

Advancing agriculture through a phytobiome perspective

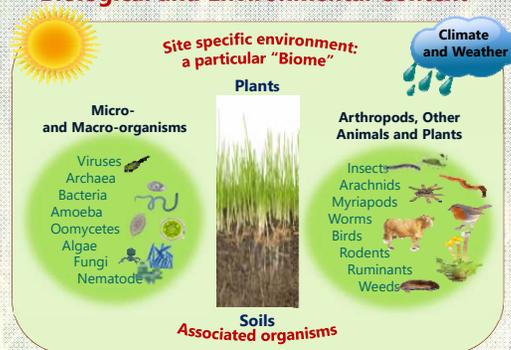
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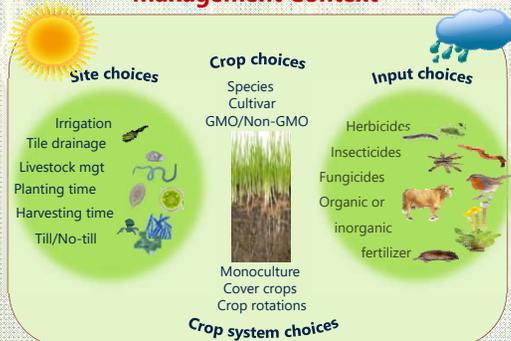
Major crop breeding efforts have propelled us through an era of remarkable agricultural prosperity, but global demands for food and feed are increasing while annual yield growths for essential food crops are slowing. Moreover, we are facing increasing resource constraints, extreme weather events and increasingly limited arable land. **We are currently at a critical juncture in which new approaches are needed to sustainably increase global crop productivity.** We outline a vision for agriculture in which crop management is founded not on managing the individual or system components but rather on exploiting systems-level knowledge of the many interacting components within phytobiomes.

Phytobiomes: Systems in Context

Biological and Environmental Context



Management Context



www.phytobiomes.org

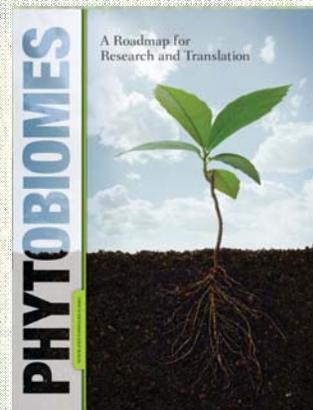
VISION:

We can achieve sustainable crop productivity through a systems-level understanding of diverse interacting components

Phytobiomes

consist of all organisms living in, on or around plants (e.g., microbes, animals, other plants), and the environment (i.e., soil, air, water and climate)

A Strategic Plan: The Phytobiomes Roadmap



www.phytobiomes.org/Roadmap

Conceptual Development of Phytobiome

Origin:
American Phytopathological Society

Phytobiomes ≠ Plant microbiomes

Phytobiomes ≠ Plant systems (these are focused on the interactions of a single plant species, such as maize)

Phytobiomes knowledge should help identify the best plant(s) to grow at a given site in a given period

Knowledge that translates into applications

What genetic linkages connect phytobiome components?
→ Support breeding plants that select for beneficial communities

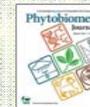
What constitutes a "healthy phytobiome"?
→ Develop biologicals and predictors of crop and soil health

What are the mechanisms by which specific management practices promote ecosystem health?
→ Design novel or improved management practices

Can we exploit predictive and prescriptive analytics to design site-specific solutions to environmental challenges?
→ Incorporate biological information into precision agriculture technologies

The road forward

• American Phytopathological Society launched a new, open-access journal



• Form linkages among disciplines to recruit a broad base of expertise to the field of phytobiomes

• Attract and strengthen a cross-trained workforce

Public & Private sector scientists

- Molecular biologists
- Soil scientists
- Organismal biologists
- Extension
- Engineers
- Statisticians
- Chemists
- Ecologists
- Agonomists
- Agribusiness
- Computational scientists
- Plant breeders
- Consumers
- Atmospheric scientists
- Crop consultants

The International Alliance for Phytobiomes Research



A nonprofit consortium of industry, academic, and governmental agencies

Mission:

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

Goals:

Identify research gaps and help coordinate projects to address these gaps;
Establish national, international, and multinational public-private projects and networks

Initial Research Priorities:

- Whole genome sequence database of microbes with geospatial data in the pre-competitive space
- Establish standards, reference materials, best practices and protocols, including reporting standards, for phytobiomes
- Advance predictive and diagnostic agricultural models dynamically linked to real-time weather and climate data

www.phytobiomesalliance.org



Phytobiomes Alliance Sponsors