ANNUAL REPORT 2021

PHYTOBIOMES ALLIANCE

International Alliance for Phytobiomes Research

CONTENTS

OPENING LETTER

By Kellye Eversole

Phytobiomes Alliance
Executive Director

2021 was another challenging year as the world continued to be impacted by the pandemic. Nevertheless, we were able to make progress in some of our projects as well as in our efforts to build an international community of scientists focused on the complex system of growing plants, i.e., phytobiomes research.

The Alliance leadership submitted or supported several collaborative interdisciplinary project proposals to funding agencies around the world aimed at addressing knowledge gaps in various components of phytobiomes research. While we are awaiting decisions on some of these, we feel optimistic about the future for all aspects of phytobiomes science and its translation and we are pleased to report the completion of the first phase of the LINS project which is part of our effort to develop a sequence-based classification system for distinguishing pathogenic microbes from nonpathogenic ones.

The LINS Alliance-led, USDA-Animal Plant Health Inspection Service funded project focused on the select agent *Ralstonia solanacearum* was completed in 2021 and manuscripts are currently under preparation. A follow-on project proposal was submitted in 2021 to complement and extend the results from the phenotypic and genomic research obtained in the first phase of our effort. A sequence-based classification system could help speed regulatory review of microbial based biological products and increase the availability of products aimed at enhancing the sustainability of agriculture.

Overall, the Alliance continues to focus on developing the science needed to facilitate the develop of regulatory frameworks globally that enable the commercialization of agricultural biologicals and microbial products. To this end, we have continued to establish connections with networks, initiatives, and regulatory agencies in the EU, the UK, and the US. Plans are just now forming to co-host a regulatory workshop on genetically engineered microbes and to re-energize our regulatory working group.

The Alliance is involved in multiple national and international efforts related to the development of standards for microbiomes, microbial genomics, metagenomics, and systems approaches to agricultural research and production. The focus of several of these efforts is on non-agricultural systems (e.g., human microbiome) and our involvement helps to ensure that the standards recognize the uniqueness of agricultural environments and agricultural research and allows us to benefit from advances in other fields.

We continued our successful webinar series in 2021 and organized ten webinars on topics as diverse as digital agriculture for smallholder farmers, costs and benefits of scientific collections, microalgae for healthier red meat, wheat take-all disease, genome classification for microbes – to name only of few – showcasing the broad range of phytobiomes research worldwide.

With the increased focus on sustainability, regenerative agriculture, agroecology, and other terms and concepts aimed at ensuring the sustainability of agricultural food, feed, and fiber production, the Phytobiomes Alliance is poised to lead the global effort in enabling systems-based approaches to plant-based agricultural research and production.

Kellye Eversole

We look forward to working with all of you in the coming year and hope to see you in Denver (Colorado, USA) in September 2022 for the International Phytobiomes Conference.

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.

Mission

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

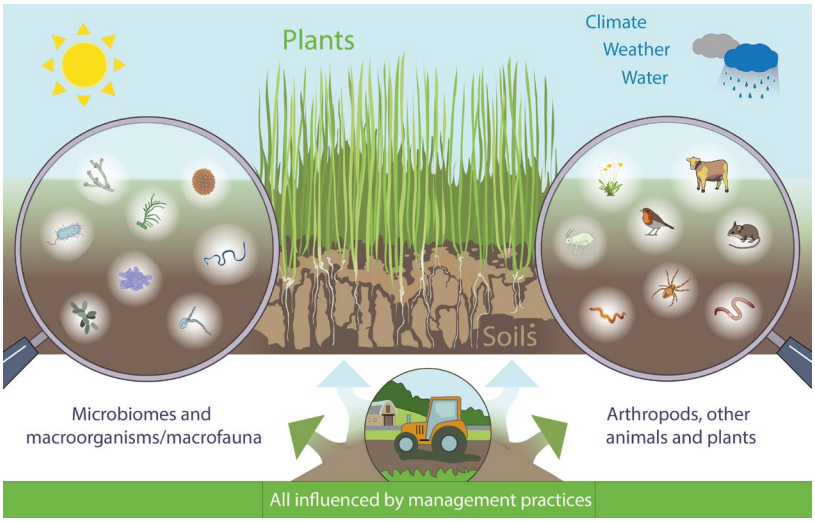
Research Priorities

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

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.



A PHYTOBIOMES VISION FOR AGRICULTURE

Establishing a foundation of knowledge on how phytobiome components interact and affect each other will be critical to ensuring sustainable global food security in the context of climate change and its impact on plant diseases, health, and productivity, while preserving biodiversity and natural resources.

- **Optimal sustainability and productivity**
- **Adaptative data-driven, on farm systems**
- **Rapid site-specific diagnostic tool**
- **Prescriptive crop management techniques**
- **Resilient crops**
- **Optimal soil health**

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

BOARD OF DIRECTORS

The Board of Directors is in charge of setting the overall vision and mission of the Alliance and provides general oversight for the Alliance operations.

KELLYE EVERSOLE

Chair of the Board

GWYN BEATTIE

Iowa State University

NATALIE BREAKFIELD

Newleaf Symbiotics

MAGALIE GUILHABERT

Bayer Crop Science

JAN LEACH

Colorado State University

EMMANUELLE MAGUIN

INRAE

MATTHEW RYAN

CABI

ANGELA SESSITSCH

AIT Austrian Institute of Technology

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 2021, the Alliance Coordinating Committee comprised 39 members from 8 countries.

PROJECTS & ACTIVITIES

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

Collaborative Research Projects

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

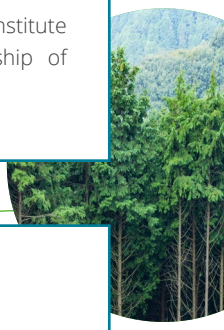
The Alliance-coordinated project began in August 2019 and was completed in August 2021. The project focuses on the select agent *Ralstonia solanacearum* (*Rs*).

In this project, a classification system based on whole genome sequences was used to precisely identify microbes and conclusively distinguish pathogenic and non-pathogenic *Rs* strains. Over the long-term and once expanded beyond *Rs*, this method will be beneficial for accelerating the regulatory pathway for international and interstate shipments as well as commercialization of microbial products.

Manuscripts are currently in preparation.

Support for funding proposals of collaborative research projects and networks

- US Culture Collection Research Coordination Network (submitted to US National Science Foundation)
  A proposal was submitted for phase 2 of the United States Culture Collection Network (USCCN) with the goal of expanding the scope and reach of the network to gain increased awareness and access to microbial collections of all sizes, from research collections to back-up collections.
- Artificial Intelligence Institute for Microbiome Biology (submitted to US National Science Foundation)
  The Alliance supported a proposal to establish the AI Institute for Microbiome Biology (AIMB) under the leadership of Clemson University researchers.



Regulatory Science – Establishing International Connections

The Alliance has established connections with networks, initiatives and regulatory agencies in the EU, the UK, and the US by participating to various Task Forces and Initiatives.

- The Alliance leadership is monitoring Australia, EU, and US regulation activities, such as those related to the development of a UK plant biosecurity strategy and regulations which may impact the commercialization of biostimulants.
- The Alliance joined the Agricultural Genome to Phenome Initiative (AG2PI) as a global engagement organization. AG2PI connects crop and livestock scientists to each other and to scientists working in data, statistics, engineering, and social sciences to identify shared problems and collaborate on solutions in genome-to-phenome science.
- The Alliance Executive Director, Kellye Eversole, was named to 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 is participating in the 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.

PROJECTS & ACTIVITIES

Standards Development

The Alliance is involved in multiple national and international efforts related to the development of standards for microbiome and systems approaches to agricultural research and production.

- The Alliance is actively engaged with the **International Microbiome Multi-Omics Standard Alliance** (IMMSA). Coordinated by the US National Institute of Standards and Technology, IMMSA is an open consortium of microbiome-focused researchers from industry, academia, and government.
- The Alliance joined the **US National Microbiome Data Collaborative** and is working to ensure that standards development takes into consideration the needs for microbial products industry and the international activities underway, especially in Europe.
- Furthermore, the Alliance continued to be involved in several projects through which a variety of standards are developed, including **EU CIRCLES, EU MASTER, EU MicrobiomeSupport, Microbiome Centers Consortium, UK Crop Microbiome CryoBank (UK-CMCB),** and the **US Agricultural Microbiome Research Coordination Network**.

Website

10,280 page views
+22% visits
+30% users

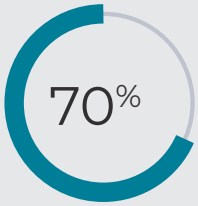
Twitter

105 tweets
120,000 impressions
3,079 followers (**+248**)

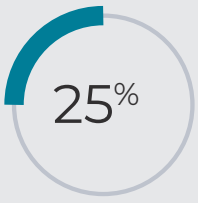
FINANCES

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.

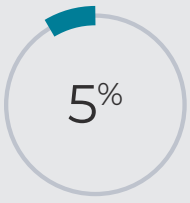
Sources of Funding



Private Companies

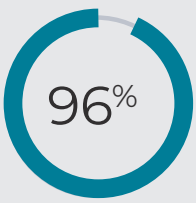


Research Institutes & Universities

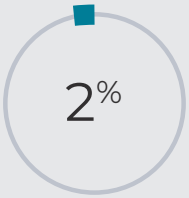


Others

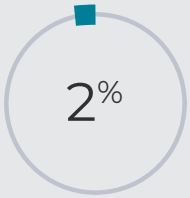
Expenses



Staffing & Professional Services



Communication & Promotion



Operating Expenses

EVENTS

Due to the COVID-19 pandemic, the Alliance did not organize any in-person **workshops** as they usually take place in conjunction with international conferences such as the Plant and Animal Genome Conference, the AAAS Annual Meeting, miCROPe, or other international meetings.

WEBINARS

The Alliance continued its webinar series showcasing research results, tools, and resources from all disciplines involved in phytobiomes research. The free webinars are recorded and subsequently posted to the Alliance YouTube channel.

In 2021, the Alliance organized 10 webinars, of which two in collaboration with the International Wheat Genome Sequencing Consortium (IWGSC), one with the US Culture Collection network (USCCN) and one with the Women in Genomics (WIG) network.

2,477	Registrations
88	Countries
45%	Attendance rate
1,239	YouTube views
+34%	YouTube subscribers

CONFERENCE

Initially planned for 2018 and then postponed due to the pandemic, the **International Phytobiomes Conference** will take place from 13 to 15 September 2022 in Denver, Colorado, USA.

2021 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.

PHYTOBIOMES ALLIANCE

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