From Aspiration to Implementation
“Building Hubble/James Webb for the Soil Universe”

BodemBreed – Themabijeenkomst Bodem en Data – 8 mei 2025

Bob Klein Lankhorst

HAL 24K AGRI

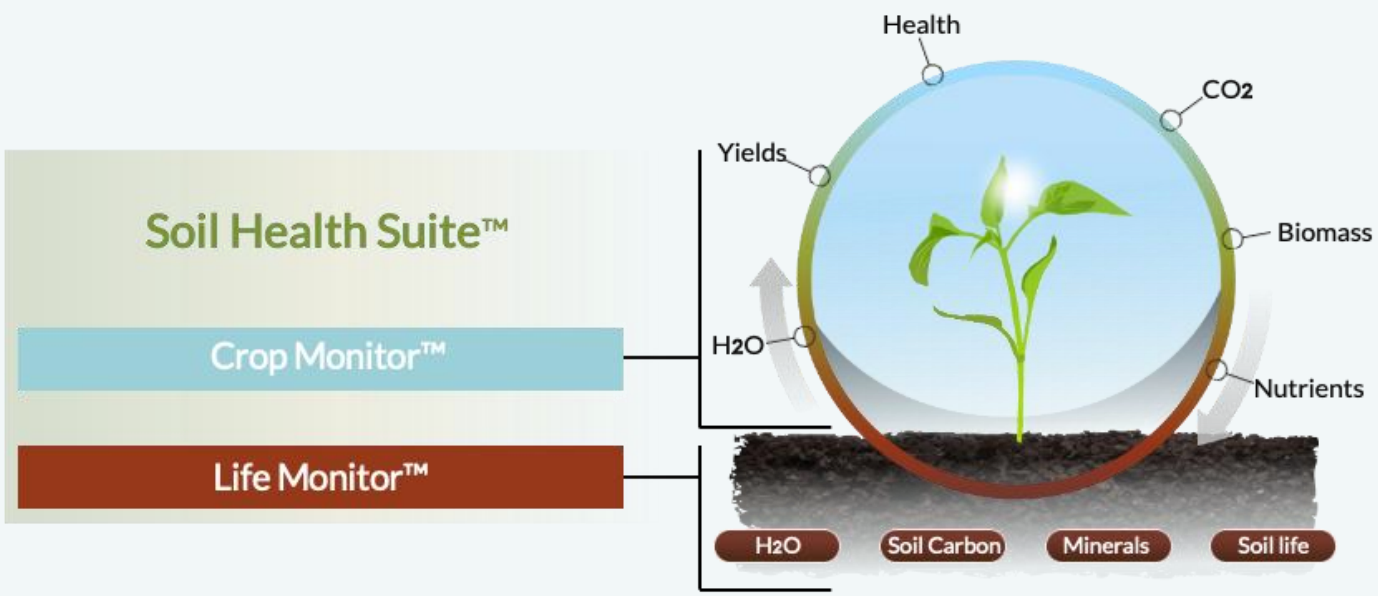
Bob Klein Lankhorst – Chief Soil Officer at HAL24K AGRI

Mission to establish the global standard for measuring functional biodiversity enabling better decisions for soil health, restoring biodiversity, and improving human well-being on Earth.

Co-Founder HAL24K Agri - Pioneering AI-driven soil intelligence, combining expertise in soil science, functional biodiversity, and ecosystem services to revolutionize soil health monitoring.

Setting a Global Standard – A member of several Standards Committees shaping new guidelines for soil health assessments

Introducing Soil Health Suite



Life Monitor

- A new technology to observe soil life enabled by Artificial Intelligence
- Measure and track functional soil biology
- Transform data to information and advice

Crop Monitor

- Monitor and manage crop growth enabled by Artificial Intelligence

Soil Health Suite

- Use unique combination of Life and Crop monitors
- Optimize Soil Asset Value
- Improve Human Health, Plant Growth, Climate, Water retention

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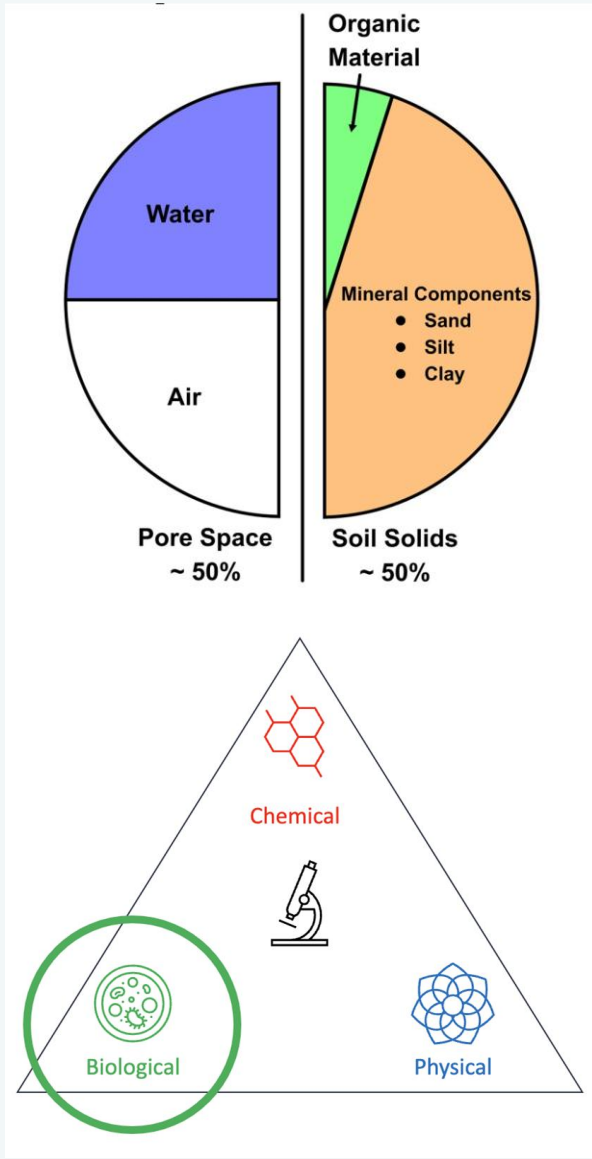
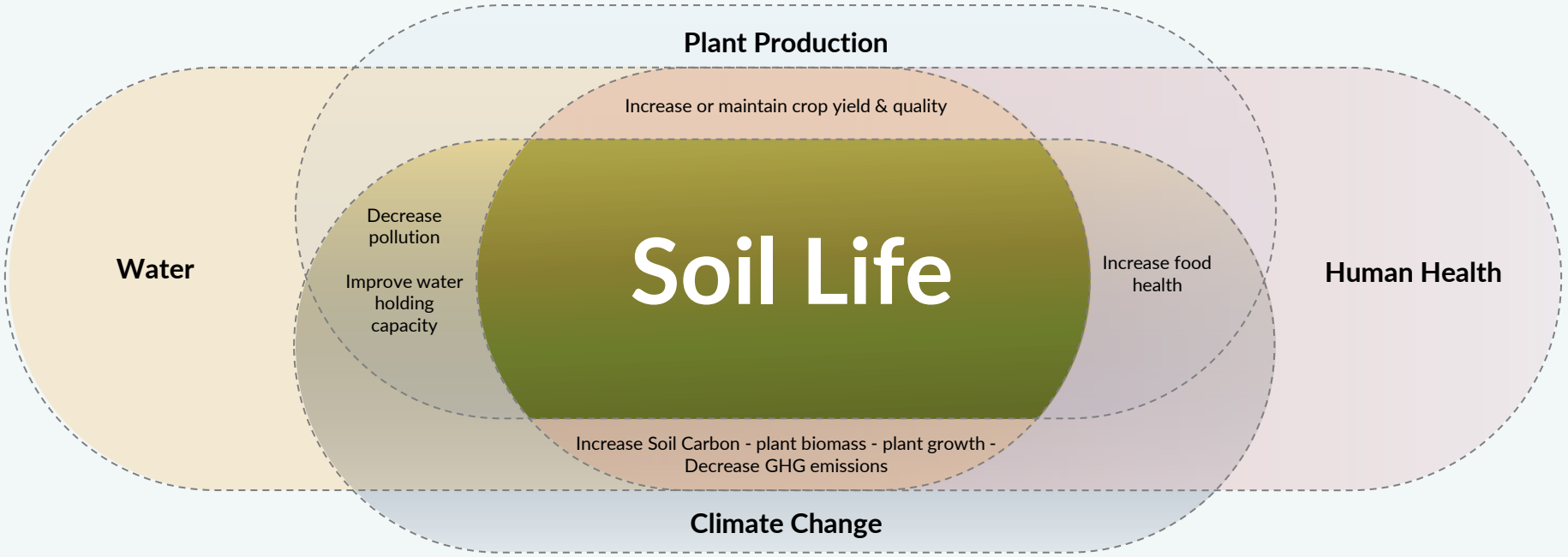
From Aspiration to Implementation “Building Hubble/James Webb for the Soil Universe”

Soil is a Complex Universe

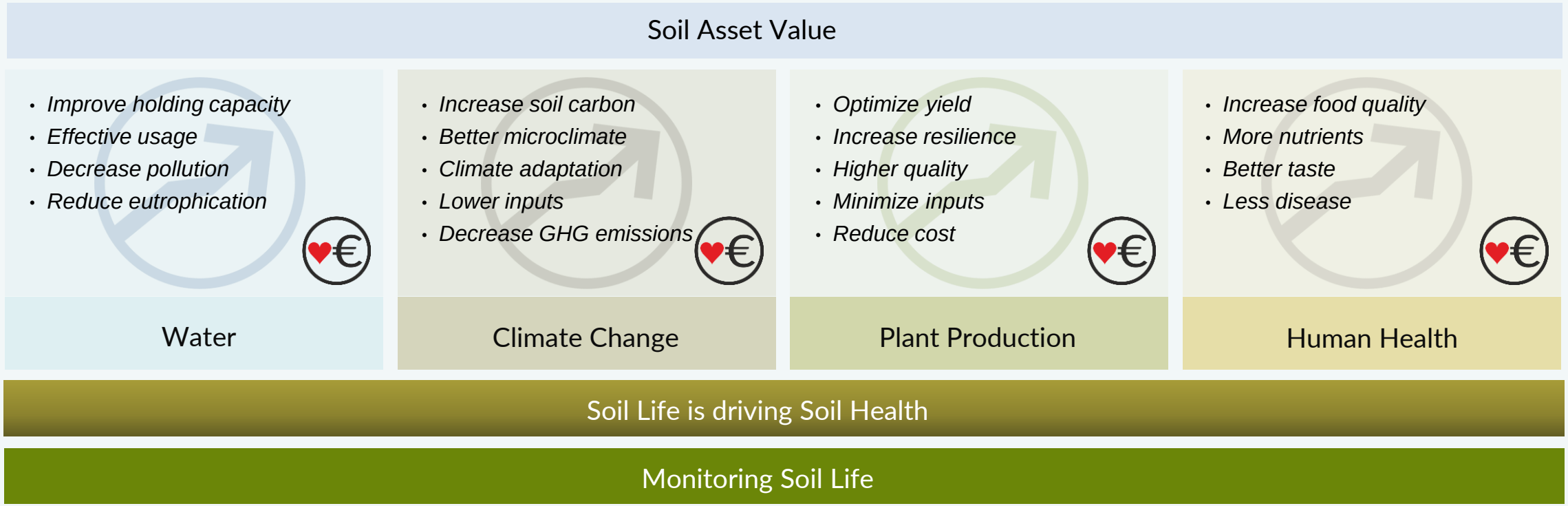
- **Bacteria:** Total weight of 5 cows per hectare!
- **Fungi:** 100,000 species known, there may be a million
- **Protists:** Thousands in a teaspoon of soil
- **Nematodes:** Most common animal on earth (±80%)



Soil Life is the Core of Our Ecosystem



Optimizing the total Asset Value of Soil



“To Make Sense of this Universe and to Value it, we Need to Observe it”

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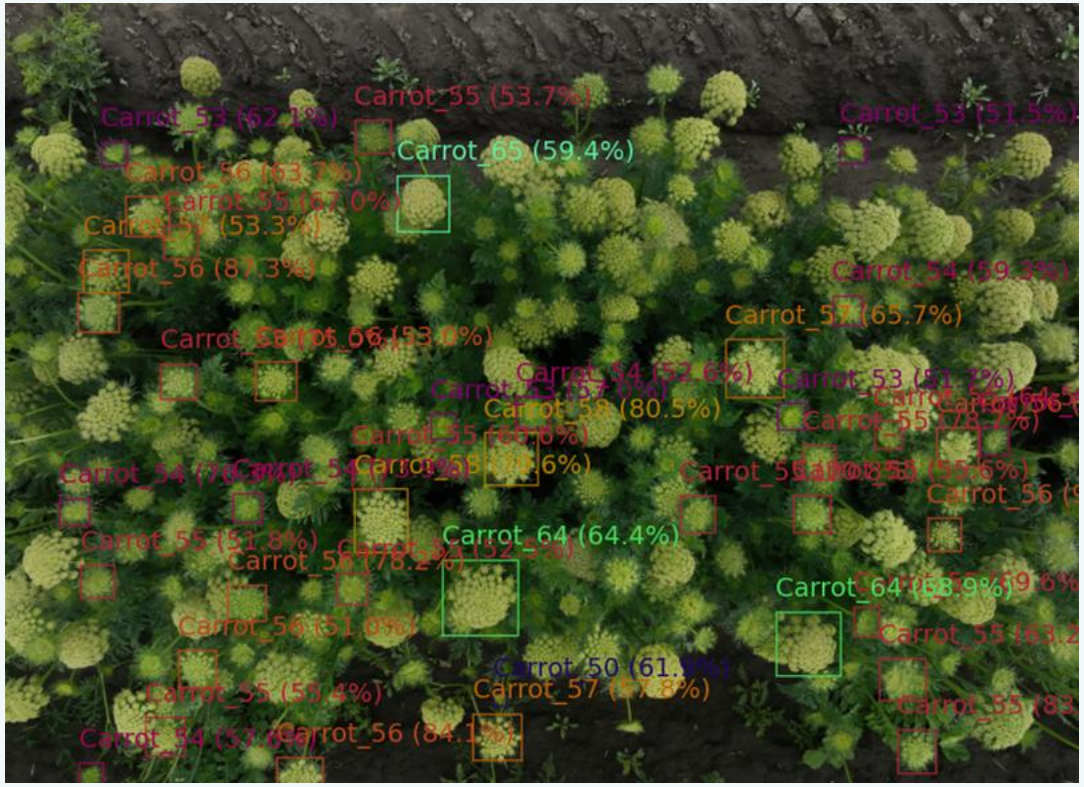
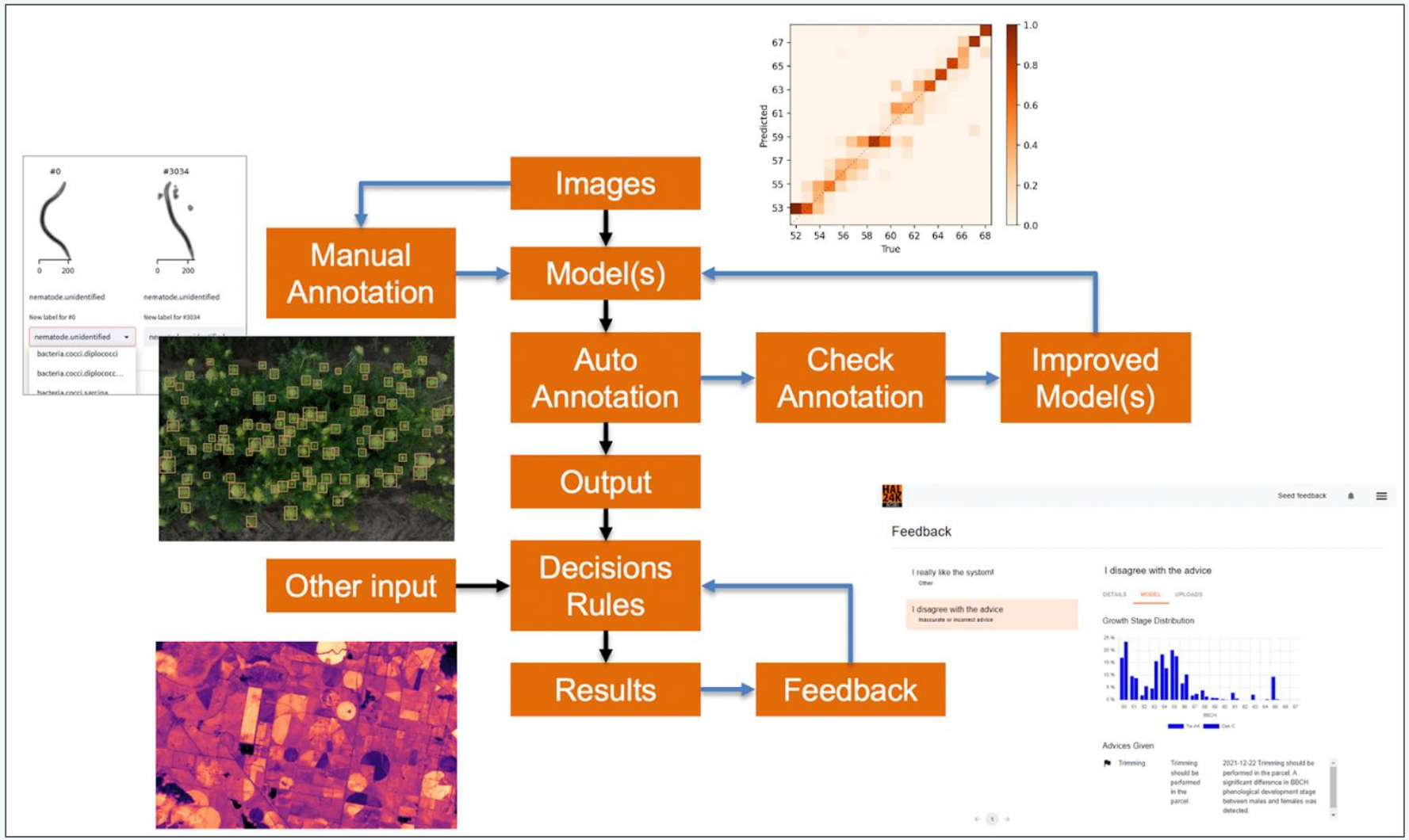
Computer Vision Aboveground has Proven to be a Useful Tool



From Images to Results



A New Era in Soil Life Measurement: Faster, Smarter, Deeper

Method	Lab	Field	Life Quality	Life Quantity	Life Activity	Expert independent	Cost
PLFA	✓			✓		✓	✓
DNA	✓		✓	✓			−
PCR	✓		✓	✓			✓
Microscopy	✓	✓	✓	✓	✓		✗
Life	✓	✓	✓	✓	✓	✓	✓

Life can take up to **1 million times** the amount of data compared to traditional microscopy in direct counting methods

- Functional biodiversity finally measurable and trackable
- Unique hardware + unique software
- System gets better, more-inclusive and faster over lifetime
- 6 orders of magnitude amount of soil measured than the traditional soil food web analysis with microscopy

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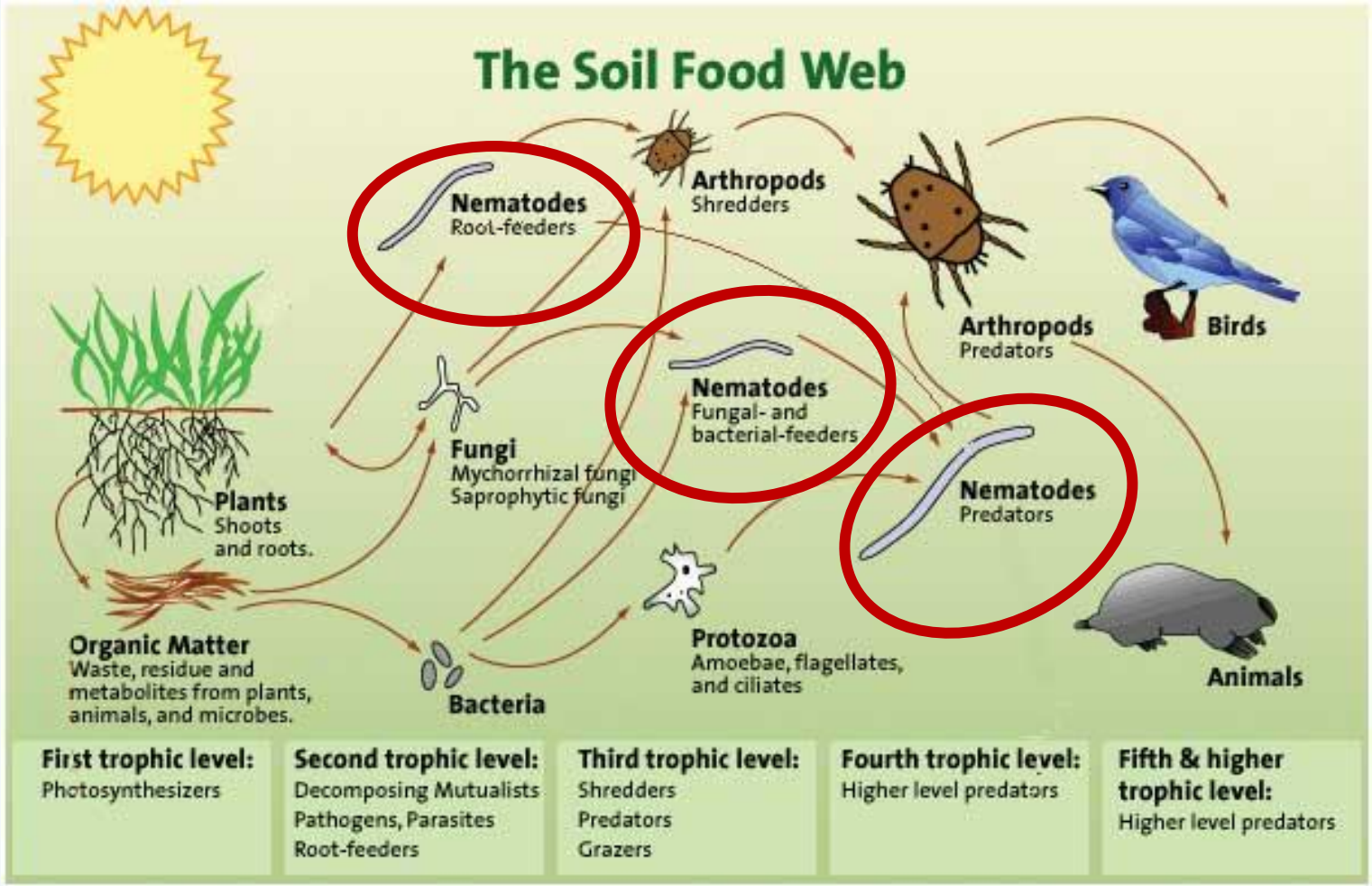
Where to start: Nematodes First!



±80% of all animals are nematodes!

Ten Reasons to Measure Nematodes

1. Nematodes are among the simplest multicellular soil organisms found in any soil type, under all climatic conditions and in habitats ranging from pristine to very polluted.
2. Nematodes are by far the most numerous group of multicellular organisms in the soil.
3. In the soil, nematodes live in capillary water and have direct contact with their environment.
4. They do not migrate quickly from stressful conditions and many species survive desiccation, frostbite or oxygen stress.
5. The structure of the communities is an indication of the circumstances in the soil they inhabit.
6. Nematodes occupy key positions in soil food webs. They feed on most soil organisms and are food for many others.
7. There is a clear connection between structure and function.
8. Nematodes respond quickly to disturbance and enrichment.
9. Nematodes are easy to sample and relatively easy to analyse.
10. Advisory tools based on nematodes well studied in academia.

Live everywhere

Very numerous

Key players in soil-food web

Hardly migrate

Respond to changes in environment

Directly indicate soil circumstances

Easy to analyse

Very well studied

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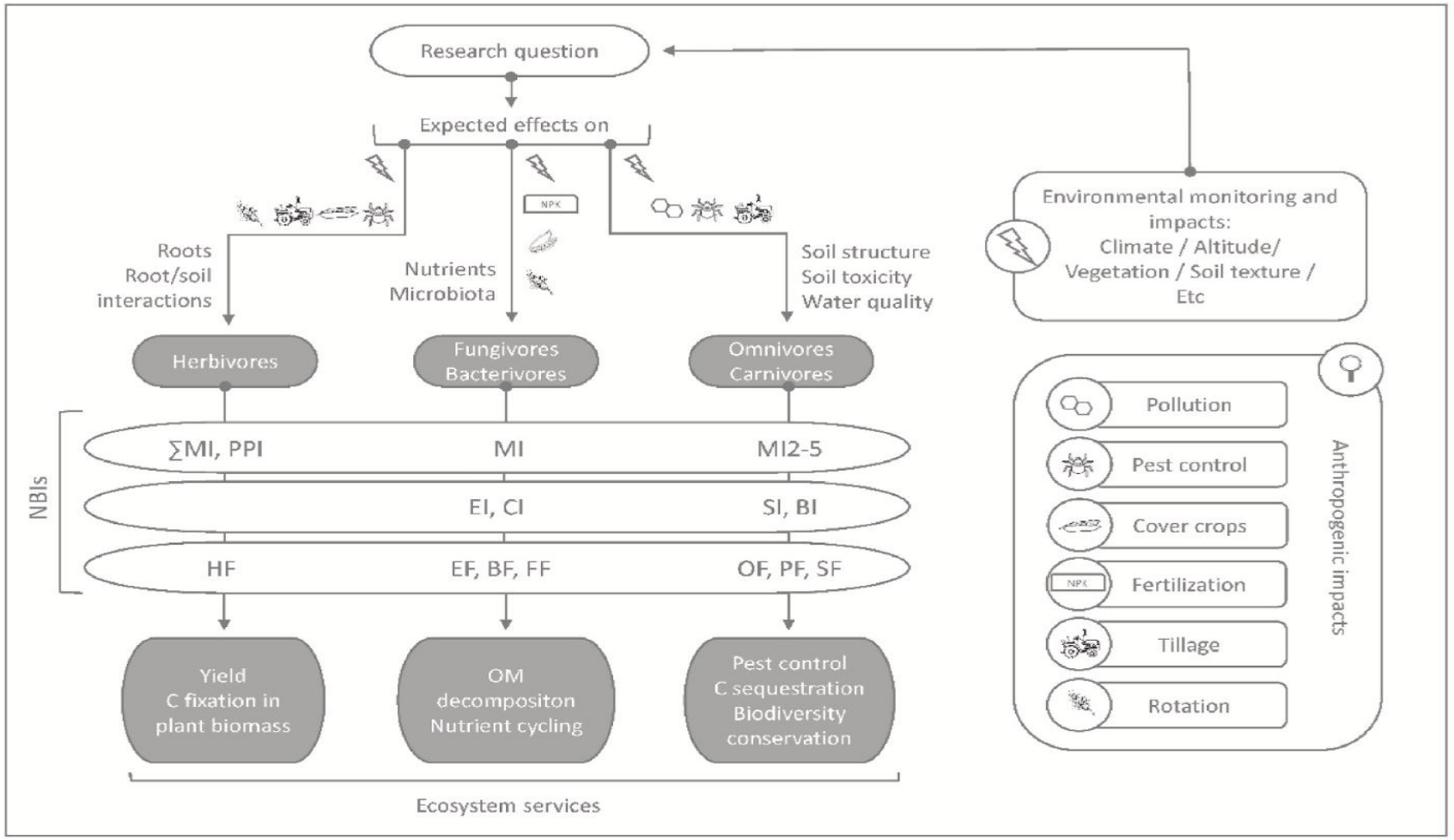
Nematode Based Indices (NBIs) – Insights in Soil Status



Examples of NBIs

- Maturity Index
- Maturity Index 2—5
- Plant Parasitic Index
- Enrichment Index
- Channel Index
- Basal Index
- Structure Index
- Metabolic Footprints

Source: Du Preez et al., (2022). Nematode-based indices in soil ecology: Application, utility, and future directions.

How NBIs Help You Make Smarter Soil Decisions

🔍 Early warning system

Detects soil stress, compaction, proneness to disease, or degradation.

🌱 Ecosystem function insight

Reveals nutrient cycling, pest pressure, and microbial activity.

🎯 Targeted management

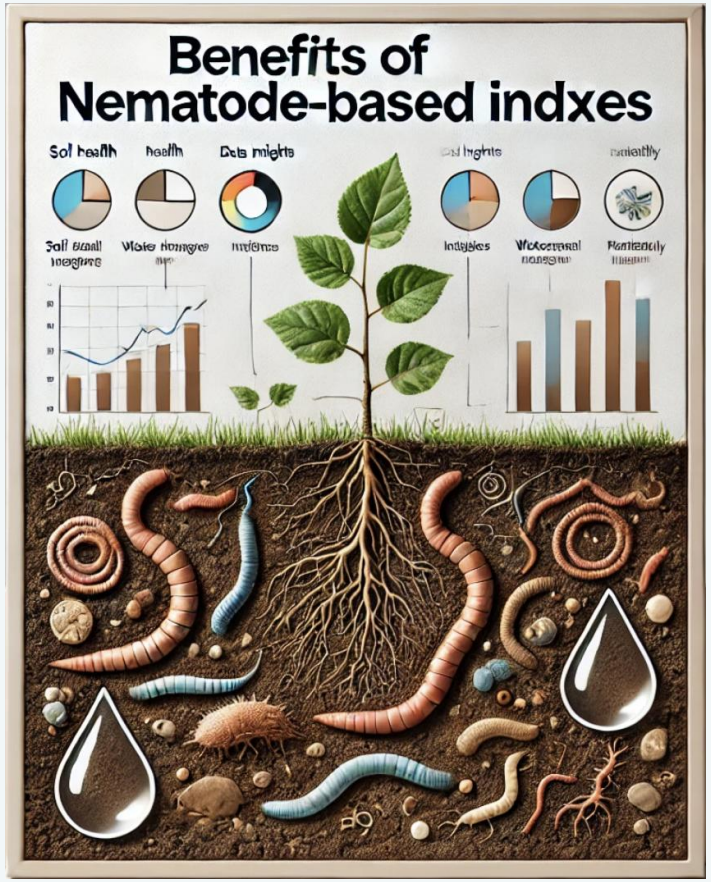
Helps farmers adjust inputs like fertilizer, compost, or biological control with more precision.

📊 Standardized and scalable

Offers a reliable metric for comparing soil health across time, fields, and regions.

🔄 Tracks improvement

Measures the biological impact of soil regeneration practices and amendments over time.



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How does it work?

Run soil sample → Analyse soil content (AI) → Extract Nematodes (AI) → Identify Nematodes (AI) → Calculate NBIs → Soil & Farm management advice

Field to Lab (current) in the future possibly also Lab to Field

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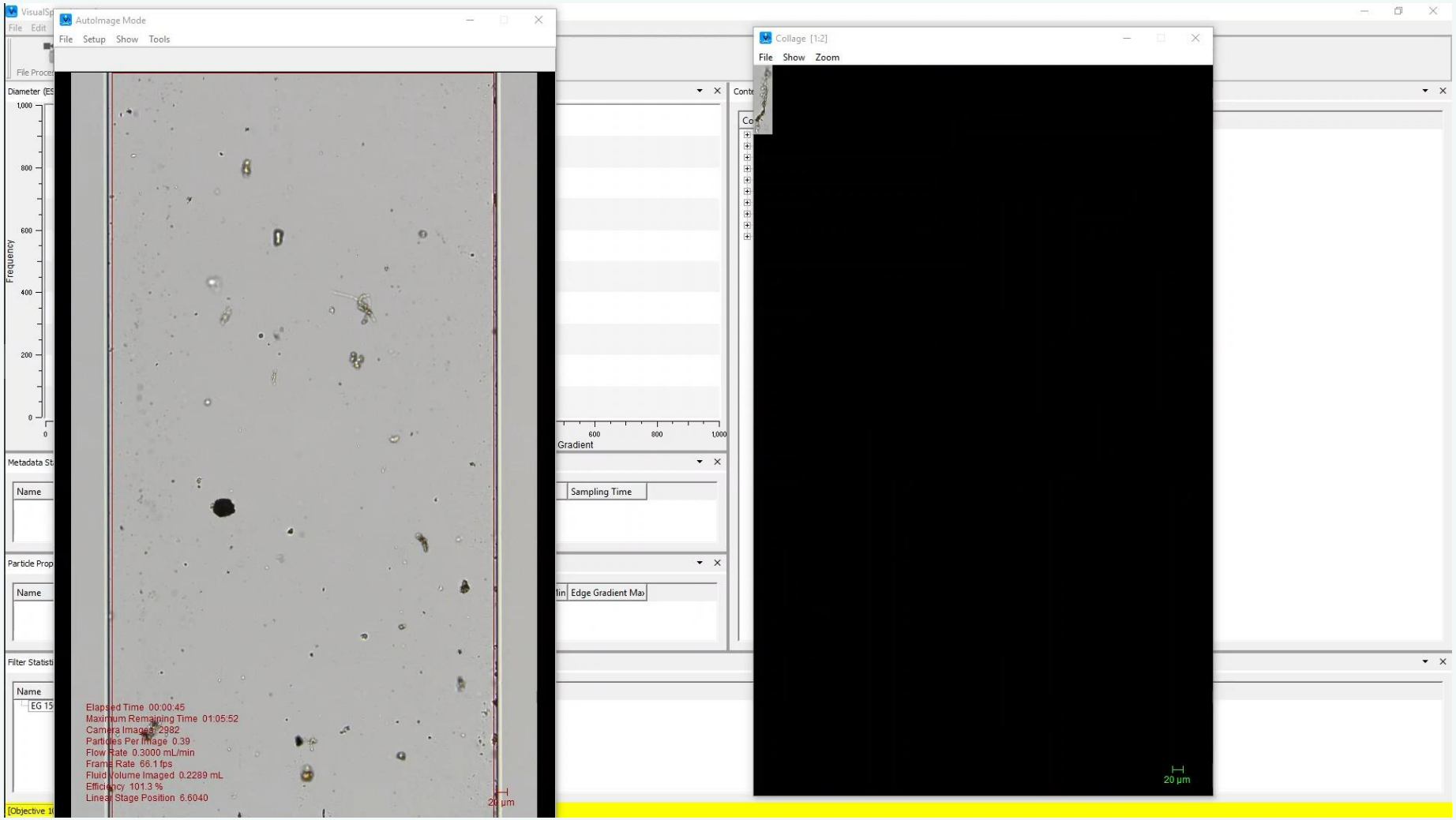
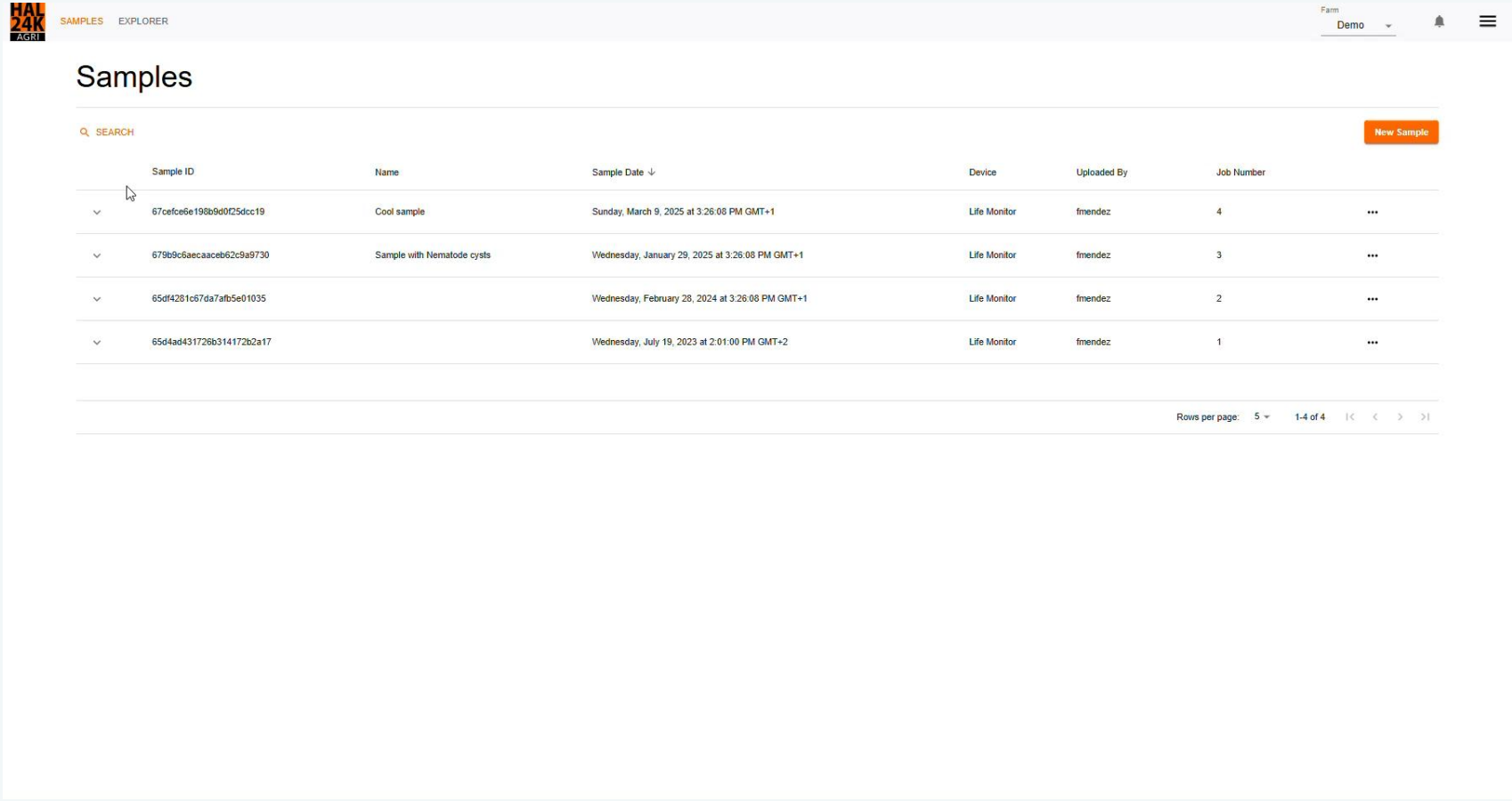
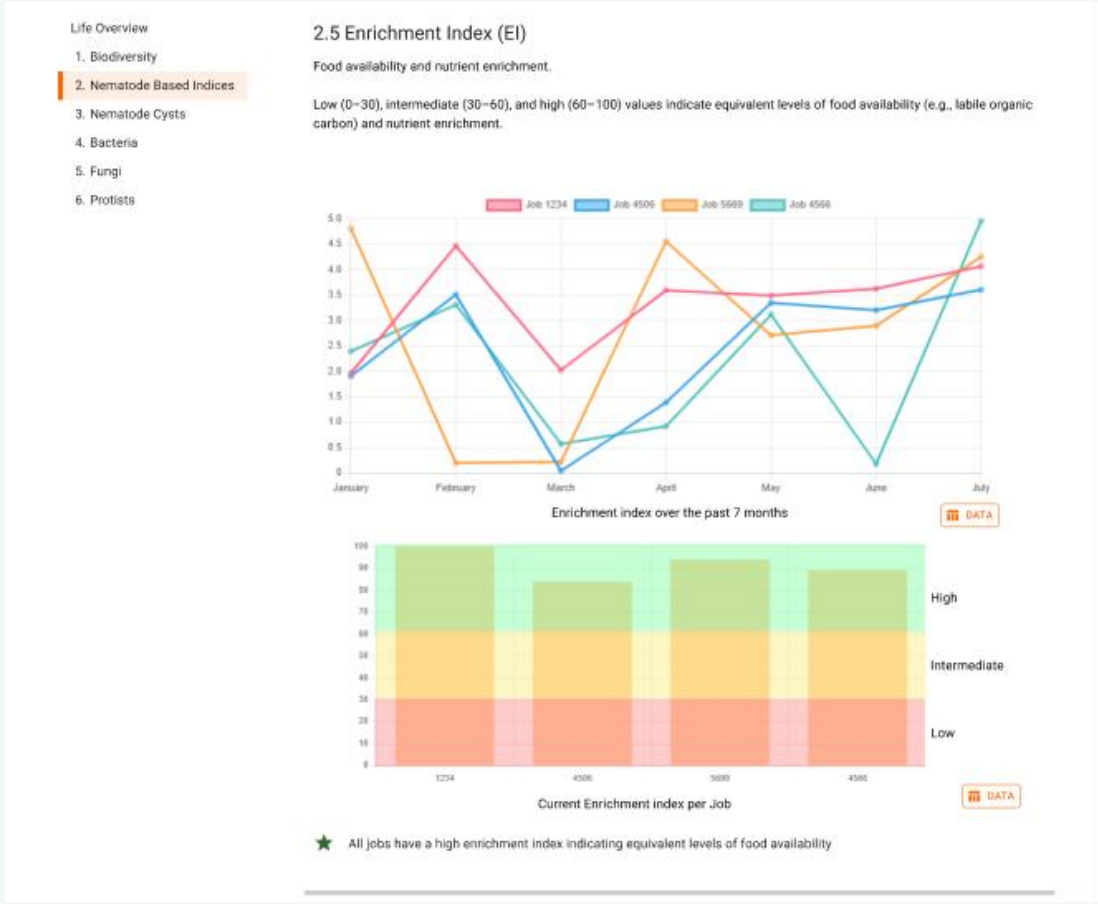
LIFE Monitor

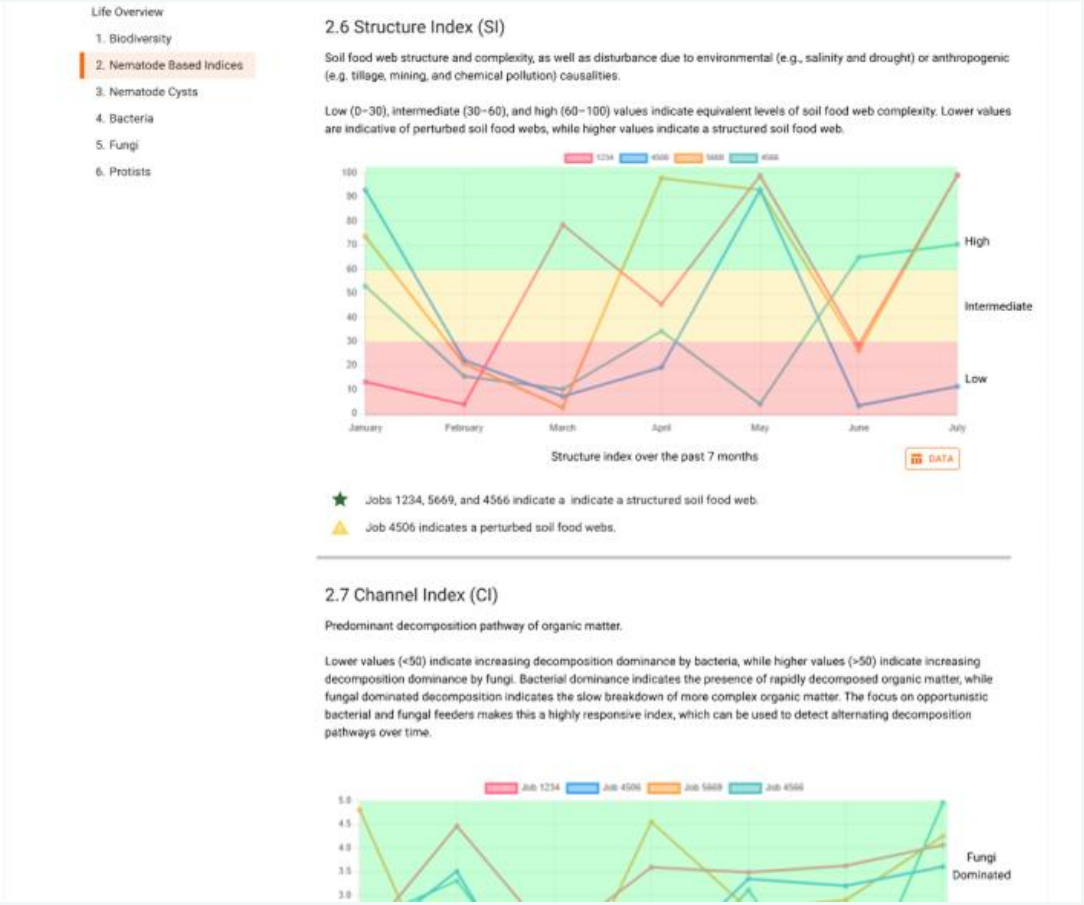


Platform Demo – Sample view



Detailed insights to Assess and Value Soil





We now have the tools to paint the full picture

Open Journal of Soil Science > Vol.10 No.12, December 2020

Check for updates

Soil Nematodes as Indicators of Heavy Metal Pollution: A Meta-Analysis

Camille Chauvin[1], Manon Trambolho[1], Mickael Hedde[2], David Makowski[3], Hélène Cérémonie[1], Anne Jimenez[1], Cécile Villenave[1*]

[1]ELISOL environnement, Congénies, France.

[2]INRAE, UMR Eco & Sols, Montpellier, France.

[3]INRAE, UMR Agronomie, Thiverval-Grignon, France.

DOI: 10.4236/ojss.2020.1012028 **PDF** **HTML** **XML** **1.259** Downloads **4.240** Views Citations

RIVM *De zorg voor morgen* begint vandaag

Onderwerpen Over RIVM Publicaties Internationaal Contact Agenda

Home › Publicaties › Nematodengemeenschappen als potentieel diagnostisch instrument voor chemische verontreinigingen

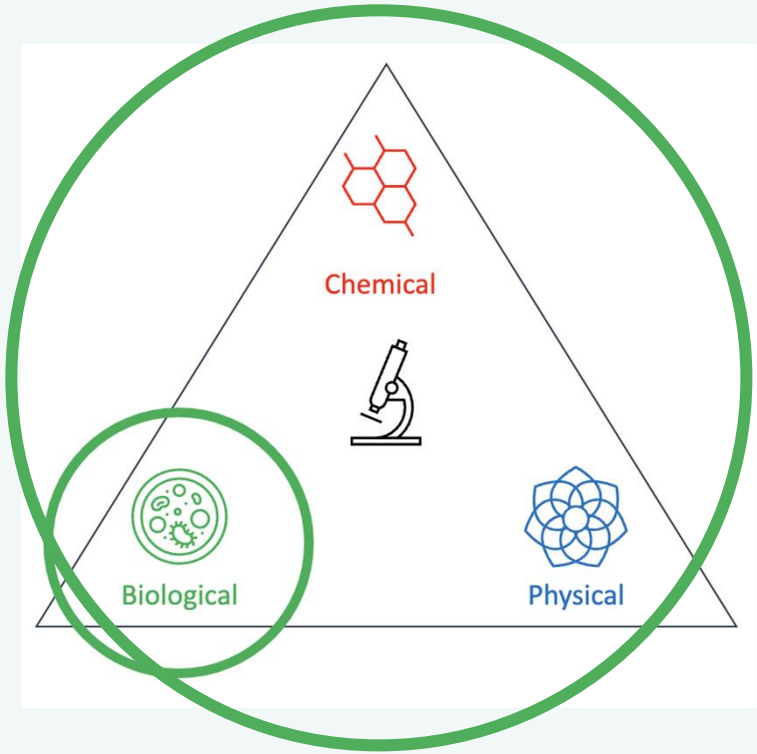
Nematodengemeenschappen als potentieel diagnostisch instrument voor chemische verontreinigingen

Publicatiedatum 11/02/1992

Auteurs

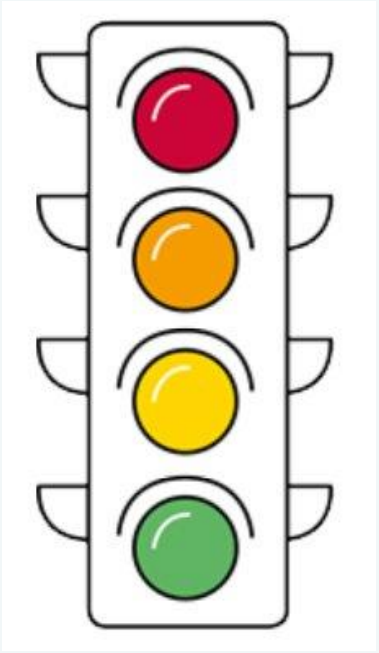
Nematode-based indices in soil ecology: Application, utility, and future directions

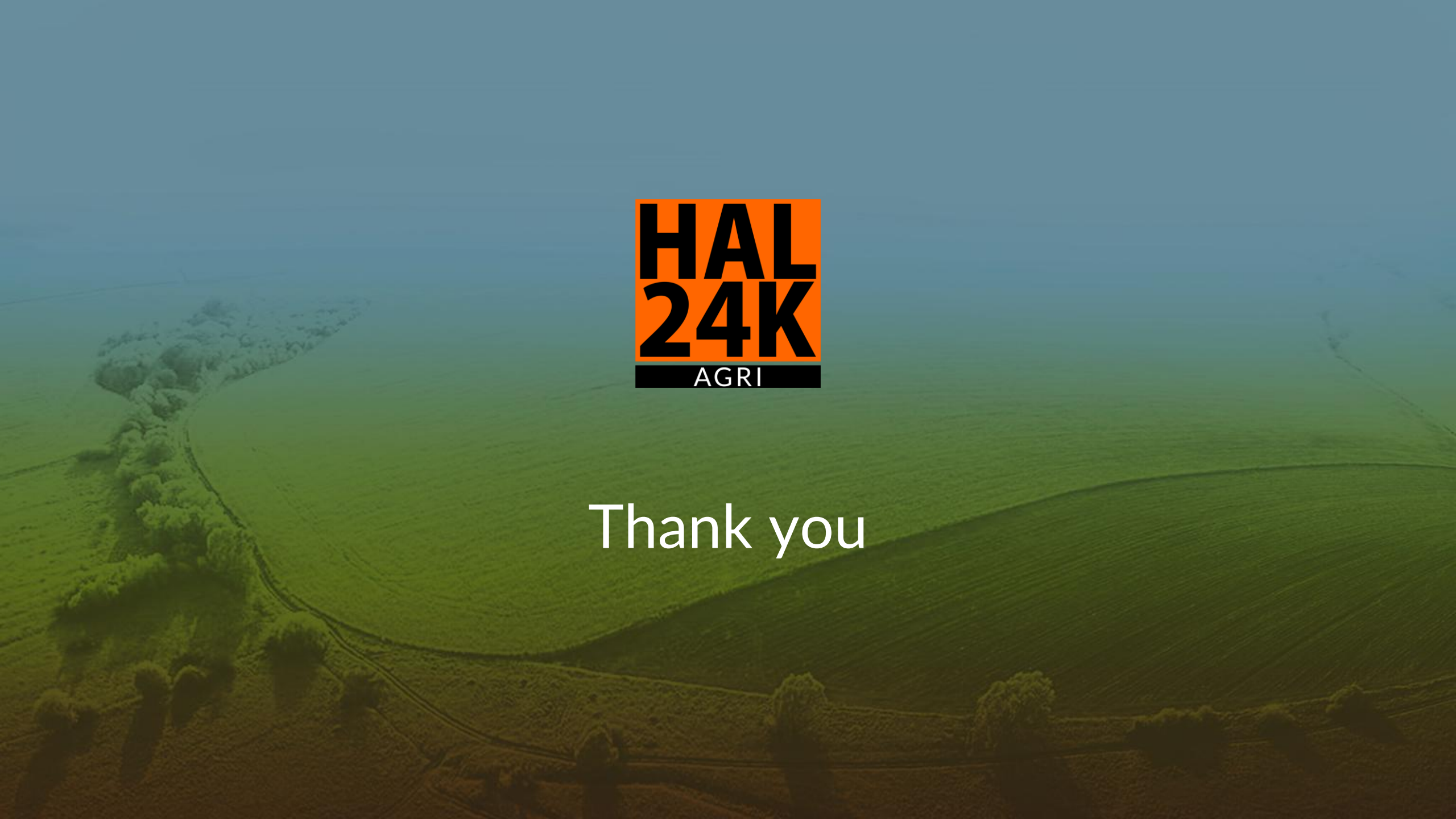
Gerhard Du Preez [a], Mieke Daneel [b], Ron De Goede [c], Marié Joey Du Toit [a], Howard Ferris [d], Hendrika Fourie [a], Stefan Geisen [e], Thomais Kakouli-Duarte [f], Gerard Korthals [g], Sara Sánchez-Moreno [h], Jan Henrik Schmidt [i]



New way of gauging soil quality or soil health

- **Legislation based on chemistry**
- **Soil life more resilient than previously thought**
- **Illogical laws**
- **Soil life as agricultural guide**
- **Soil life for remediation purposes**
- **Soil life as an environmental proxy**
- **Soil life as a proxy for polluting elements**
- **Soil life as a "policy advisor"**





Thank you

METK Centre of Estonian Rural Research and Knowledge

Implementation - Project Overview

SoilProS - The Netherlands Organisation for Scientific Research

Regenerative Agriculture - Dutch National Growth Fund

SHAPE - Soil Health Check and Practices

Soil Valley - Soil Health & Agroecology Living Lab

Linking to HE & Soil Mission - e.g. SOLO, PREPSOIL, BioMonitor4CAP

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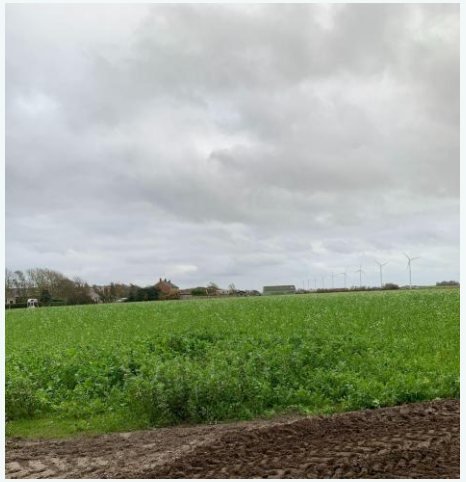
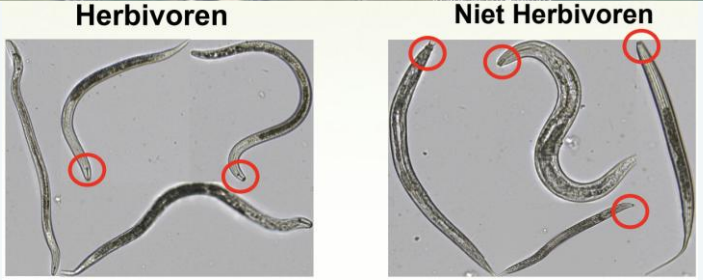
Use Case Examples
LIFE Monitor™
Huiberts Biologische Bloembollen

LIFE Monitor - Parasitic Pressure and Green Manures

- 4 fields - 2 strategies
- The efficacy of inundation as anti-parasitic strategy
- The (possible) benefits of growing a green manure crop
- Expected outcome: detailed information on: 1) the efficacy of inundation as anti-parasitic strategy; 2) the benefits of green manure

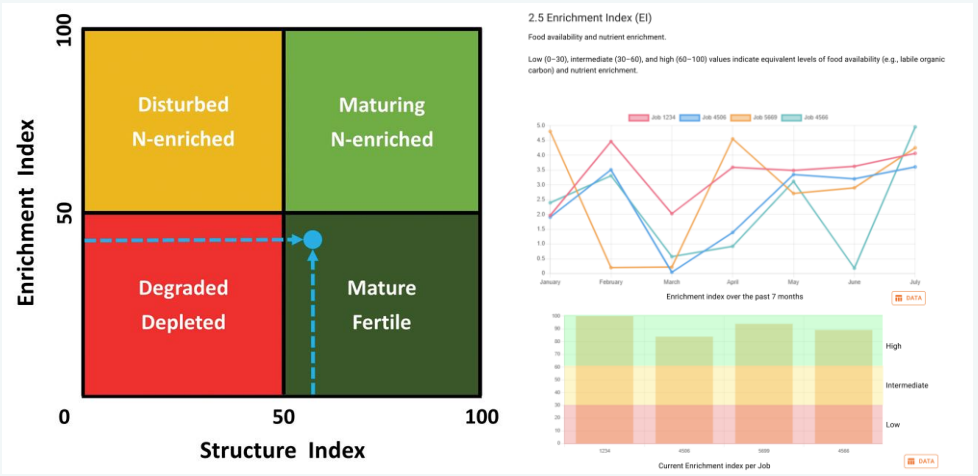




Use Case Examples
LIFE Monitor™
Agrifirm

LIFE Monitor - Nitrogen Efficiencies

- Nitrogen efficiencies - 4 intensity steps
- Nitrogen steps in relation to practical fertilization
- Not fertilized towards fully fertilized
- To what extent does the Plant activate the Microbiome?
- Follow the different intensity steps through time
- Expected outcome: detailed information on nitrogen efficiencies in relation to plant-soil life interactions



Use Case Examples
LIFE Monitor™
Gebroeders Ham

LIFE Monitor - Conventional & Regenerative Practices

- 4 fields with different farming approaches
- Field 1: Conventional
- Field 2: Conventional to Regenerative
- Field 3: Regenerative (3 years)
- Field 4: CSA Vegetable garden
- Expected outcome: detailed information soil life pattern evolution, food quality and yields

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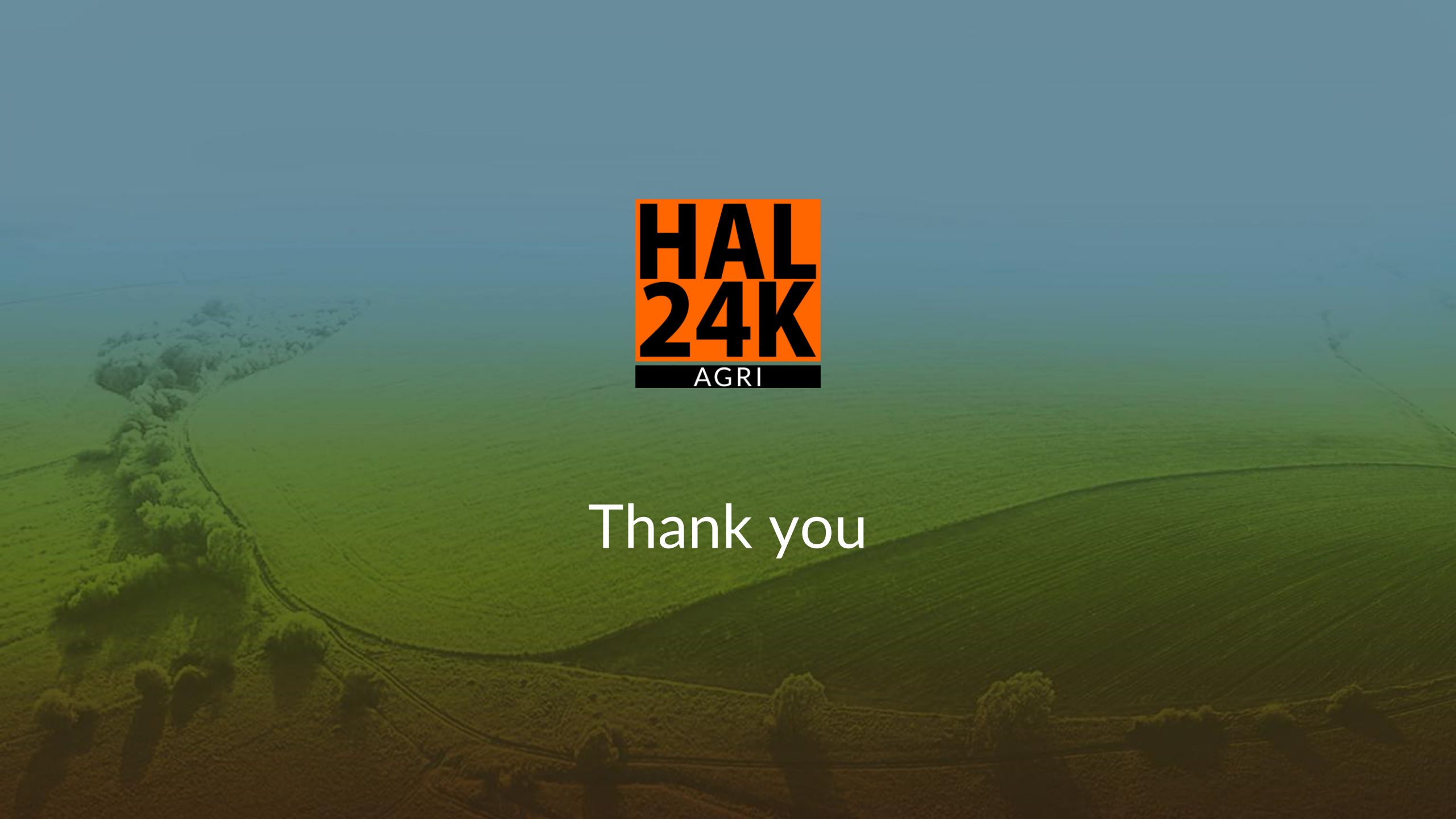

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