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Annual Report 2023

International Alliance for Phytobiomes Research

PHYTOBIOMES ALLIANCE

Opening Letter

By Kellye Eversole, Phytobiomes Alliance Executive Director

I am pleased to welcome you to the Annual Report where we reflect on the achievements and advancements made over the past year. In 2023, we made great progress in our collaborative projects, working groups and overall efforts to promote phytobiomes science as an interdisciplinary, systems approach to plant-based agriculture.

The Alliance projects, all at different stages of completion, are a statement of the power of collaborative research in tackling complex, multifaceted issues such as phytobiomes research. Whether it's harnessing novel microbiome technologies to strengthen Australian horticulture or developing a genome sequence-based classification system to help regulatory review of microbes in the United States, each project made significant strides in increasing our understanding of the diverse and dynamic interactions within phytobiomes. Furthermore, thanks to the partnerships developed by the U.S. Culture Collection Network, the Alliance joined a newly funded multinational Horizon Europe project aimed at deepening our understanding of climate change and its impact on biodiversity and ecosystems.

The Alliance Working Groups made substantial progress. These groups, serving as the implementation arm of the Alliance, spearhead efforts across various disciplines to expand our understanding and impact. The Microbiomes Working Group's prospective article on plant microbiome research within the broader context of phytobiomes aims to become a guiding document for future actions to promote plant microbiome research and discovery. The Regulatory Working Group is currently working on a white paper that will contribute to the development of a science-based regulatory framework for agricultural biologicals and microbial products. The newly operating Controlled Environment Agriculture (CEA), Animal Microbiome and the forthcoming Soil Health Working Groups will focus on identifying gaps in research, tools, and resources that will allow these fields to be fully integrated or linked to phytobiomes research.

The Animal Microbiome working group is advancing the One Health Concept by linking research in phytobiomes to animal nutrition, health, and food safety. We were pleased to forge a partnership with the British Society of Animal Science (BSAS) to engage in discussions and dialogue on key global issues related to the understanding of the interconnection between people, animals, plants, and their shared environments, as defined in the One Health approach.

Furthermore, our commitment to knowledge-sharing and community engagement was exemplified through a series of workshops and webinars organized throughout the year. These platforms not only facilitated the exchange of ideas but also fostered connections essential for collaborative, interdisciplinary science.

In 2023, I was thrilled to welcome Trevor Charles (University of Waterloo) to the Alliance Board, a pioneer in studying the role of microbes in controlled environment agriculture phytobiomes. His leadership and vision will be invaluable to shaping the Alliance strategy for the coming years.

We also welcomed several new sponsors and their representatives: Syngenta, Mosaic Biosciences, Ginkgo Bioworks, Purdue University's College of Agriculture, and FarmBox Foods. I am truly grateful to all our sponsors for their unwavering support and partnership. The diversity of institutions and companies supporting the Alliance is a testament to our uniqueness, showcasing the diversity and breadth of disciplines involved in phytobiomes science.

Finally, I would like to invite all of you to the 2024 International Phytobiomes Conference, an event that embodies what the Phytobiomes Alliance is striving for by bringing together agricultural producers, public and private experts and scientists from disciples that rarely cross paths at conferences and providing them with the opportunity to learn about each other's research, network, and build cross-disciplinary and public-private collaborations.

I look forward to seeing you all in St Louis, Missouri, USA, in November 2024!

About the Alliance

The Phytobiomes Alliance is an international, nonprofit alliance of industry, academic, and governmental scientists.

The Alliance facilitates and coordinates international efforts toward expanding phytobiomes research.

The Alliance is a 501(c)(3) nonprofit organization registered in the United States.

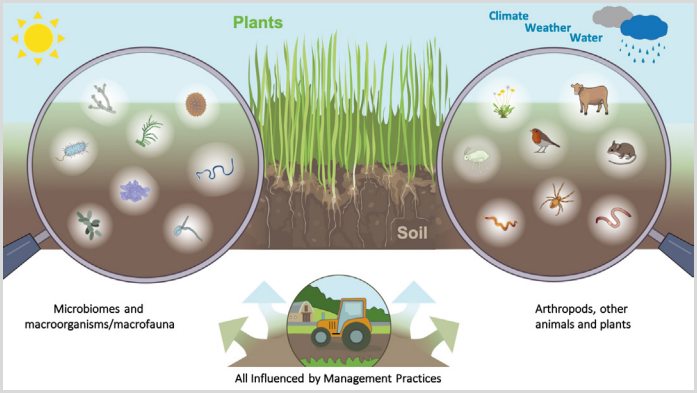
Vision

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 a given year.

Mission

Establish a science and technology foundation for site-specific, phytobiome-based enhancement of sustainable food, feed, and fiber production.

The Phytobiomes Concept



Plants grow in association and interaction with complex communities of organisms, environmental conditions, and management practices. The term “Phytobiomes” encompasses all of this complexity.

A phytobiome is a plant (“phyto”) in a distinct geographical unit (“biome”) – a field, grassland, greenhouse, garden, or forest. A phytobiome includes the plant itself, all micro- and macro-organisms living in, on, or around the plant – such as microbes, animals, insects, and other plants – and the environment, including soil, air, water, weather, and climate. All these interactions are influenced by management practices.

Phytobiomes have an important role in ensuring the sustained health and productivity of plants and plant ecosystems.

Board of Directors

Kellye Eversole
Executive Director & Chair of the Board

Gwyn Beattie
Iowa State University, US

Natalie Breakfield
NewLeaf Symbiotics, US

Trevor Charles
University of Waterloo, CA

Magalie Guilhabert
Ginkgo Bioworks, US

Jan Leach
Colorado State University, US

Emmanuelle Maguin
INRAE, FR

Matthew Ryan
CABI, UK

Angela Sessitsch
AIT Austrian Institute of Technology, AT

Coordinating Committee

The Scientific Coordinating Committee consists of representatives of financial sponsors and leaders of projects. The role of the Coordinating Committee is to establish Alliance priorities; identify research, resource, and technology gaps; develop strategies to fill these gaps; and create working groups to lead efforts focused on specific topics. At the end of 2023, the Alliance Coordinating Committee comprised 42 members from 9 countries, representing 34 public and private entities.

Projects & Activities

The Alliance initiates, participates in, and supports collaborative research projects and activities to address the short-term priorities identified by the scientific Coordinating Committee to build a foundation of systems-level knowledge of various phytobiomes.

Collaborative Research Projects and Networks

Novel Microbiome Technologies to Increase Profitability for Australian Horticulture (funded by Hort Innovation, Australia)

The project started in March 2022 under the leadership of Kirsty Bayliss (Murdoch University, Australia), in collaboration with Hort Innovation Australia, Future Food Systems, Ecogrowth, Melville Park, and the Phytobiomes Alliance.

The objective is to develop and deploy new microbiome-based products that increase the yield and profitability of annual and perennial Australian horticultural crops. The products will be developed by analyzing the microbiomes associated with the life cycle of the crop, from seed to harvest, under different biotic or abiotic stresses. The aim is to select consortia of microorganisms associated with crops that exhibit higher tolerance to these stresses, and then develop these into new products that increase crop yield.

The first phase of the project – a situation analysis – was completed in October 2022 and two manuscripts are currently in preparation. The project moved to phase two in 2023, with field studies of three biological products on two plots of tomatoes and one avocado plantation. The crops were monitored throughout the growing season for performance and yield, with biomass and other parameters measured at the end of the season. Metabarcoding and metagenomic analyses of soil and plant samples were performed, and two metagenome-assembled genomes were generated.

Genome Sequence-Based Classification System for Microbes (funded by the USDA Animal Plant Health Inspection Service – APHIS)

The Alliance-coordinated project began in August 2019 and focused on the select agent *Ralstonia solanacearum* (*Rs*). In this project, a classification system based on whole genome sequences was used to precisely identify microbes and conclusively distinguish between *Rs* strains of high impact and biosecurity concern and those that are not. The first phase of the project was completed in August 2021.

The second phase of the project started in July 2022, again with funding from USDA-APHIS, with a goal of complementing and extending results from the phenotypic and genomic research obtained in the first phase. The purpose of this second phase is to precisely circumscribe the authentically threatening *Rs* strains that are highly aggressive on potato at cool temperatures using a combination of phenotypic assays and bioinformatics to develop diagnostic markers that reliably and specifically identify these threatening strains.

The project was completed in December 2023 and manuscripts, covering both phases, are currently in preparation.

United States Culture Collection Network – USCCN (funded by the U.S. National Science Foundation – NSF)

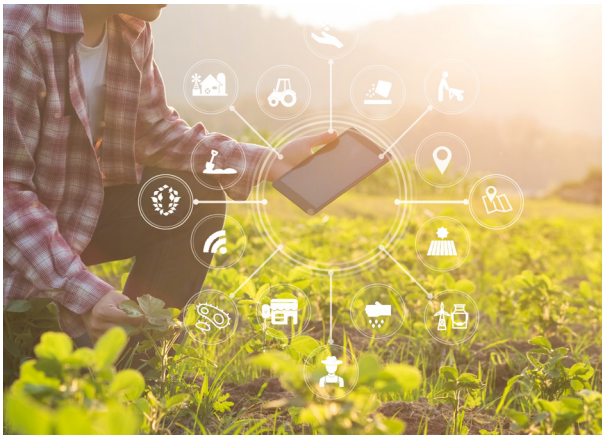
The five-year Alliance-coordinated project started in April 2022. It brings together scientists working with laboratory-based living collections of microbes. The mission of the network is to facilitate the safe and responsible utilization of microbial resources for research, education, industry, medicine, and agriculture for the betterment of humankind.

In 2023, the network continued developing and promoting its online searchable registry of plant-associated microbial culture collections. This registry includes all types of collections, from university small research collections to large federally funded culture collections.

USCCN also organized a workshop and two webinars to engage scientists across multiple disciplines to work toward addressing challenges and needs shared by all microbial collection managers and users, as well as scientists who have small research collections.

Microbes-4-Climate (funded by the Horizon Europe program)

The Alliance joined a large, transnational community of researchers and users on this project that seeks to unravel the intricate interactions between soil, microorganisms, plants, and the environment. The project, bringing together 31 partners from 13 countries, officially started in February 2024.



Participation in International Networks

The Alliance is participating to various Task Forces and Initiatives in the EU, the UK, and the US:

- The Alliance is a member of the Agricultural Genome to Phenome Initiative (AG2PI). This initiative connects crop and livestock/poultry scientists to each other and to scientists working in data, statistics, engineering, and social sciences. The goal is to identify shared problems and collaborate on solutions in genome-to-phenome science.
- The Alliance Executive Director, Kellye Eversole, is a member of the scientific advisory board of the World Bioprotection Forum, a UK-based, international, non-profit organization focused on improving regulatory frameworks for microbial products and encouraging collaboration between the biocontrol industry and academia in the AgriTech sector.
- The Alliance Executive Director, Kellye Eversole, is a member of the project resource advisory board of the UK Crop Microbiome Cryobank project.
- The Alliance Executive Director, Kellye Eversole, is a member of the advisory board of MASTER – Microbiome Applications for Sustainable food systems through Technologies and Enterprise, an EU project.
- The Alliance is participating in the US-based AgBioData research coordination network which is focused on bringing together the international community to enhance genomics, genetics, and breeding research outcomes through standardization of practices and protocols across agricultural databases.
- The Alliance is a member of IMMSA (International Microbiome and Multi-Omics Standards Alliance), a consortium that focuses on coordinating cross-cutting efforts that address microbiome measurement challenges of all major microbiological ecosystems.

Working Groups

Working Groups are the implementation arm of the Alliance. They lead efforts and develop priorities on specific topics, disciplines, and technologies.

Microbiomes

The Microbiomes Working Group focuses on identifying knowledge and resource gaps that need to be addressed to advance understanding of the role that microbes play within the broad phytobiome systems and how this can be used to improve agricultural sustainability.

In 2023, the group wrote a prospective article that was submitted to a journal in early 2024. The article discusses the challenges and opportunities associated with plant microbiome research within the broader context of phytobiomes.

Regulatory

The Regulatory Working Group focuses on the development of a regulatory science roadmap to facilitate the commercialization of agricultural biologicals and microbial products.

In 2023, the group worked on evaluating regulatory barriers for emerging microbial technologies and how to support development of a science and risk based regulatory framework for new technologies. The group submitted comments on the U.S. Department of Agriculture-Biotechnology Regulatory Services (BRS) "Draft Guide for Submitting Permit Applications for Microorganisms Developed using Genetic Engineering" in connection with new regulations and worked on the development of a white paper on research needs for regulation of microbes, and in particular on the need to use genome-based classification systems and phenotypic information to better inform regulations.

Controlled Environment Agriculture (CEA)

The aim of the CEA Working Group is to identify major controlled environment agriculture challenges that could be addressed by phytobiomes research.

The group was organized in 2023 and started regular activities at the end of the year. One of its planned activity is to work on a perspective article identifying the major challenges in CEA, and opportunities to address those challenges from a phytobiomes perspective.

Animal Microbiomes

The Animal Microbiomes Working Group works on identifying knowledge and resource gaps that need to be addressed to advance our understanding of the interconnection between people, animals, plants, and their shared environments, as defined in the One Health approach.

The group helped organize the workshop "The Uniqueness and Commonalities Between Plant, Animal and Soil Microbiomes" at the 2023 Plant and Animal Genome Conference and organized the workshop "One Health, Phytobiomes and Animal Science" during the British Society of Animal Science (BSAS) Conference in March 2023.

A group focused on Soil Health was created at the end of 2023 and will start operating in 2024.

Webinars

In 2023, the Alliance organized six webinars covering topics such as: the need for a Specimen Management Plan in project proposals, host-microbiota interactions in the barley rhizosphere, microbial community composition in hydroponic leafy green production, design strategies for altering microbial communities in the rhizosphere, host-microbe dynamics under biotic and abiotic stresses. Additionally, we learn about Team Science in interdisciplinary and international settings, and about the activities of the U.S. Culture Collection Network.

1,668
Registrations

74
Countries

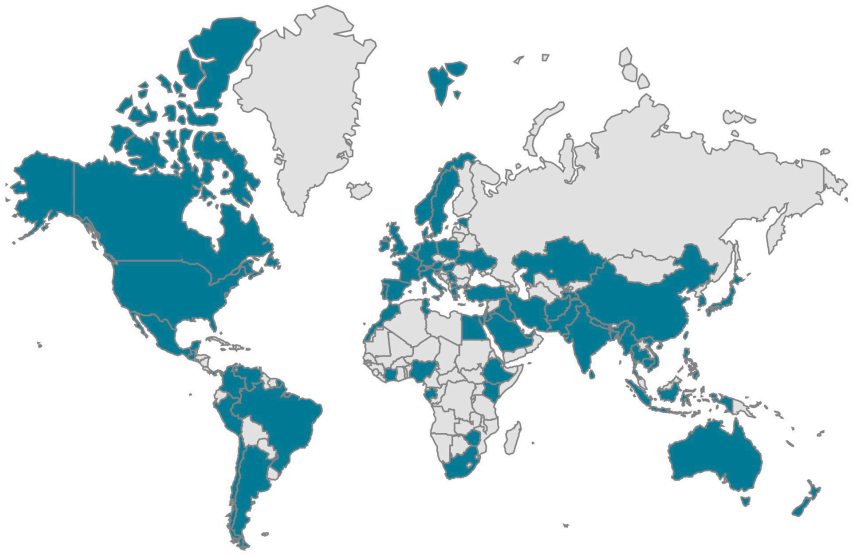
YouTube Channel

2,249
Views in 2023

372
Subscribers

7,750
Lifetime views

Library of
36 webinars



Webinar registrations

Workshops

In 2023, Alliance organized five workshops in conjunction with international conferences:

- Two workshops during the Plant and Animal Genome Conference (San Diego, CA, USA) in January: “Exploring Phytobiomes” and “The Uniqueness and Commonalities Between Plant, Animal and Soil Microbiomes”.
- One workshop during the British Society of Animal Science (BSAS) Conference in Birmingham (UK) in March: “One Health, Phytobiomes and Animal Science”.
- Two satellites workshops before the 12th International Congress of Plant Pathology (ICPP) in Lyon, France, in August: “Phytobiomes Research for Plant Health” and “Harnessing Culture Collections for Improved Plant Health”.

These workshops featured presentations and panel discussions showcasing the latest trends and research results in phytobiomes science, exemplifying the diversity of studies conducted in the field.

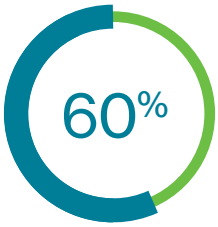
Twitter/X

78 tweets **3,600** followers

Finances

The Alliance is financially supported by sponsors – private companies and research institutions – that support the Alliance vision and contribute to the establishment of the Alliance priorities and strategies through the Coordinating Committee.

Sources of Funding

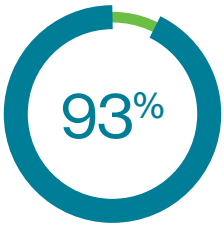


Private Companies

Research Institutes & Universities

Others

Expenses



Staffing & Professional Services

Operating Expenses

Meetings, Workshops & Travel

Communication & Promotion

Thank you 2023 Sponsors

Interested in sponsoring the Alliance? Contact Us!

The Alliance is looking forward to welcoming new sponsors to help identify priorities and work towards solutions to the challenges facing plant-based food, feed, and fiber production.

Join Us
in November
2024

INTERNATIONAL PHYTOBIOMES CONFERENCE 2024

INTERNATIONAL PHYTOBIOMES CONFERENCE 2024

Harvesting the Future: Bridging Phytobiomes, Agriculture and Climate

19-21 November
St. Louis, MO, USA

www.phytobiomesconference.org

International Alliance for Phytobiomes Research

Get in Touch!

Contact us if you would like to get involved in the Alliance.
And follow us on social media to stay abreast of the latest news and activities in the phytobiomes science space.

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