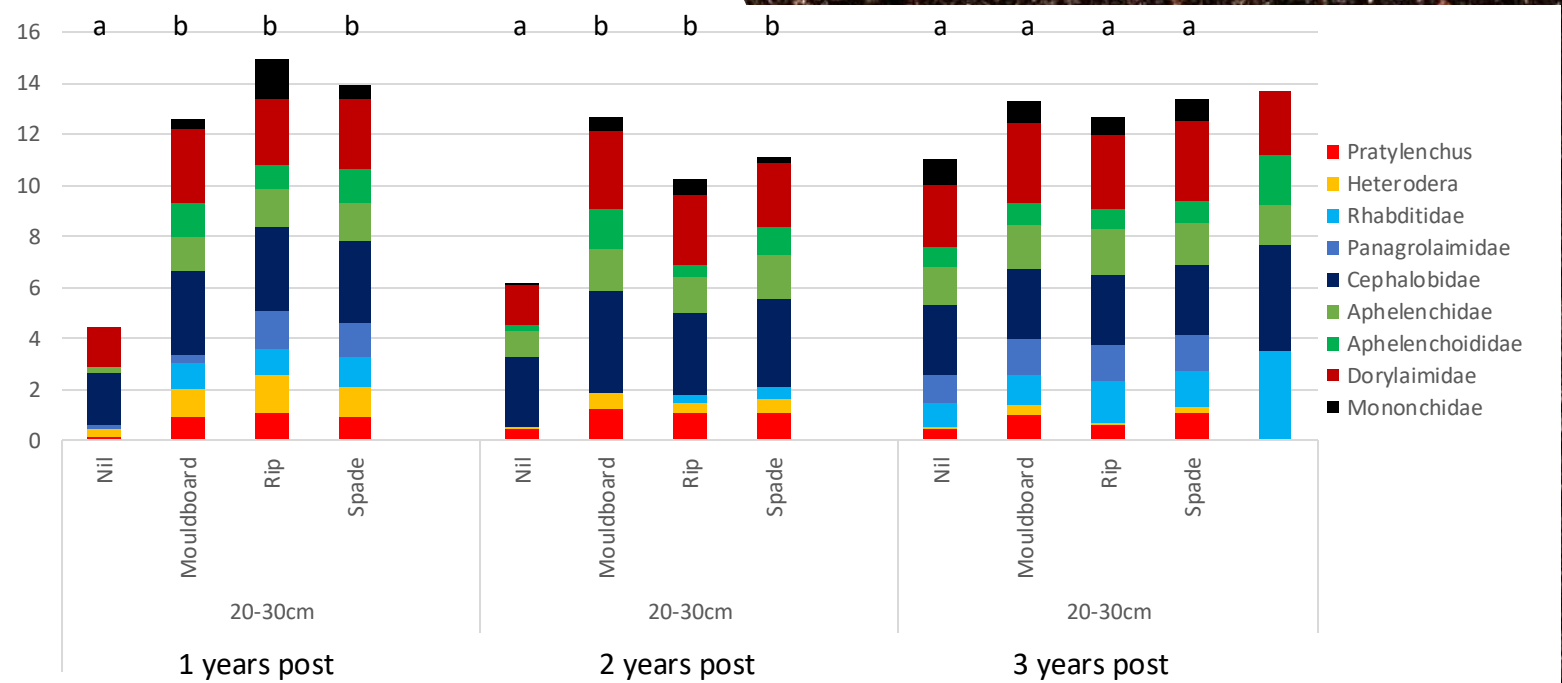| qPCR Assay	Feeding Group	Classification
Dorylaimida	Omnivore	Order
Mononchida	Predator	Order
Aphelenchidae	Fungivore	Family
Aphelenchoididae	Fungivore	Family
Cephalobidae	Bacterivore	Family
Mesorhabditidae	Bacterivore	Family
Rhabditidae 1 and 2	Bacterivore	Family
Panagrolaimidae	Bacterivore	Family
Tylenchidae 1 - 6	Plant associate	Family
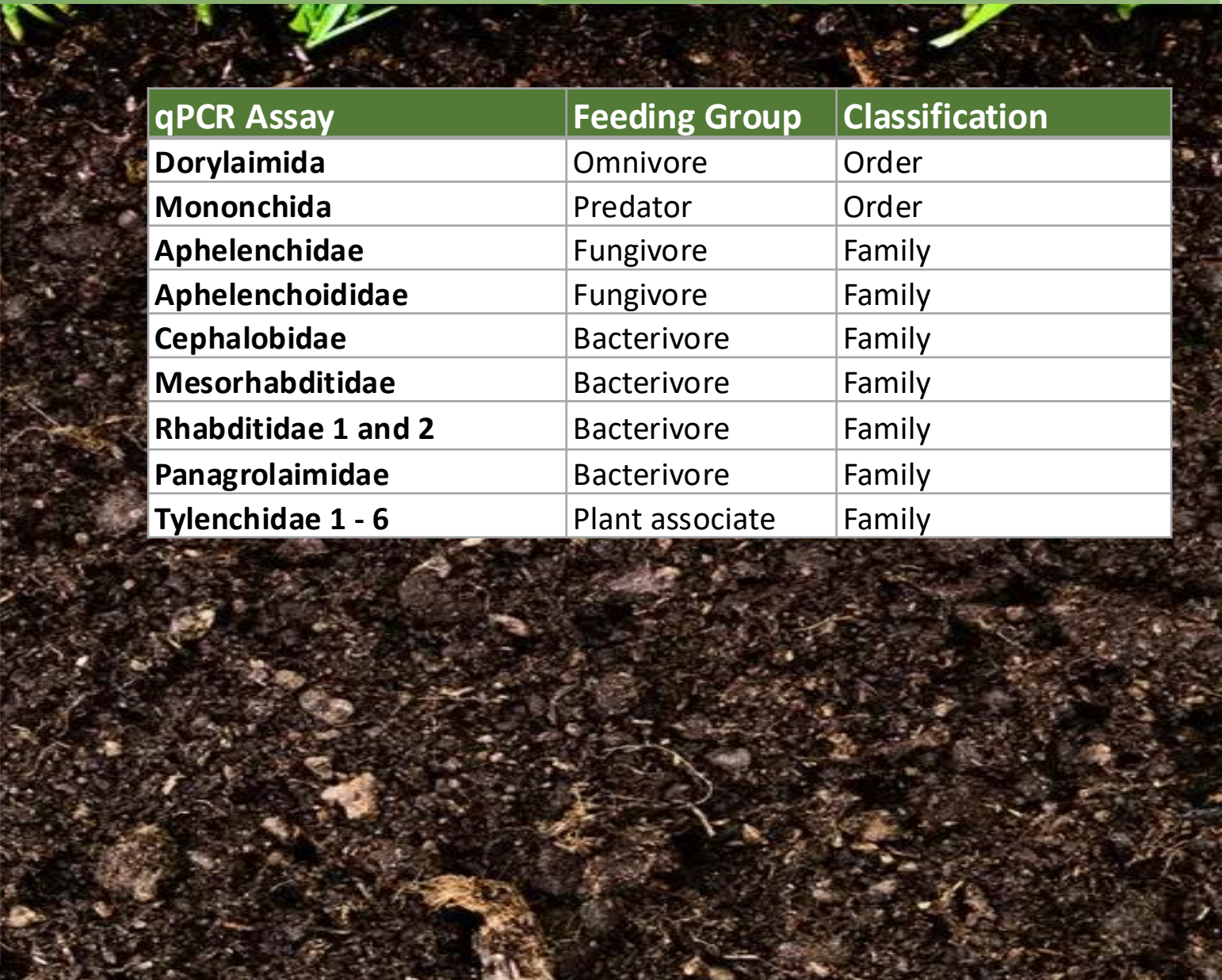
Nematodes as Indicators
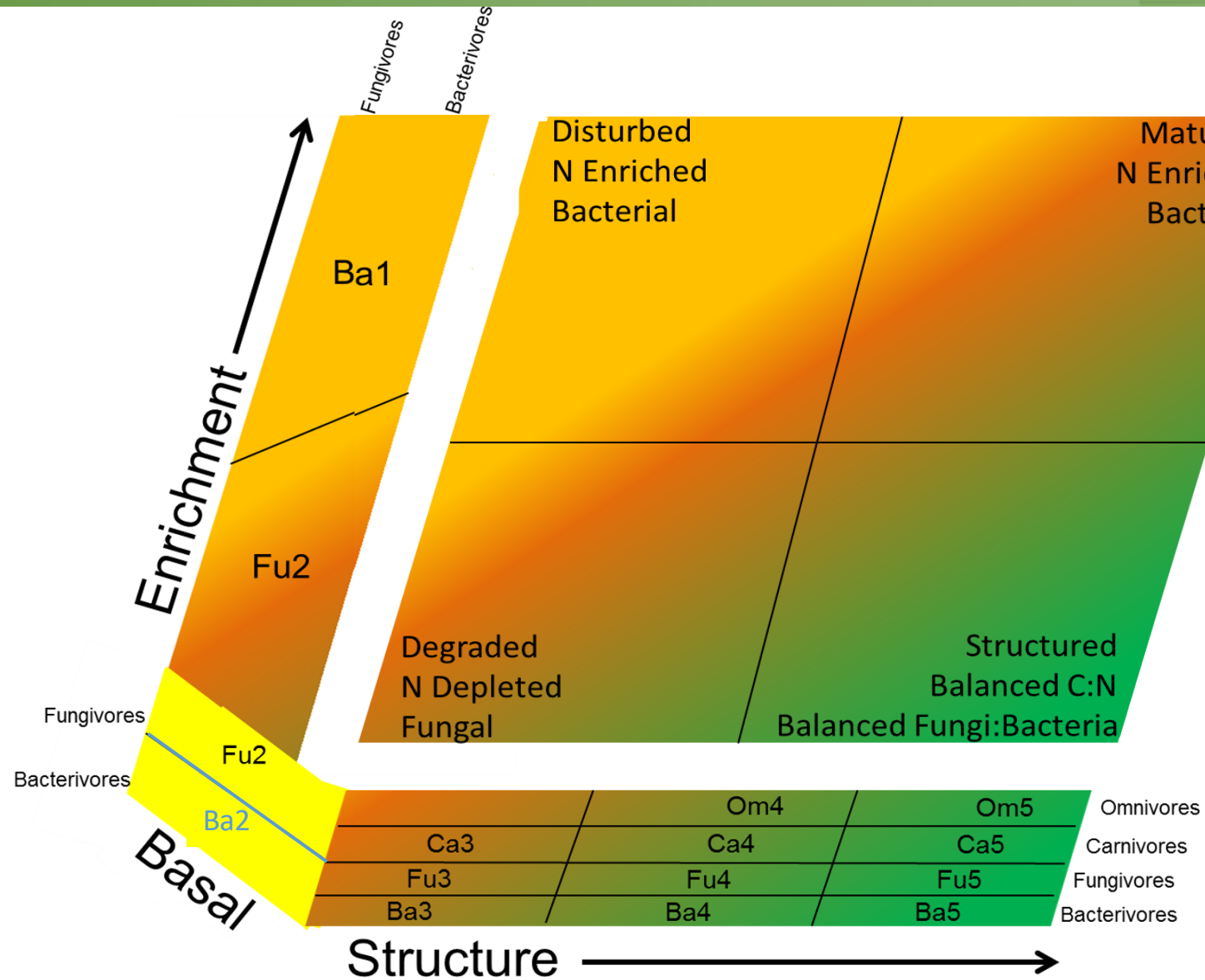
How can they be used?

- Amelioration treatments at depths and monitoring benefits post application

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- Amelioration treatments at depths and monitoring benefits post application

- Pesticide and Herbicide usage

Non-metric MDS

Transform: Square root
Resemblance: S17 Bray-Curtis similarity

2D Stress: 0.05

Type
- ■ Organic
- ▲ Partially Organic
- ▼ Not Organic

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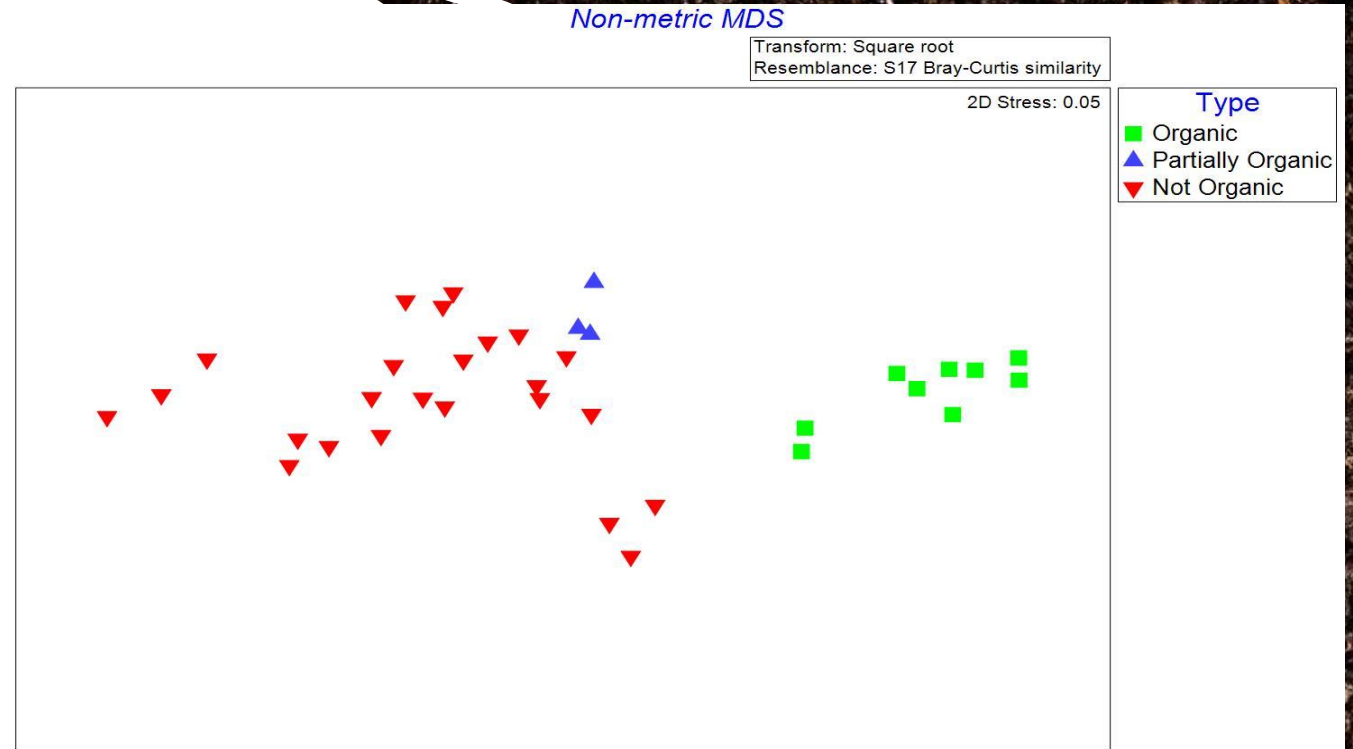
How can they be used?

- Amelioration treatments at depths and monitoring benefits post application

- Pesticide and Herbicide usage

- Types of OM additions/ soil amendments and incorporation and monitoring benefits post application

How can they be used?

- What is a "good" level will be context-specific
- We should not expect all soils to have a single 'optimal' community type

- To track how soil health changes across time, space, or in response to shifts in management practices

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PREDICTA Soil Health

Sample :

Paddock: Nearest Town:

Soil Type:

Grower: Region:

Paddock history	2 years ago	Last year
Crop/variety		

METRIC	RESULT		SOIL BIOLOGICAL HEALTH		
			High	Intermediate	Low
Soil Biological Health Index	xx				
Total FF	xx	kDNA copies/g sample			
Total BF	xx	kDNA copies/g sample			
BF:FF	xx				
Total FLN	xx	kDNA copies/g sample			
Total PPN	xx	nematodes/ g sample			
SI	xx				
EI	xx				

NEMATODE TEST		RESULT		POPULATION DENSITY			
				High	Intermediate	Low	Not Detected
Dorylaimida	Omnivore	xx	kDNA copies/g sample				
Mononchida	Predator	xx	kDNA copies/g sample				
Aphelenchidae	Fungivore	xx	kDNA copies/g sample				
Aphelenchoididae	Fungivore	xx	kDNA copies/g sample				
Cephalobidae	Bacterivore	xx	kDNA copies/g sample				
Mesorhabditidae	Bacterivore	xx	kDNA copies/g sample				
Rhabditidae	Bacterivore	xx	kDNA copies/g sample				
Panagrolaimidae	Bacterivore	xx	kDNA copies/g sample				
Tylenchidae	Plant associate	xx	kDNA copies/g sample				

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