PHYTOBIOMES ALLIANCE

# Harnessing Phytobiomes for Sustainable Agricultural Productivity

25 October 2023

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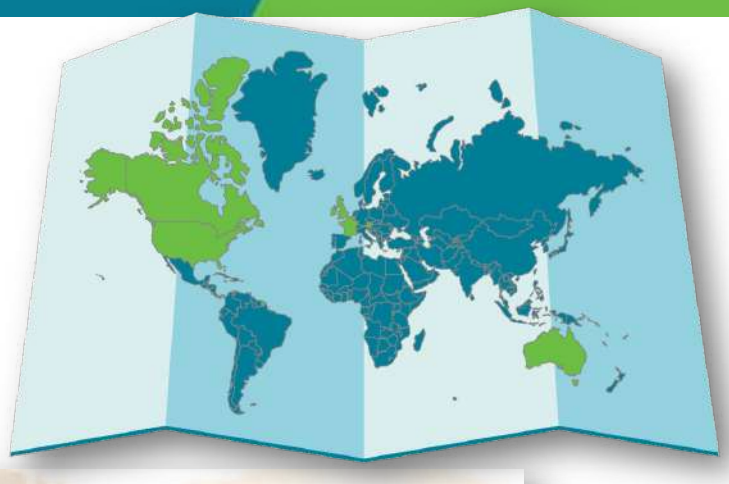
Project Manager

**Partnership in Biocontrol, Biostimulant & Microbiome Congress: Raleigh, NC, USA**

# International Alliance for Phytobiomes Research



- Nonprofit, precompetitive research consortium
- Industry, academia, and government
- Paradigm shift in agricultural research & production

**Vision:** By 2050, all farmers have the ability to use predictive and prescriptive analytics based on geophysical and biological conditions for determining the best combination of crops, management practices, and inputs for a specific site in any given year.

**Strategy:** Identify gaps in research, tools, and technologies and develop projects to address them.

# Moving From Simple to Complex

## Traditional Science Approach

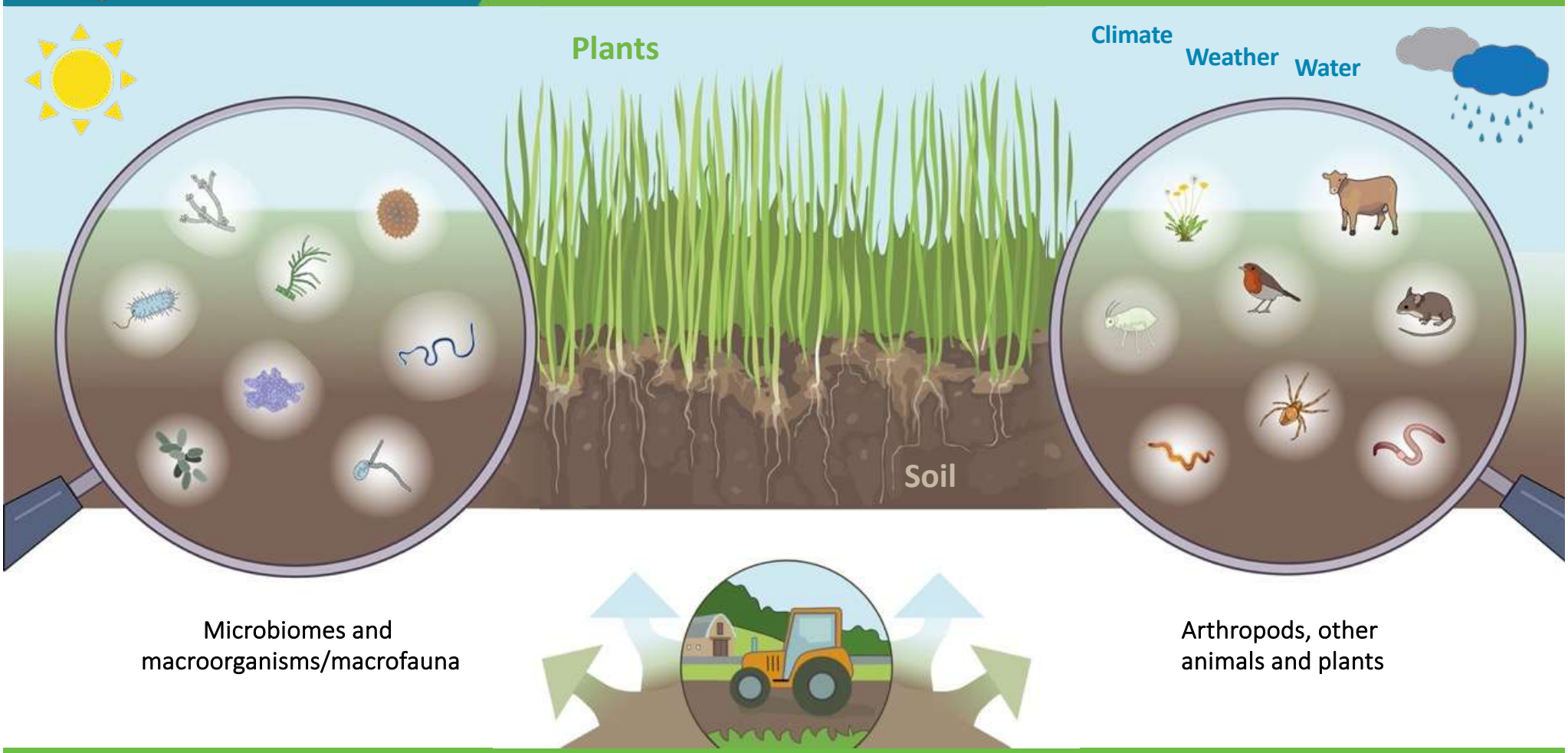
- Linear
- Reductionist
- Can be understood by focusing on individual components
  (Soils, Plant genetics, Microbiomes, or Weather)

## Agriculture is a Complex System

- Non-linear
- Multiple interactions and variables
- Adapts via learning or evolution
- Can be influenced

**Paradigm shift to a complex systems approach**

# Phytobiomes: Complex Systems of Plant-based Agriculture




All influenced by management practices

# Examples of Phytobiomes





# Controlled Environment Phytobiomes

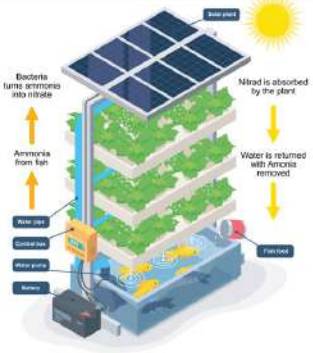
Greenhouse Farming

Vertical Farming

Hydroponic

Container Farming


Aquaponic



# Holy Grail for Phytobiomics

**To understand, predict, and control emergent phenotypes within specific phytobiomes for the sustainable production of food, feed, and fiber.**

# Phytobiomes Alliance - Why Now?

Technological advances in

## Probing & understanding biological components

- Genome enabled technologies

## Computational science

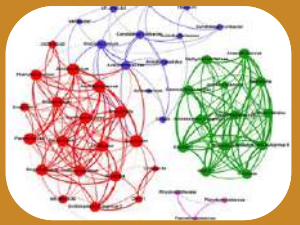
- Machine learning
- Quantum computing
- Deep learning

## Precision crop management systems

- Variable rate technology
- Unmanned Aerial Systems
- Soil, plant & weather sensors
- Robots

## Systems science

- Network analysis



**Convergence of need & opportunity**

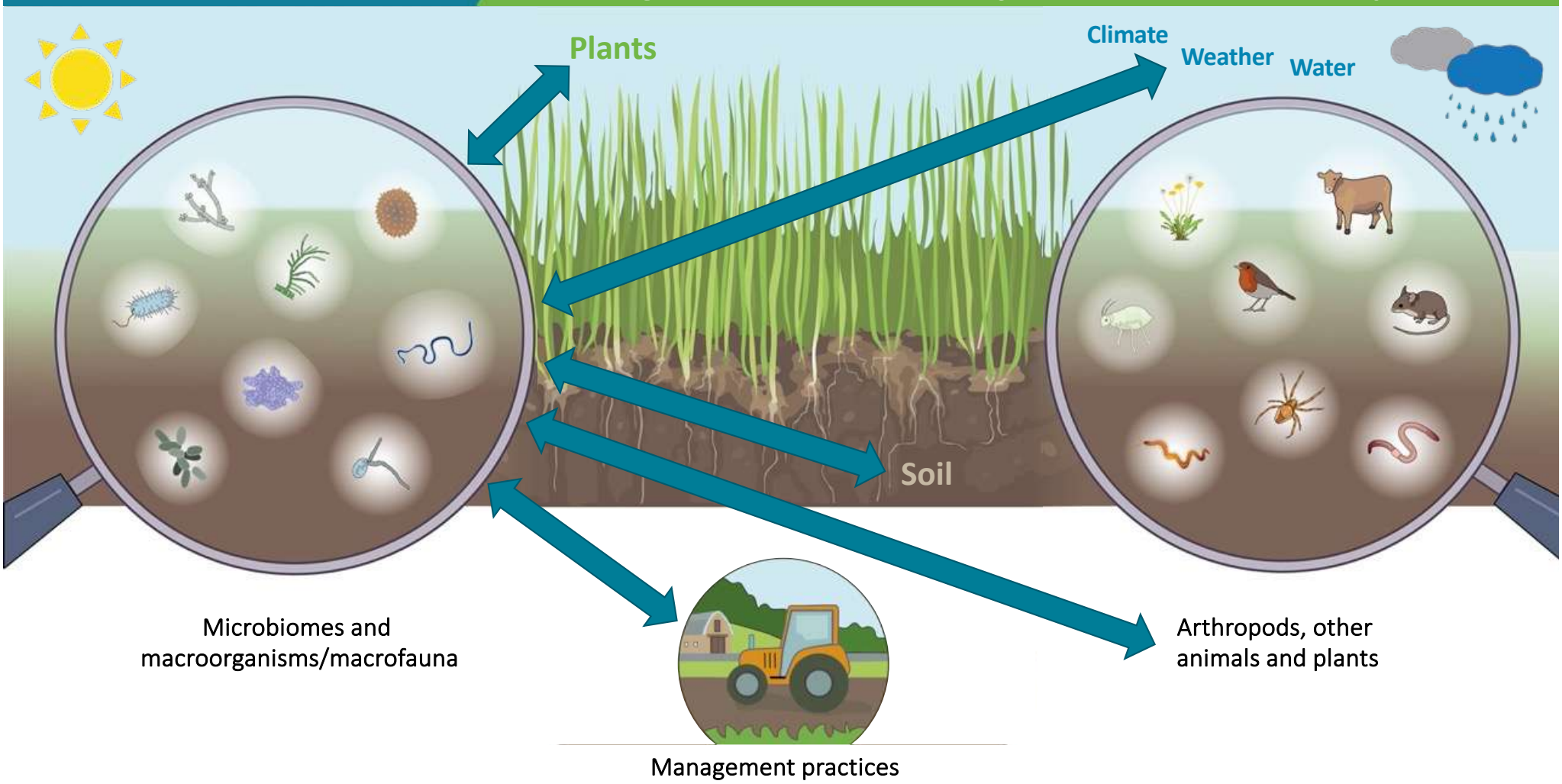
# Phytobiomes Strategy for Agriculture






| | | | | | |
|---|---|---|---|---|---|
| Optimal sustainability and productivity | Adaptive, data-driven, on-farm systems | Rapid site-specific diagnostic tools | Prescriptive crop management techniques | Resilient crops | Optimized soil health |

# **Phytobiomes:** Major Research Gaps



# Research Priorities

- Microbiome-knowledge generation
- Standards and protocols
- Regulatory framework
- Data generation & management
- Multi-disciplinary capacity building
- Precision/digital Ag integration

# Major Efforts Underway

- Projects that Link Components Within the Entire Phytobiomes Network
- Sequence-based Classification System for Microbes
- Microbiome Standards – International Microbiome & Multi'omics Standards Alliance
- Facilitate Regulatory Compliance
- Coordination of Microbial Collections and Networks: Public & Private
- Establish Linkages with Human and Animal Health & Nutrition

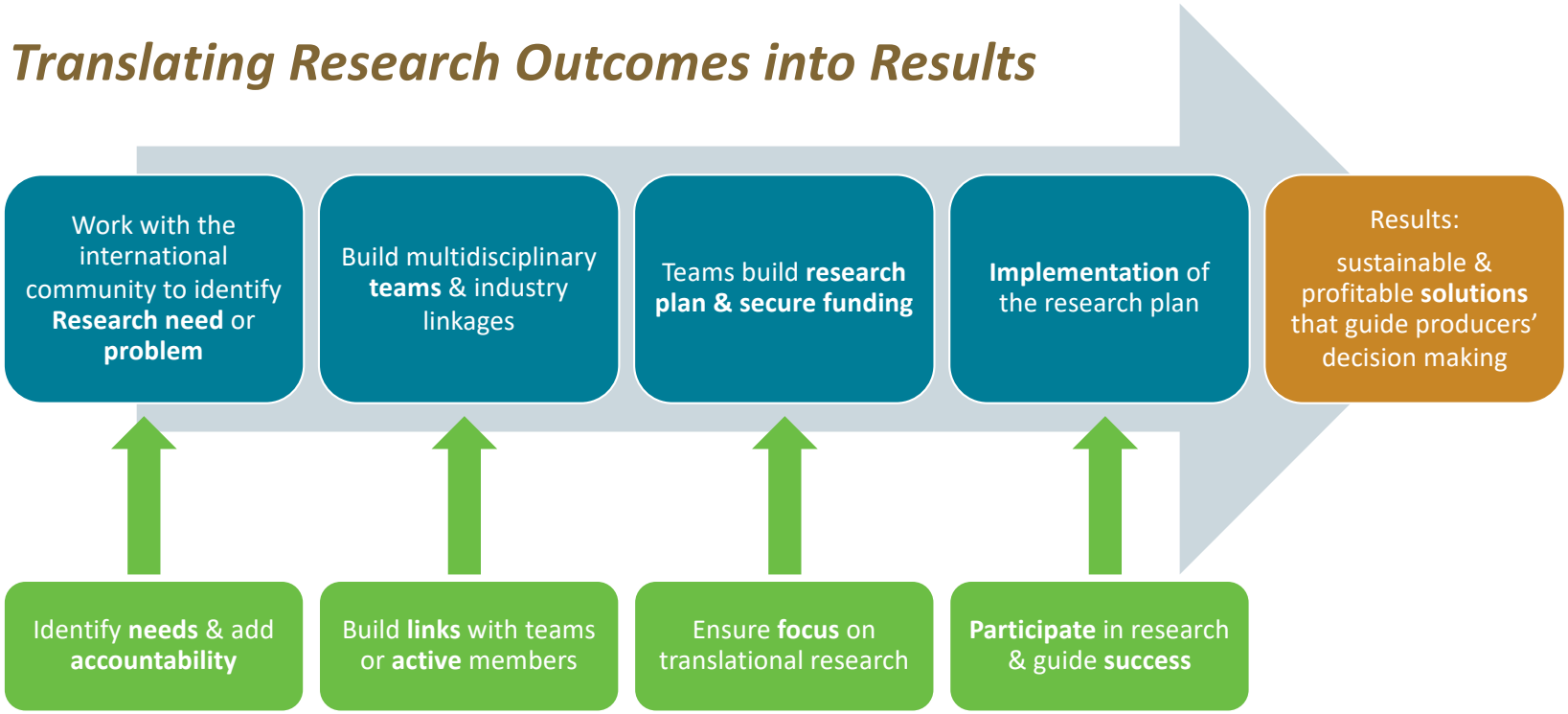
# Phytobiomes Alliance Working Groups

Lead and coordinate efforts on specific topics

- **Soil Health (currently being organized)**
- **Microbiomes**
- **Regulatory**
- **Animal Microbiomes**
- **Controlled Environment Agriculture**

# The Alliance in Action

## *Translating Research Outcomes into Results*




## Industry Sponsor Participation

# Examples of Alliance Project Involvement

## Alliance Led/Principal Investigator

- **Sequence-based Classification System for Microbes**
  - Assist industry to get products through the regulatory system
- **U.S. Culture Collections Network**
  - Identifying all living microbial collections; building & coordinating network

## Alliance Facilitated/Academic and Industry linkages

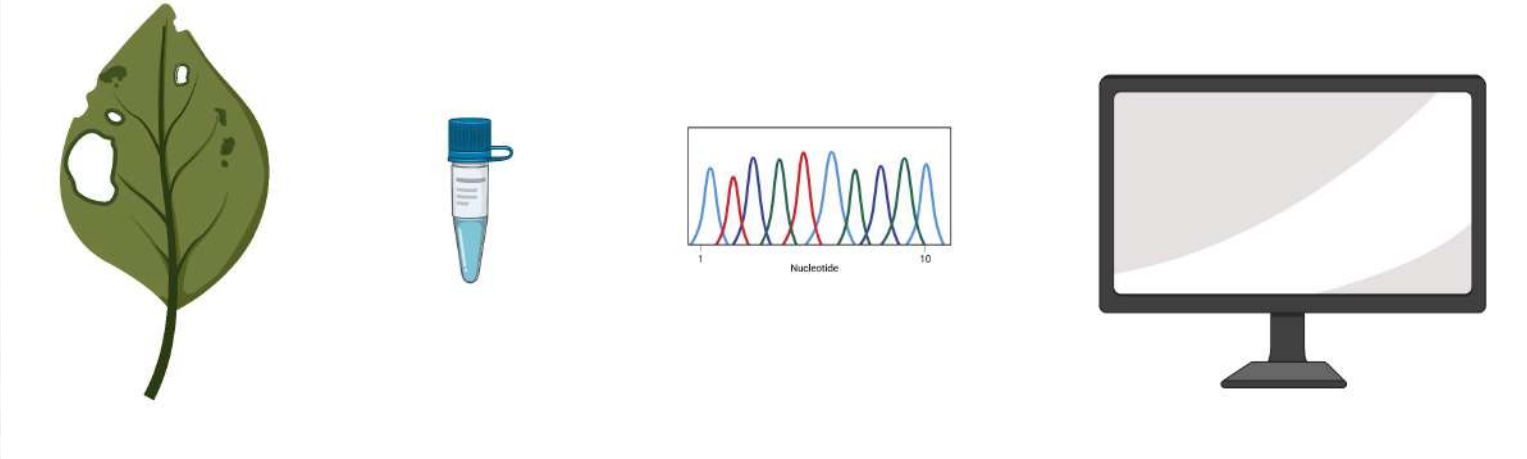
- **Development of Synthetic Microbial Communities** (UK-US)
- **Novel microbiome technologies to increase profitability for Australian horticulture** - Hort Innovation (AUS)

## Alliance Supported

- **The UK Crop Microbiome Cryobank** (UK)
- **MASTER** – Microbiome Applications for Sustainable food systems through Technologies and EnteRprise (EU)

# Project: Sequenced Based Classification of Microbes

Plant pathogen identification of the future




Extract + sequence + computer programs + databases + AI + network

hours … maybe minutes?

Identification + characterization + outbreak investigation
for any and all pathogens everywhere

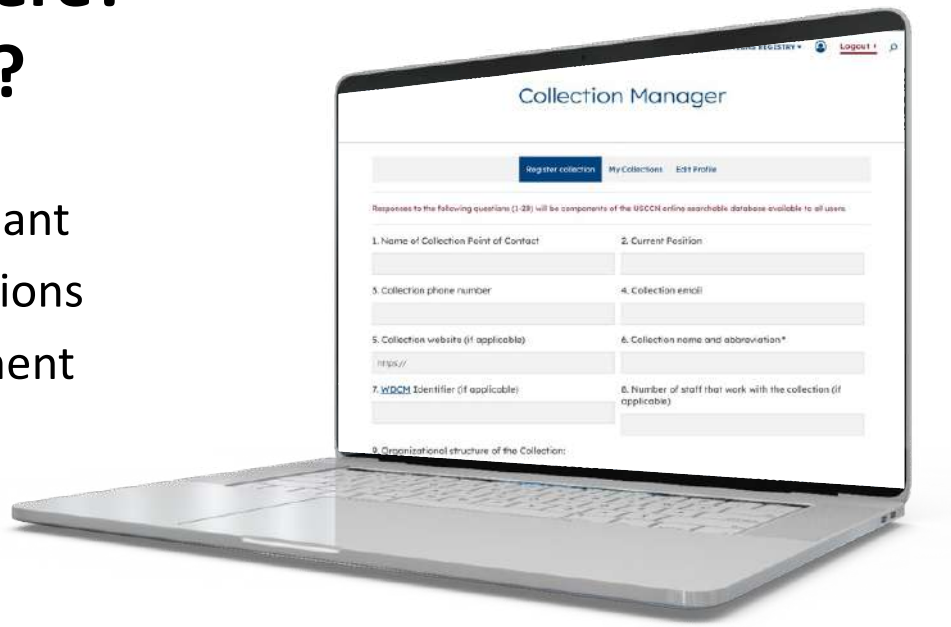
Source: Boris Vinatzer

made with biorender.com

# Project: U.S. Culture Collections Network

## Census of Microbes: What is available & where? Genome Sequences?

Building a searchable database of plant associated, microbial culture collections from industry, universities, government agencies




UNITED STATES CULTURE COLLECTION NETWORK

usccn.org/culture-collections

# Get Involved

## International Conferences

Create opportunity to incubate ideas

- Biannual Conferences, in Europe or U.S.
- Participants: public & private scientists, agricultural producers…
- Broad cross-section of disciplines: Microbiomes, Sustainability, Soils, Plants, Rhizosphere, Engineering, Imaging, Modeling, Regulatory, Agronomy, Biologicals, Climate/Weather...

## Workshops

Deep dive for specific research areas

- In conjunction with International Conferences in 2023 -
  - Exploring Phytobiomes (PAG, San Diego, CA, USA)
  - Uniqueness & Commonalities Between Plant, Soil, and Animal Microbiomes (PAG, San Diego, CA, USA)
  - One Health, Phytobiomes and Animal Science (BSAS, Birmingham, UK)
  - Phytobiomes Research for Plant Health (ICPP, Lyon, FR)
  - Harnessing Culture Collections for Improved Plant Health (ICPP, Lyon, FR)

## Webinars

Share knowledge of new results & projects

- 6 to 8 per year on broad selection of topics
- Large international attendance

# Coordinating Committee Member Affiliations

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# Thank you for listening

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