Embracing Complexity: Building an International Phytobiomes Alliance

Jan E. Leach
Colorado State University
Member, Board of Directors
Phytobiomes Alliance

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

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

Plants

Climate
Weather
Water

Soil

Microbiomes and macroorganisms/macrofauna

Arthropods, other animals and plants

All influenced by management practices
Examples of Phytobiomes

- Crop Field
- Pasture
- Vegetable Garden
- Forest
- Vertical Farm
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
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

- Plants
- Soil
- Climate
- Weather
- Water
- Microbiomes and macroorganisms/macrofauna
- Arthropods, other animals and plants
- Management practices

All influenced by management practices.
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.

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)

**Workshops**

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

**Webinars**
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
Thank you!

www.phytobiomesalliance.org