Embracing Complexity: Building an International Phytobiomes Alliance

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AgBioData Community Workshop
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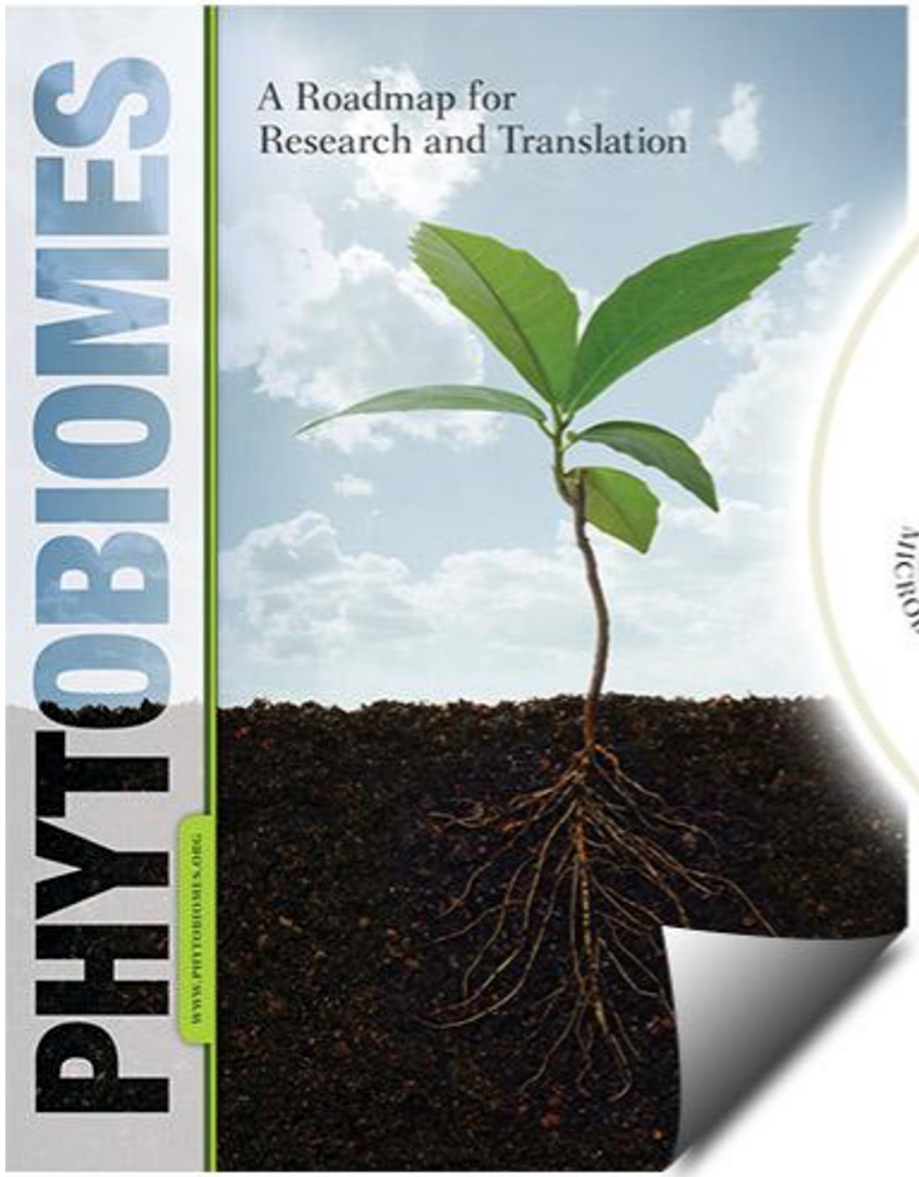
Phytobiomes Roadmap: A New Vision for Agriculture

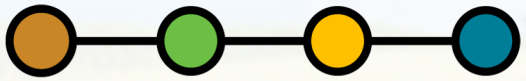


Maximize sustainable food, feed, and fiber production through the knowledge of Phytobiomes.

Phytobiomes: A Roadmap for Research and translation, 2016. St. Paul, MN: American Phytopathological Society, pp. 15

Phytobiomes are Complex

Traditional Science Approach



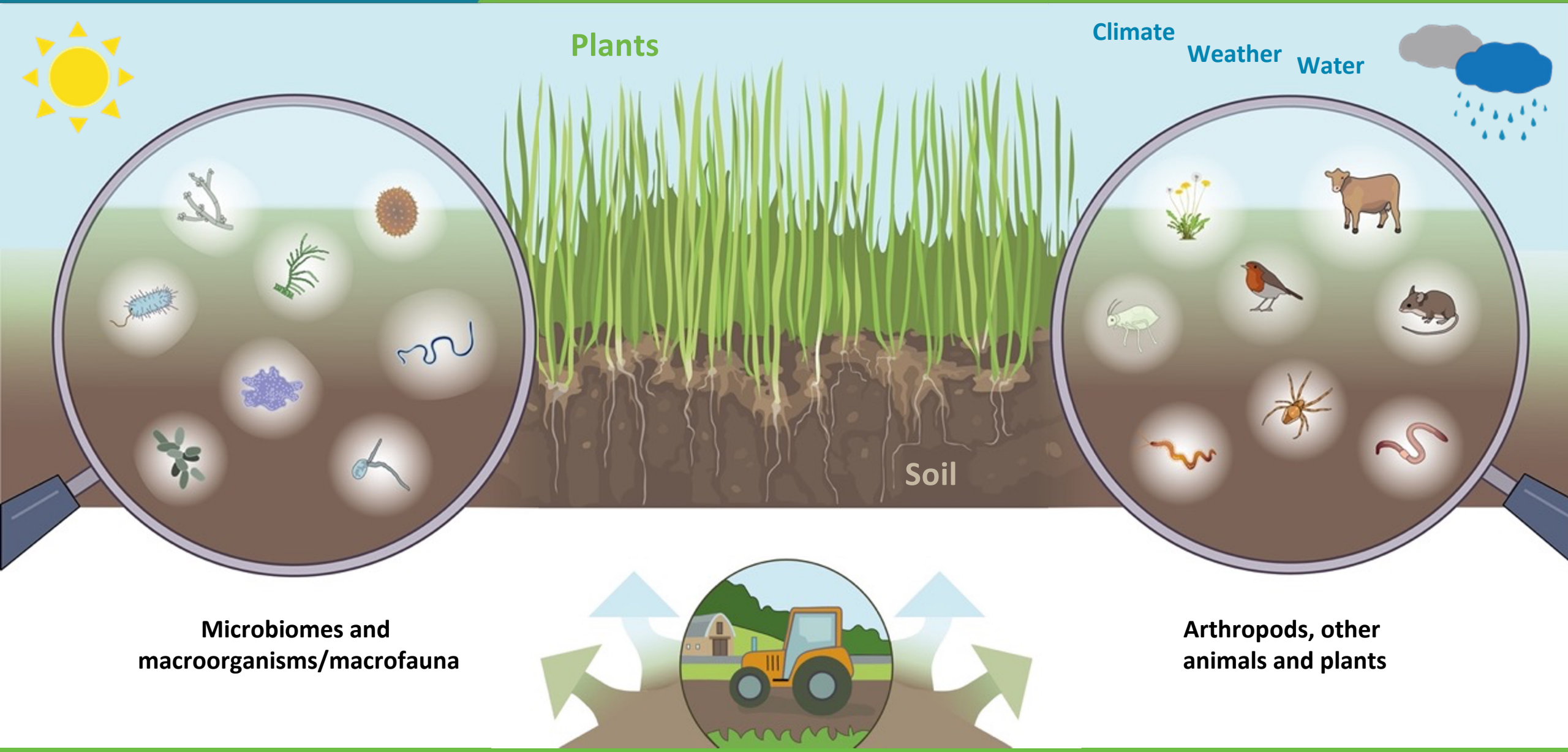
- Linear
- Reductionist
- Focus on individual components
  (Soils, Plant genetics, Microbiomes, or Weather)

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



Microbiomes and macroorganisms/macrofauna

Arthropods, other animals and plants

All influenced by management practices

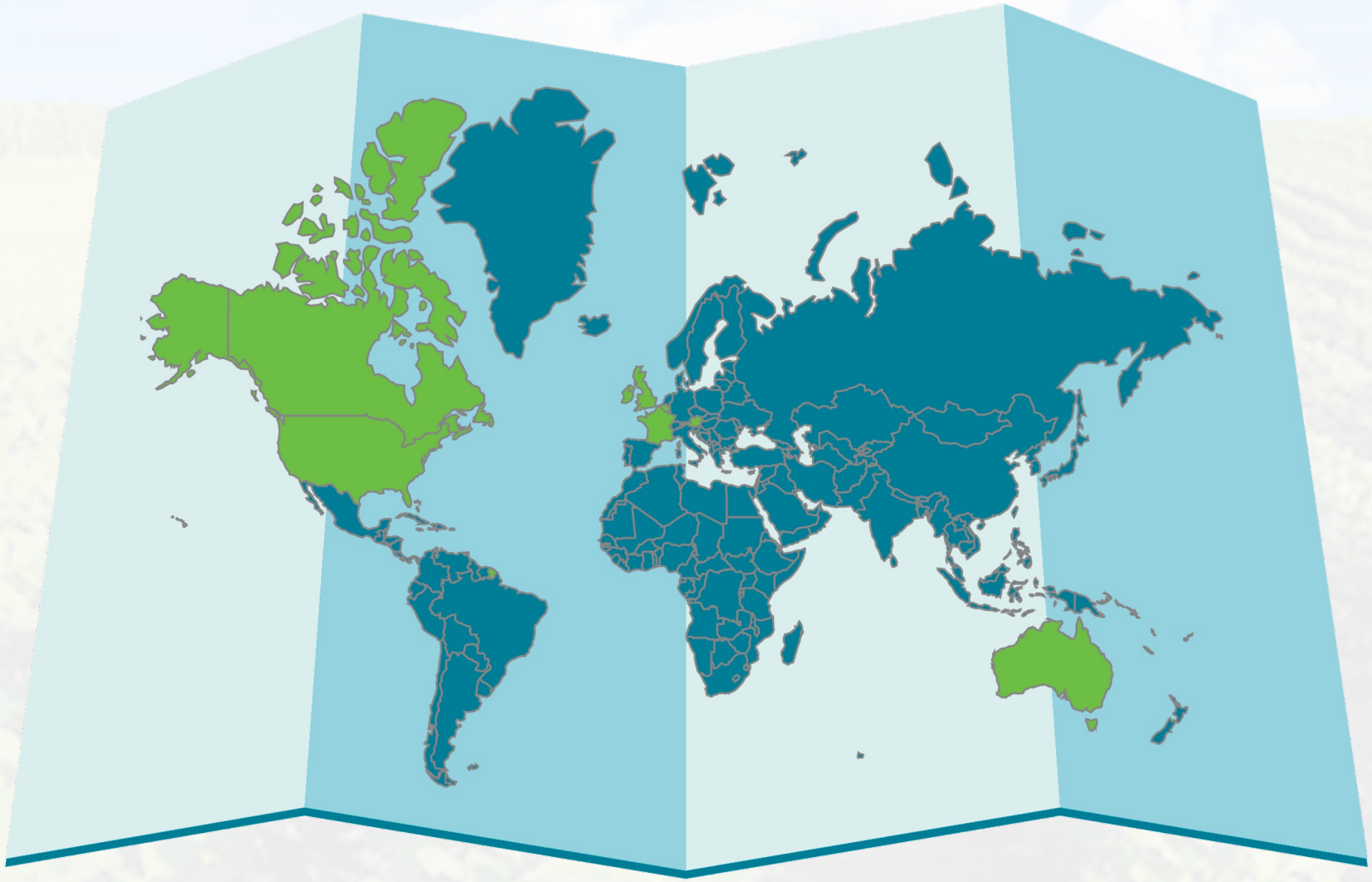
Examples of Phytobiomes

Holy Grail for Phytobiome Science

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

Phytobiomes Science will contribute to solving the grand challenges facing agriculture

International Alliance for Phytobiomes Research



- Established in 2016
- Nonprofit, precompetitive research consortium
- Industry, Academia & Government
- International: 8 countries
- Coordinating a paradigm shift in agricultural research & production
- Kellye Eversole, Executive Director

Phytobiomes Alliance Sponsors

Phytobiomes Alliance Vision

By 2050, all farmers will 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 field in a given year.

Phytobiomes Vision for Agriculture






Optimal sustainability and productivity

Adaptive, data-driven, on-farm systems

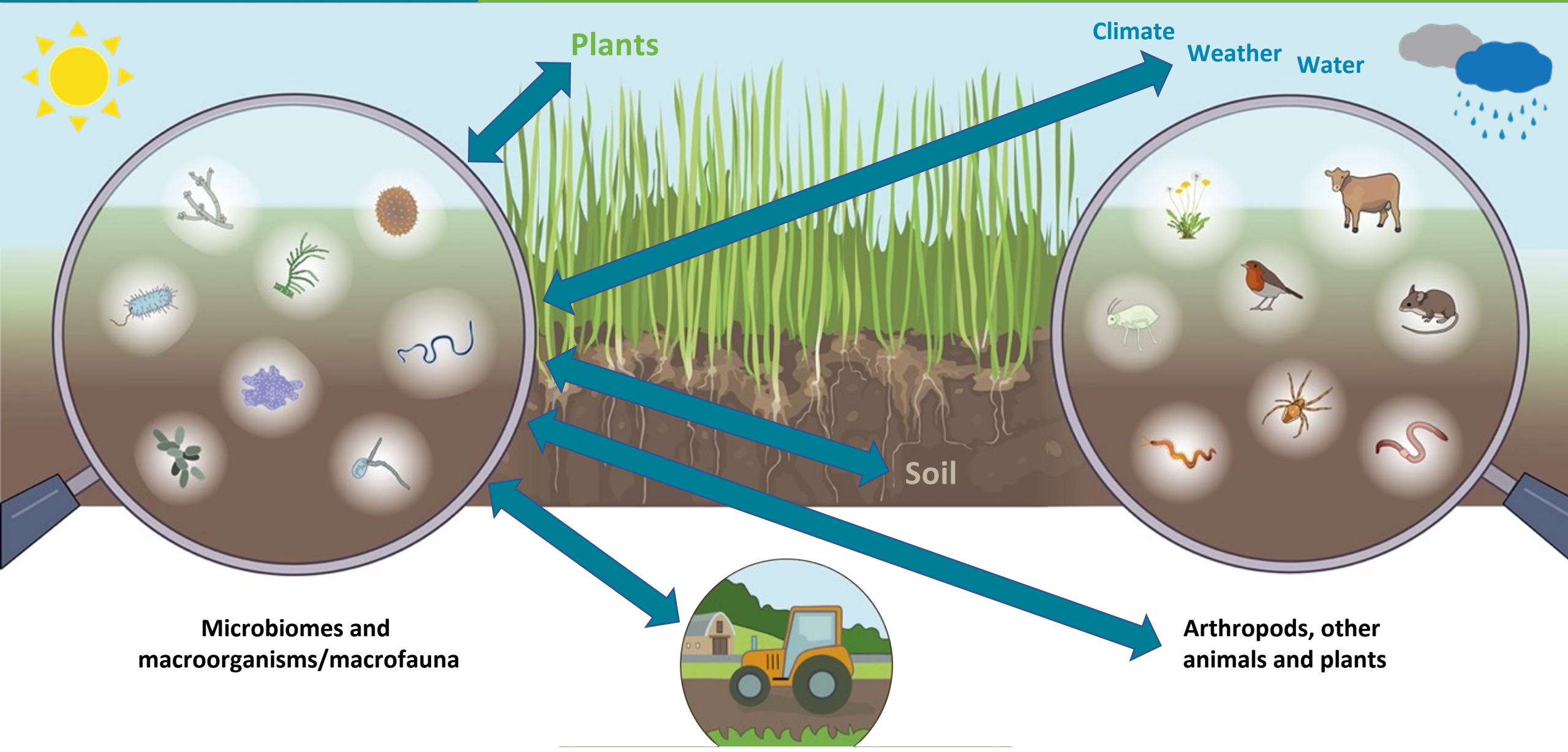
Rapid site-specific diagnostic tools

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 Current Efforts

Promote Projects that Link Components Within the Entire Phytobiomes Network

Elevate Sequence-based Classification System for Microbes

Develop Microbiome Standards – International Microbiome & Multi'omics Standards Alliance

Facilitate Regulatory Compliance

Coordinate Microbial Collections and Networks: Public & Private

Establish Linkages with Human and Animal Health & Nutrition (One Health)

Current Alliance Working Groups

- Controlled Environment Agriculture
- Regulatory
- Microbiomes
- Livestock & Poultry Microbiomes

Why Now?

Technological advances in

Probing & understanding biological components

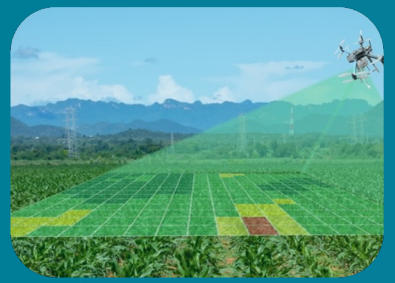
- Genome enabled technologies

Computational science

- Machine learning
- Quantum computing
- Deep learning

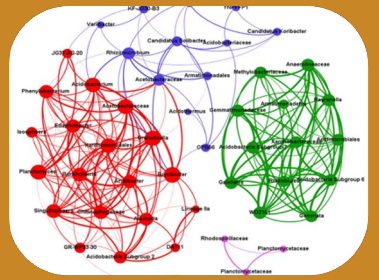
Precision crop management systems

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



Systems science

- Network analysis



Convergence of need & opportunity

Phytobiomes Alliance Events

International Conferences

- Biannual Conferences, in Europe or U.S.
- Participants represent broad cross-section of disciplines: public & private scientists, agricultural producers, agronomists, etc.
- Diverse speakers and topics: farm sustainability, soil & rhizosphere, phytobiomes engineering, imaging & modeling, regulatory challenges, biologicals, etc.

Workshops

- During major International Conferences
- 3/4 per year
- 2023: - Exploring Phytobiomes (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)**

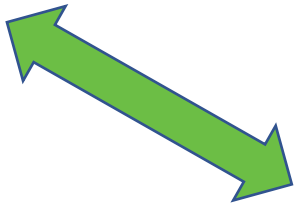
Webinars

- 6/8 per year
- Broad selection of topics
- Large international attendance

How can we engage to expand impact?

AgBioData

Toward enhanced genomics, genetics, and breeding research outcomes through standardization of practices and protocols across agricultural databases



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Thank you!

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