PHYTOBIOMES ALLIANCE

2024 Annual Report

International Alliance for Phytobiomes Research

www.phytobiomesalliance.org

Opening
Letter

By Dusti Gallagher
Phytobiomes Alliance Executive Director

Welcome to the 2024 Annual Report. This year has been a remarkable year for the Phytobiomes Alliance, culminating with the International Phytobiomes Conference 2024 and marked by significant strides in advancing phytobiomes science, fostering interdisciplinary collaborations, and driving innovation in plant-based agriculture.

The Alliance now has five active Working Groups contributing to expanding the reach and impact of system-based research. Notably, the Microbiomes Working Group's perspective article on plant microbiome research published in August is set to become a key guiding document that outlines critical actions to harness plant microbiomes for agricultural sustainability and promote further research and discovery. The Regulatory Working Group is working on identifying research needs and technology gaps that would facilitate regulatory review of microbes. The Animal Microbiome Working Group is exploring the links between phytobiomes research to animal nutrition, health, and food safety. The Controlled Environment Agriculture (CEA) Working Group is advancing discussions on integrating phytobiomes science into CEA practices, while the newly launched Soil Health Working Group has started discussing priorities and future initiatives. Together, these efforts exemplify the Alliance's commitment to fostering collaboration, driving scientific progress, and delivering real-world impact.

Similarly, each project in which the Alliance is involved has contributed to advancing our understanding of the diverse and dynamic interactions within phytobiomes. This includes laying the groundwork for developing microbiome-based products to enhance crop yield and profitability in Australian horticulture, promoting the safe and responsible use of microbial resources through the U.S. Culture Collection Network, and developing a genome sequence-based classification system to support regulatory reviews of microbes in the United States. Furthermore, through our involvement in the Horizon Europe project Microbes-4-Climate, we are advancing our knowledge of the interactions between microbes, soils, plants and their environments to help mitigate climate change.

We also continued our commitment to knowledge-sharing and community engagement through our workshops and webinars throughout the year. These events have facilitated the

The Alliance is committed to fostering collaboration, driving scientific progress, and delivering real-world impacts.

exchange of ideas and have also helped strengthened collaborative networks that are essential for tackling complex agricultural challenges through interdisciplinary science.

The highlight of the year was, undoubtedly, the International Phytobiomes Conference 2024 which brought together a broad and diverse group of public and private scientists from disciplines that rarely cross paths at conferences. The Conference provided a unique platform for participants to exchange ideas, learn from one another, and build the cross-disciplinary and public-private collaborations that are essential for shaping the future of agriculture and generating societal benefits. I am particularly thrilled by the high participation of early career scientists, who presented their work, networked with peers, and contributed to critical discussions to advance the phytobiomes science field. Their participation enriched the conference and reinforced the importance of including new voices and fresh perspectives in phytobiomes research.

This year, we were particularly pleased to welcome Earth Microbial and the United Soybean Board as a new sponsors. Having biotechnology companies and agricultural producers actively engaged in the Alliance is fundamental to our mission. They are at the core of what we strive to achieve – translating and applying systems-based, multidisciplinary, and results-oriented research to real-world agricultural and societal challenges.

I am immensely grateful to all our sponsors for their continued support and partnerships. The breadth of institutions and companies involved in the Alliance reflects our unique approach to bridge diverse scientific disciplines to advance phytobiomes research in ways that benefit both science and industry.

As we reflect on an extraordinary year of progress, I look forward to building on this momentum, driving further innovation in phytobiomes science, strengthening collaborations, and expanding the reach and impact of the Phytobiomes Alliance.

Thank you for being part of this journey.

Dusti Gallagher

About
The Phytobiomes Alliance

The Phytobiomes Alliance is an international, nonprofit alliance of industry, academic, and governmental scientists that 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 plants, management practices, and inputs for a specific site in a given year.**

Mission

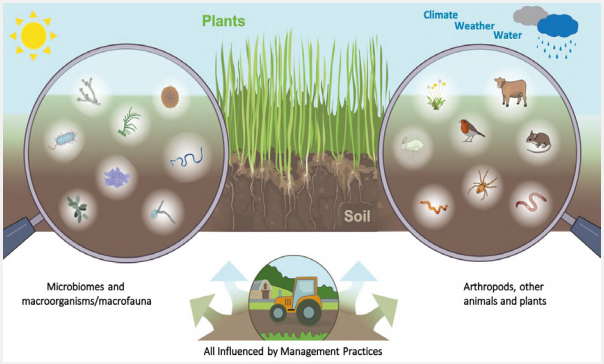
> **Establish a science and technology foundation for site-specific, phytobiome-based enhancement of sustainable food, feed, and fiber production.**

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.

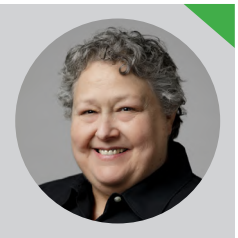
A phytobiome is a plant ("phyto") in a distinct geographical unit ("biome") – a field, grassland, greenhouse, garden, or forest. A phytobiome includes the plant itself, all micro- and macro-organisms living in, on, or around the plant – such as microbes, animals, insects, and other plants – and the environment, 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.

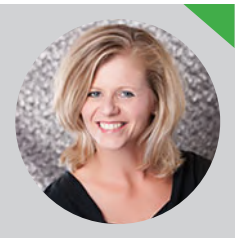


Board of Directors

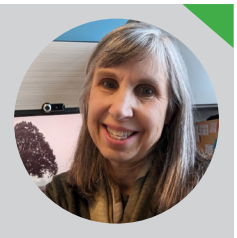
The Board of Directors sets the overall vision and mission of the Alliance and provides general oversight for the Alliance operations.



Kellye Eversole
Chair of the Board

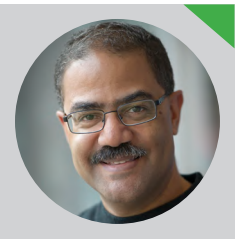


Dusti Gallagher
Executive Director



Gwyn Beattie
Iowa State University, US

Natalie Breakfield
NewLeaf Symbiotics, US



Trevor Charles
Waterloo University, CA

Magalie Guilhabert
Ginkgo Bioworks, US

Jan Leach
Colorado State University, US

Emmanuelle Maguin
INRAE, FR

Matthew Ryan
CABI, UK

Coordinating Committee

The Scientific Coordinating Committee establishes the Alliance priorities; identifies research, resource, and technology gaps; develops strategies to fill these gaps; and creates working groups to lead efforts focused on specific topics.

The Coordinating Committee consists of representatives of financial sponsors and leaders of projects. At the end of 2024, the Alliance Coordinating Committee comprised 40 members from 8 countries, representing 34 public and private entities.

Executive Staff Changes

In July 2024, the Board of Directors appointed Dusti Gallagher as Executive Director of the Alliance. Dusti has been working for the Alliance since 2007, overseeing several key projects. Her leadership, strategic planning, and stakeholder engagement skills, make her exceptionally qualified to lead the Alliance.

Former Executive Director, Kellye Eversole, remains involved with the Alliance as Scientific Advisor and Chair of the Board of Directors, and continues to contribute her expertise and leadership.

Dusti Gallagher

Outstanding Leadership Award

As Kellye Eversole transitioned from her role of Executive Director to Scientific Advisor of the Alliance in July 2024, the Alliance Board honored her visionary leadership and lasting impact over the past decade by awarding her an Outstanding Leadership Award. Her dedication in creating and guiding the Phytobiomes Alliance has established a strong foundation for continued progress and growth in the coming years.

> *"Kellye had a steadfast belief that we could, should, and would be able to shift the way we approach agriculture and food production if we pointedly and collectively recognized complexity of phytobiomes-systems while driving toward each of our own pursuits. She was the beam of light providing direction in a distinctly back-of-the-room leadership style.*
>
> *Kellye is a mentor to many and visionary for all of us."*
>
> *Gwyn Beattie*

Gwyn Beattie and Jan Leach, both founding members and Board members of the Alliance, honored Kellye Eversole during the Phytobiomes Conference. Beattie presented the Outstanding Leadership Award and Leach shared a video tribute.

Gwyn Beattie and Kellye Eversole

Working Groups

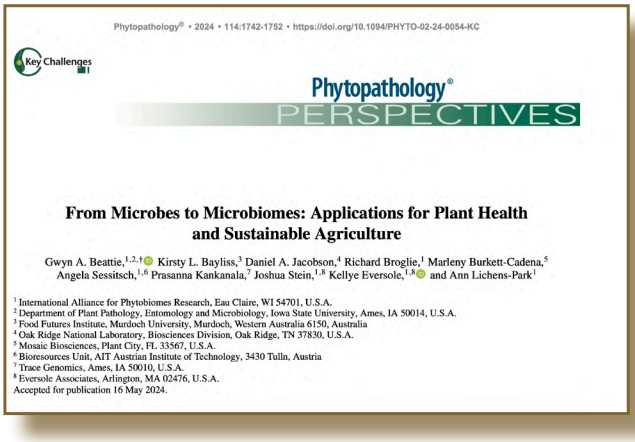
Working Groups are the implementation arm of the Alliance. They lead efforts and develop priorities on specific topic, disciplines, and technologies. The Alliance currently has five active working groups.

Microbiomes

The Microbiomes Working Group focuses on identifying knowledge and resource gaps to advance understanding of the role of microbes in phytobiome systems and their potential to improve agricultural sustainability.

In August 2024, the group published a perspective article in Phytopathology (Beattie GA, Bayliss KL, Jacobson DA, et al. From Microbes to Microbiomes: Applications for Plant Health and Sustainable Agriculture. Phytopathology. 2024;114(8):1742-1752.)

The article discusses challenges and opportunities in plant microbiome research within the phytobiome context and highlights actions to harness the power of plant microbiomes for societal benefits.



https://doi.org/10.1094/PHYTO-02-24-0054-KC

Key recommendations

- **Consider translational implications at every stage of research**
- **Advance transdisciplinary in research to address microbiome complexity and phytobiomes**
- **Expand public-private partnerships focused on plant agriculture to accelerate translation of scientific advances**
- **Engage in developing efficient and effective regulatory policies that support innovation**
- **Be realistic about the practical use and benefits of plant microbiomes**

Working Groups (Continued)

Regulatory

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

In 2024, the group started working to identify research needs and technology gaps that would facilitate more rapid regulatory review of microbes, proposing the use of genome-based risk assessment – or genome-based classification systems – and phenotypic information to better inform regulations. The group also provided comments to USDA on the proposed revisions to the select agent list.

Controlled Environment Agriculture (CEA)

The CEA Working Group focuses on identifying key challenges in controlled environment agriculture (CEA) that can be addressed through Phytobiomes research.

In 2024, the group worked on identifying key research questions for CEA and began working on a perspective article outlining the current state of phytobiomes knowledge within CEA.

Members of the group also represented the Phytobiomes Alliance at conferences and established connections within the CEA industry.

Animal Microbiomes

The Animal Microbiomes Working Group was formally reactivated in 2024. The group focuses on identifying knowledge and resource gaps to advance our understanding of the interconnections between people, animals, plants, and their shared environments, as defined in the One Health approach.

In 2024, the group helped organize the workshop "The Uniqueness and Commonalities Between Plant, Animal, and Soil Microbiomes" at the Plant and Animal Genome Conference in San Diego. They also began planning a series of webinars for 2025.

Soil Health

The group began operating at the end of 2024 and started discussions to identify research gaps and priorities for its work.

In addition to their regular activities, the Working Groups also contributed to the Phytobiomes Conference 2024 program by suggesting presentation topics, organizing and chairing panel discussions and recommending speakers.

Projects & Activities

Building a foundation of systems-level knowledge of phytobiomes

The Alliance initiates, participates in, and supports collaborative research projects and activities to address the priorities identified by the Coordinating Committee.

Collaborative Research Projects and Networks

Novel Microbiome Technologies to Increase Profitability for Australian Horticulture

(Funded by Hort Innovation, Australia)

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 Phytobiome Alliance, the project aims to develop new microbiome-based products to increase the yield and profitability of Australian annual and perennial horticultural crops.

In 2024, the project team completed field trials on tomatoes, potatoes, and avocados, along with additional surveys on avocado farms across three biogeographical regions in Western Australia. Metabarcoding data was collected from all three crops, as well as metagenomic data from tomatoes and potatoes

Preliminary analysis indicates that certain biological products increase tomato growth and yield in the field, and some may reduce nematode-induced galls. Core microbes present in avocados, regardless of their growing location, have been identified and their functions are being further investigated. In 2025, the team will continue data analysis and its work on potato and avocado.

United States Culture Collection Network

(funded by the U.S. National Science Foundation – NSF)
www.usccn.org

Launched in April 2022, the five-year Alliance-coordinated project 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 2024, the network continued expanding its connections and promoting its online searchable registry of plant-associated microbial culture collections. This registry includes a wide range of collections, from small university research collections to large federally funded culture collections.

USCCN also organized two workshops to strengthen relationships and engage scientists across disciplines to address challenges and needs shared by all microbial collection managers and users. A first workshop held in June 2024 at UC Davis focused on genome sequencing and other microbial resources. A second workshop held before the International Phytobiomes 2024 in St Louis in November 2024 explored the value of microbial germplasm for research and industry.

Additionally, the network organized a webinar in January 2024 on the UK Crop Microbiome Cryobank.

Projects & Activities (Continued)

Genome Sequence-Based Classification System for Microbes

(funded by the USDA Animal Plant Health Inspection Service – APHIS)

The Alliance-coordinated project concluded in December 2023. Its goal was to develop diagnostic markers for the reliable and specific identification of highly aggressive *Ralstonia solanacearum* (Rs) strains that threaten potatoes at cool temperatures, using a combination of phenotypic assays and bioinformatics.

A summary of the findings was published in Phytopathology in June 2024 (Dewberry RJ, Sharma P, Prom JL, et al. Genotypic and Phenotypic Analyses Show *Ralstonia solanacearum* Cool Virulence Is a Quantitative Trait Not Restricted to "Race 3 Biovar 2". Phytopathology. 2024;114(12):2468-2480. https://doi.org/10.1094/PHYTO-06-24-0187-R)

This project serves as a proof of concept that genome-based classification, combined with phenotyping, can be used effectively to improve science-based regulation.

Microbes-4-Climate: Microbial services addressing climate change risks for biodiversity, agricultural and forestry ecosystems

(Funded by the European Union)
www.microbes4climate.eu

Launched in February 2024, this large transnational European project brings together 31 partners (including the Alliance) from 13 countries. The project's goal is to understand the complexity of microbe-soil-plant-environment interactions and explore how this system can help mitigate the adverse effects of climate change.

The Alliance contributes to the project by providing advice and guidance on accessing US microbial resources and cooperating entities.

Participation in International Networks

- The Alliance Executive Director, Dusti Gallagher, is a member of the scientific advisory board of the EU project MICRObiome Biobanking (RI) Enabler: MICROBE, which aim is to develop methods and technologies for biobanking of microbiome samples.
- The Alliance Scientific Advisor, 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 Scientific Advisor, Kellye Eversole, is a member of the project resource advisory board of the UK Crop Microbiome Cryobank 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.
- 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.

Events

Webinars & Workshops

The Alliance organizes webinars, workshops, and a biennial Conference to showcase the latest research advances and connect experts across disciplines in phytobiomes science.

Webinars

In 2024, the Alliance organized five webinars on topics including a biobanking model to support phytobiomes research, plant phenotyping technologies, engineering root nitrogen-fixing microbial communities, soil metagenomics, and the impact of root exudates on carbon cycling, sequestration, and soil health.

Additionally, the Alliance participated in a conversation, organized by the Women in Genomics network, featuring a speaker who shared her experiences as a woman in STEM.

1754
Registrations

86
Countries

YouTube Channel

Library of **37** webinars

3,130 views in 2024

10,453 lifetime views

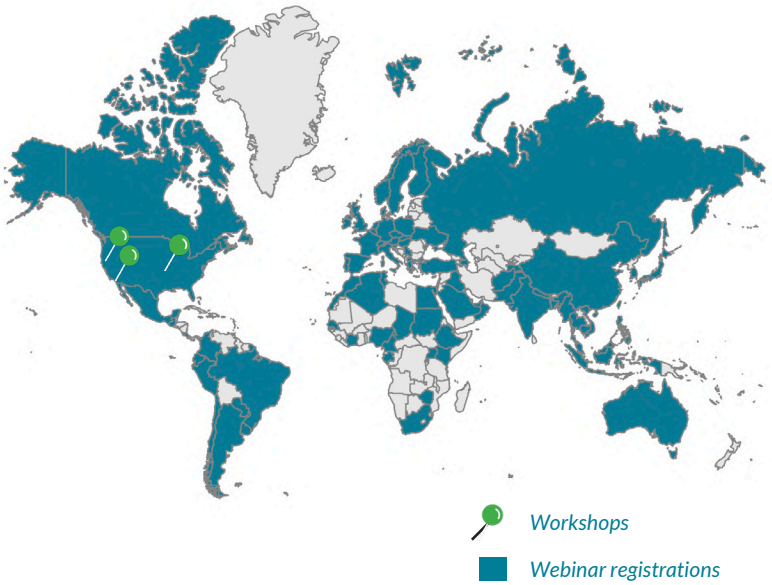
+44% subscribers

Workshops

In 2024, Alliance organized four workshops:

- Two workshops during the Plant and Animal Genome Conference (San Diego, CA, US) in January: “Exploring Phytobiomes” and “The Uniqueness and Commonalities Between Plant, Animal and Soil Microbiomes”.
- Two workshops organized by the USCCN project: “Genome Sequencing and Microbial Resources” in June (Davis, CA, US) and “Exploring the Value of Microbial Germplasm for Research and Industry” in November (St Louis, MO, US)

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.



International Phytobiomes Conference 2024

Held in St Louis (Missouri, US) in November, the Conference brought together 147 scientists, researchers, industry experts, and early-career scientists to share and discuss the latest advancements in phytobiomes research.

Over three days, the Conference featured plenary talks, research presentations, poster flash talks, panel discussions, and ample networking opportunities, during poster sessions, lunches, and a gala dinner.

The program covered a wide range of topics, from plant-microbe-insect interactions and digital agriculture to soil health, regulatory frameworks, and sustainable agriculture. Instead of traditional topical sessions, presentations were organized around broad daily themes to encourage interdisciplinary discussions:

- Day 1: The Value of a Systems Approach for Agriculture
- Day 2: Harnessing Interactions and Influences within the Phytobiomes
- Day 3: Building Collaborations to Drive Innovative Systems-based Research

A key feature of the Phytobiomes Conferences is the strong participation of early-career scientists, both as attendees and presenters. For many, it was their first opportunity to showcase their research to a broad audience, providing them with valuable exposure and opportunities to build professional connections.

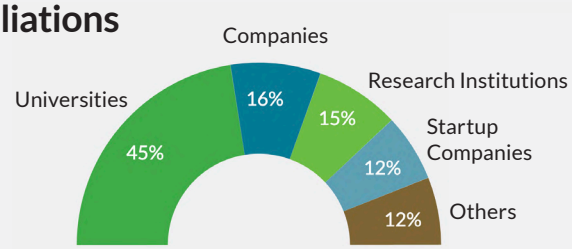
The conference received overwhelmingly positive feedback in the post conference survey, with an overall rating of 4.7 (out of 5). Attendees particularly appreciated the single-session format, the networking opportunities and the intimate, small size, well-organized and friendly nature of the event. They praised the high-quality of the talks, the multidisciplinary scope, and the variety of topics presented, as well as the balance between academia and industry perspectives. The diversity of attendees, in terms of scientific backgrounds and career stages, was also highly valued.

147 Attendees

11 Countries

27% Students

Affiliations



Program

6 Plenaries

25 Talks

5 Panel Discussions

61 Posters

12 Poster Flash Talks

International Phytobiomes Conference 2024 (Continued)

A recurring theme throughout the conference was the importance of breaking down barriers between disciplines and fostering transnational, interdisciplinary collaborations to address global agricultural challenges.

Conference program, speaker profiles, abstract book, and PDFs of some of presentations can be found at phytobiomesconference.org

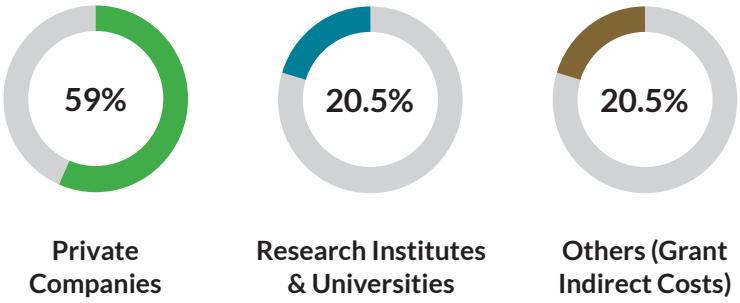
Looking forward to the next edition in 2026!

2024

Finances

The Alliance is financially supported by sponsors, private companies, and research institutions that share its vision and contribute to establishing its priorities and strategies through the Coordinating Committee.

Sources of funding



Private Companies

Research Institutes & Universities

Others (Grant Indirect Costs)

Expenses

Staffing & Professional Services

Meetings, Workshops & Travel

Operating Expenses

Communication & Promotion

Thank you

2024 Sponsors

Interested in sponsoring the Alliance? Contact Us!
The Alliance is looking forward to welcoming new sponsors to help identify priorities, drive scientific progress, and deliver real-world impact for the future of agriculture and society.

Get in Touch with Us!

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