

The Future of Soil Health Research

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**Human's closest
relationship with
Earth is through
agriculture**



Innovations that have “done the most to shape the nature of modern life”

Top 10: printing press, electricity, internal combustion engine, paper, Internet, and steam engine

- 11. Nitrogen fixation, 1918:** Fritz Haber wins a Nobel Prize for the ammonia-synthesis Martinus Beijerinck
- 13. Refrigeration, 1850s:**
- 22. Green Revolution, mid-20th century:** Norman Borlaug’s green revolution
- 30. Moldboard plow, 18th century**
- 32. Cotton gin, 1793**
- 33. Pasteurization, 1863**
- 38. Scientific plant breeding, 1866:** Gregor Mendel
- 50. Self-propelled Combine harvester, 1930s**



Agriculture is the place to be these days in science!

- Importance of the issues
- Take fundamental knowledge almost immediately to application
- New technologies often apply directly to agriculture before any other sector
- Growing consumer interest in the food system



How quickly can science make a difference?

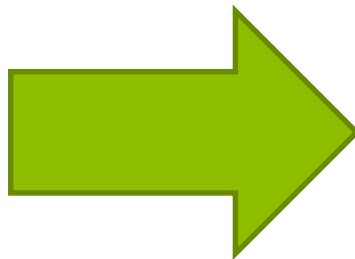
On average, public agricultural research undertaken today will begin to noticeably influence agricultural productivity in as little as 2 years and its impact could be felt for as long as 30 years.

**More data generated in the past two years than
in the entire history of the human race.**

The pace of science continues to accelerate.

**We must take advantage of this incredible time
in science.**

What does
a *billion*
times faster
look like?



Copyright Apple

Only 125,000 times faster

What does a billion times faster look like?

Imagine a 3.7 mile commute



Home



3.7 mph



Work

What does a billion times faster look like?

Imagine a 3.7 mile commute



Home



3.7 mph



Pluto

Burgeoning Fields in Ag Research

Progress happens when our knowledge of how things work converges with technological advances to reveal new ways to approach problems!



- **Phenomic/Genomic associations**
- **Big Data – Digital Ag**
- **New technologies (imaging, drones)**
- **Bioeconomy**
- **Systems Analysis**



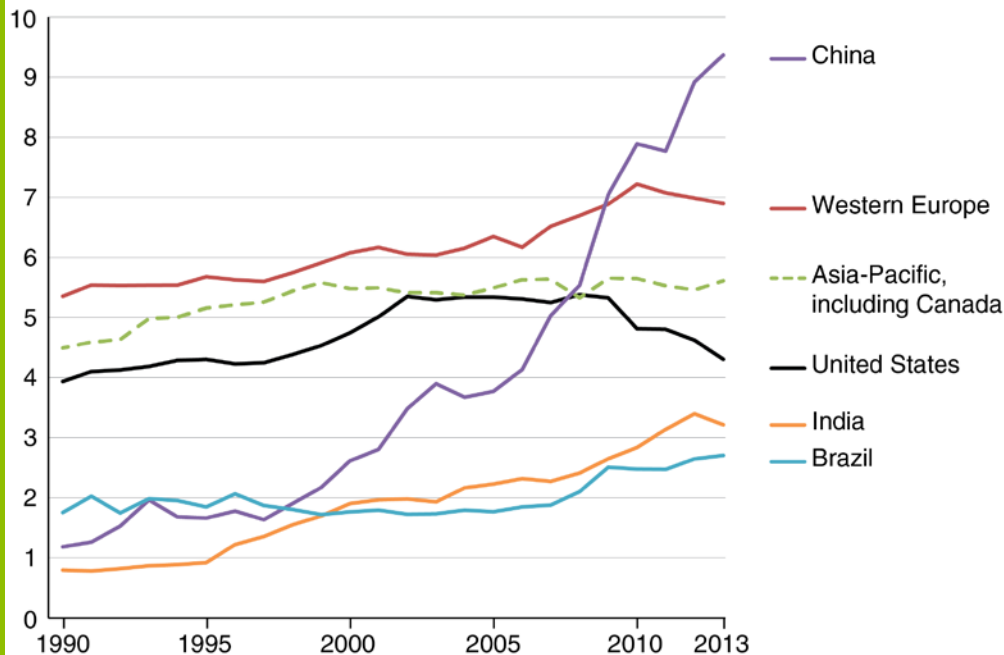
The Challenge

**\$9.7 billion
is needed
by 2050**

**Scientific innovation
is critical to meet
the needs of a
growing global
population.**

Funding for Agricultural R&D

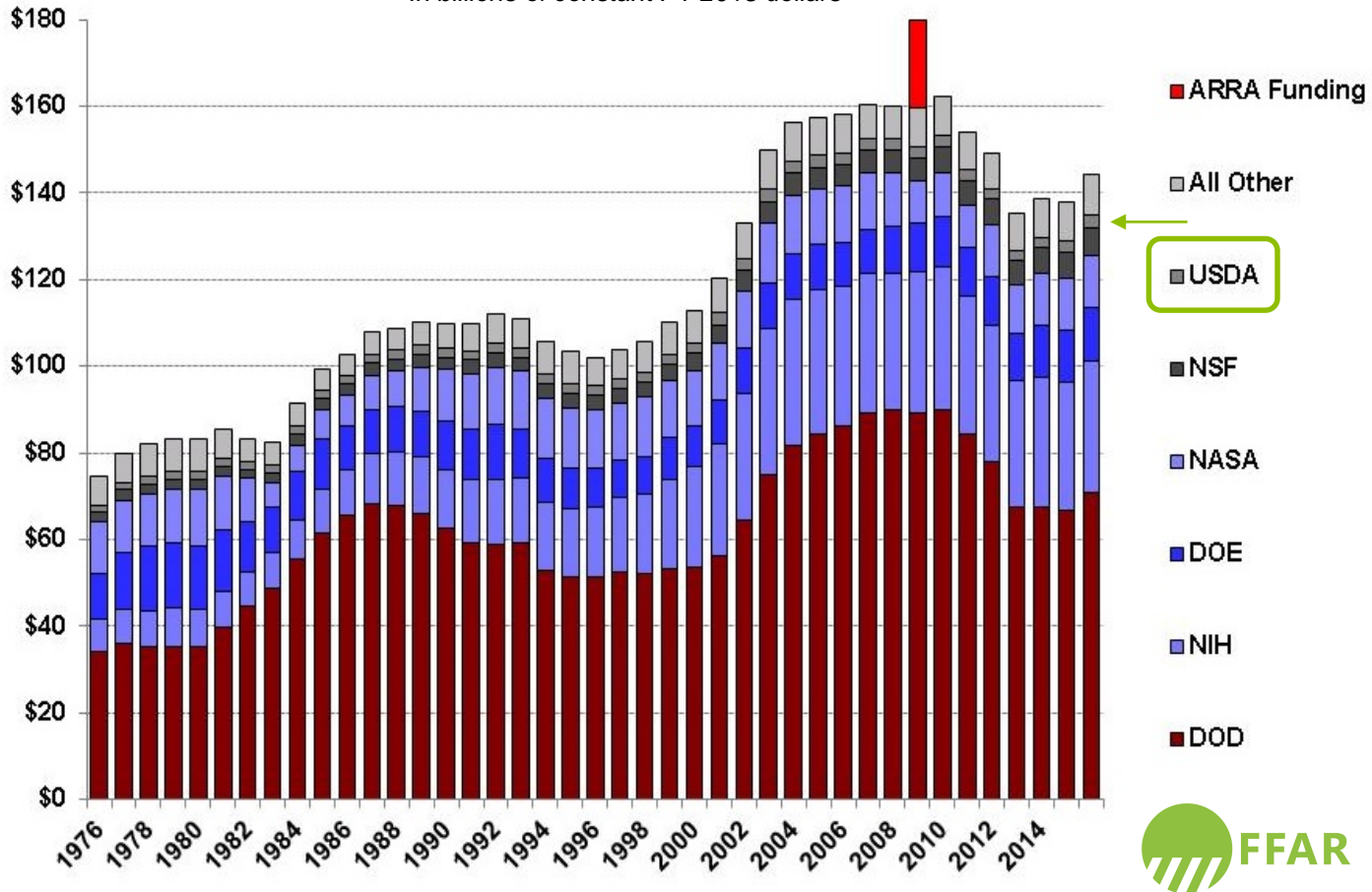
Constant 2011 PPP\$, billions



Source: UDA ERS and ASTI, Organisation for Economic Cooperation and Development

Trends in R&D by Agency

In billions of constant FY 2015 dollars



Why is agricultural research funding not commensurate with its value in improving the quality of life?

“When it comes right down to it, food is practically the whole story every time.”

- Kurt Vonnegut, Galápagos



More food will be eaten in the next 50 years than in the past 7,000 years.

How will we feed 10 billion people when public investment in food and agriculture R&D is declining?



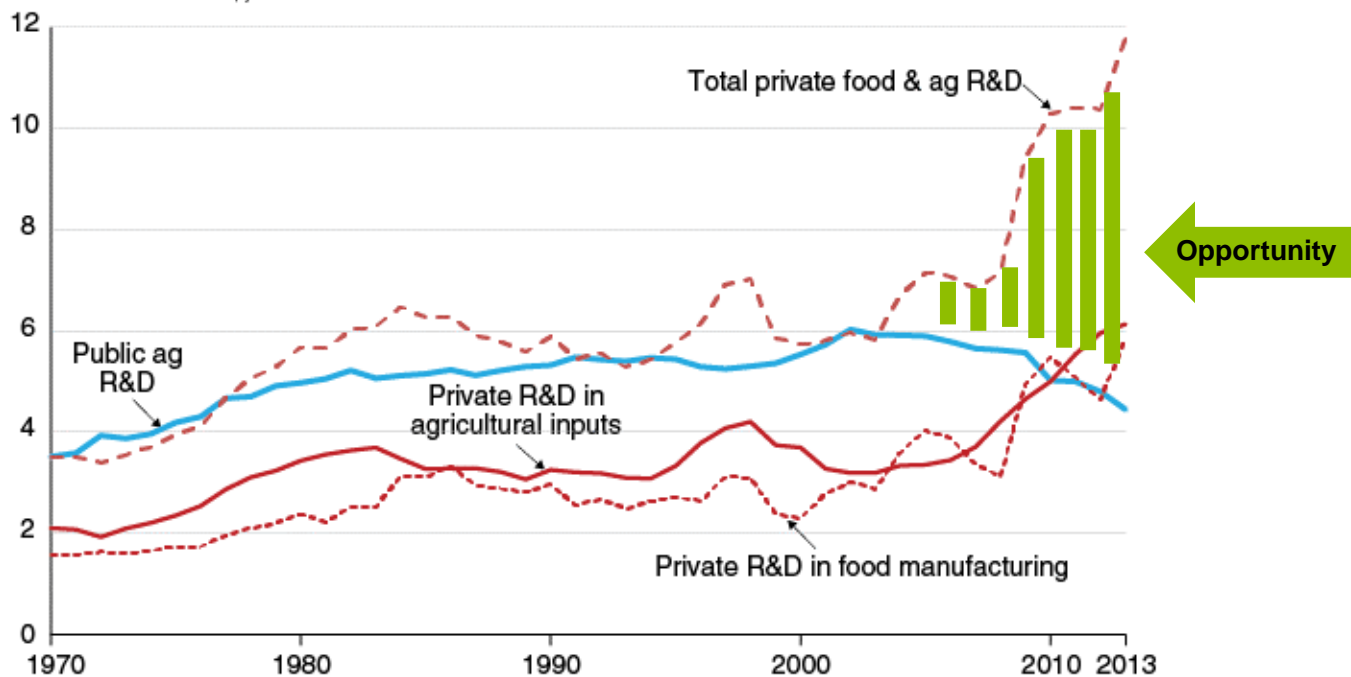
Funding for Agricultural Research

How stagnant funding
has led to new
funding models and
opportunities



The FFAR model leverages private funds for public good.

Constant 2013 US\$, billions



FFAR Mission

We build unique partnerships to support innovative science addressing today's food and agriculture challenges.



The FFAR Model

- **Established with bipartisan** congressional support in 2014 Farm Bill
- **Creates novel research partnerships** across the food and agriculture sector.
- **Works nimbly** to efficiently address emerging issues in food and agriculture.
- **Leverages public dollars** with private dollars to expand research impact.
- **Fills research gaps** to ensure great science supports thriving farms, reduces food insecurity, and supports better health.

Why Engage Industry?

Shift to private and proprietary R&D in agriculture means we must move together.



2) Figure out the Pre-Competitive Space

Pooling resources for public benefit.

Accomplishing more, together.



Pre-Competitive Space:



Areas of business in which a firm feels **comfortable** against **competitive pressures**, on the basis of its **cost advantage** and/or technological **leadership**.

Areas of business in which a firm feels **uncomfortable** against **unambitious relaxation**, on the basis of its **cost disadvantage** and/or technological **inferiority**.

Pre-Competitive Space:



Area of research where outcomes offer no particular advantage relative to peers and where there is potential to positively impact all parties.

Allows resources and data to be readily shared.

Public-Private Partnership Incentives

Private sector incentives:

- Corporate social responsibility
- More rapidly develop products where there are common obstacles to advancement
- Cost savings
- Direct access to important fundamental research
- Access to academic expertise
- Cultivate future employees through access to students and trainees

Public Sector incentives:

- Address real-world problems
- Generate research that is transferred quickly to the economy
- Access to resources and data otherwise unattainable
- Access to expertise

How to make public-private partnerships work

- Shared Goals
- Shared values (honesty)
- Agreement on responsibilities and rules of engagement including IP
- Transparent value proposition for each partner (trust)
- Synergy (goals cannot be achieved by any partner working alone)
- Skin-in-the-game from all partners
- Joint celebration of successes
- Shared responsibility for failures



Who is Funding Ag Research?

Investments are coming from unconventional sources



- **Venture Capitalists**
- **Philanthropists**
- **Private Foundations**
- **Industry**
 - Including non-ag companies

Crops of the Future

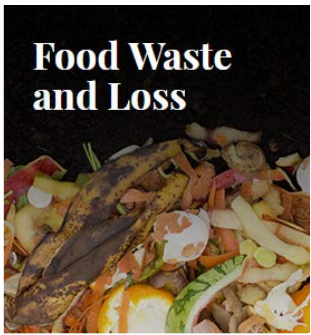
A  FFAR COLLABORATIVE

Founding Partners



FFAR Challenge Areas

Food Waste and Loss



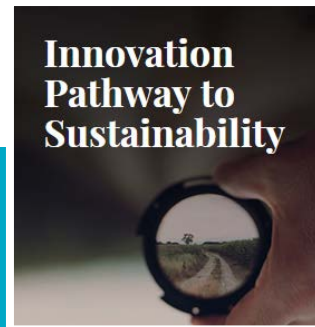
Healthy Soils, Thriving Farms



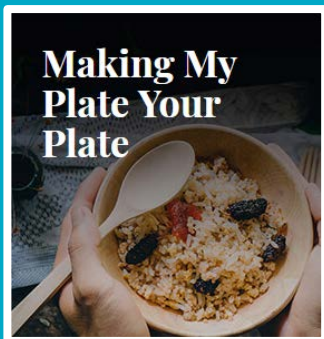
Protein Challenge



Innovation Pathway to Sustainability



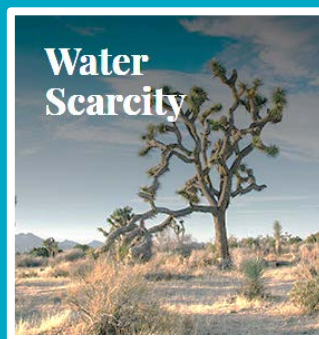
Making My Plate Your Plate



Urban Food Systems



Water Scarcity



*“The nation that destroys its
soil destroys itself.”*

-Franklin D. Roosevelt



Grand Challenges in Agriculture

Feeding the
World



Plant
Efficiency



Improving
Health &
Nutrition



Environmental
Stewardship

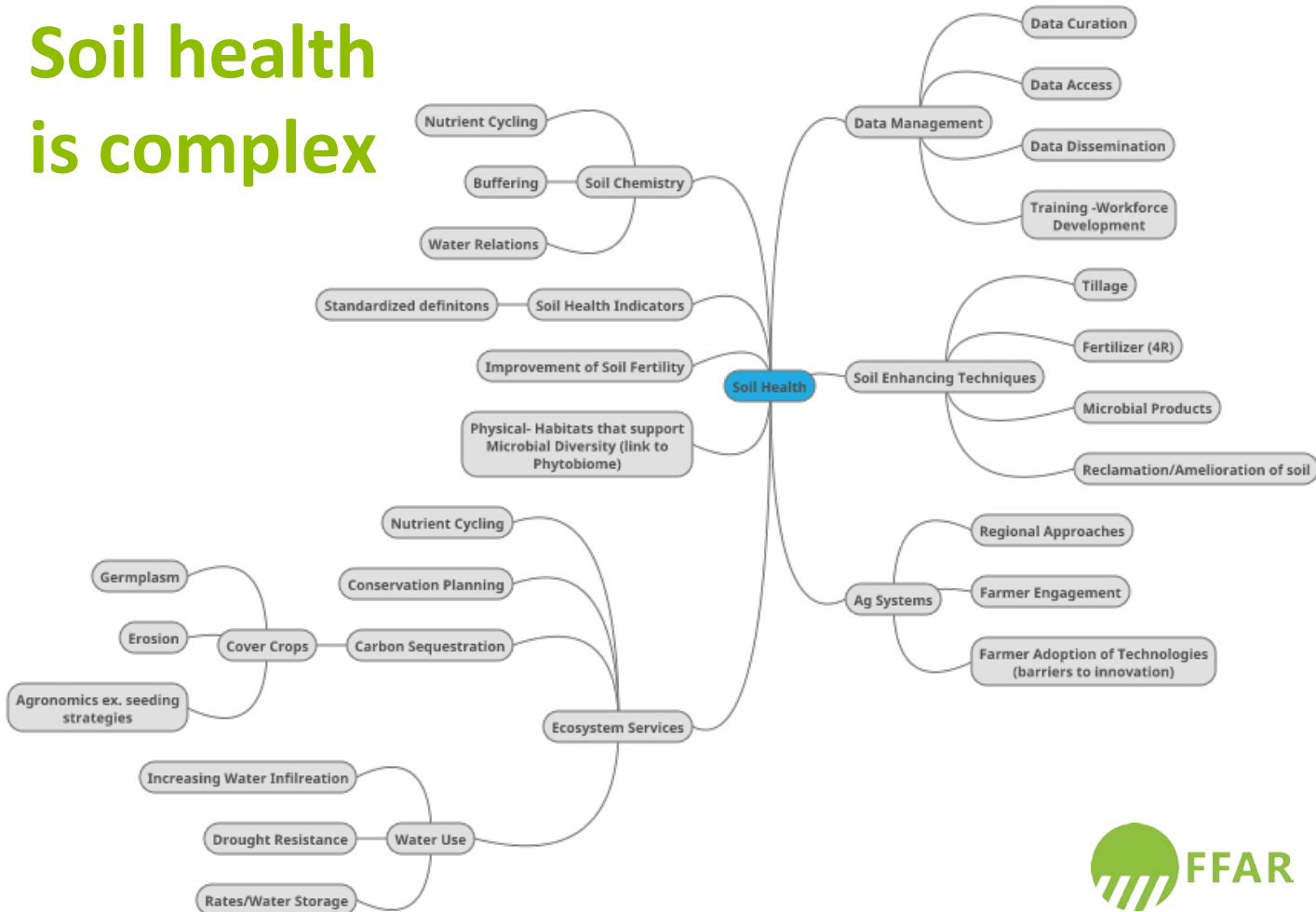


Sustainable
Livestock

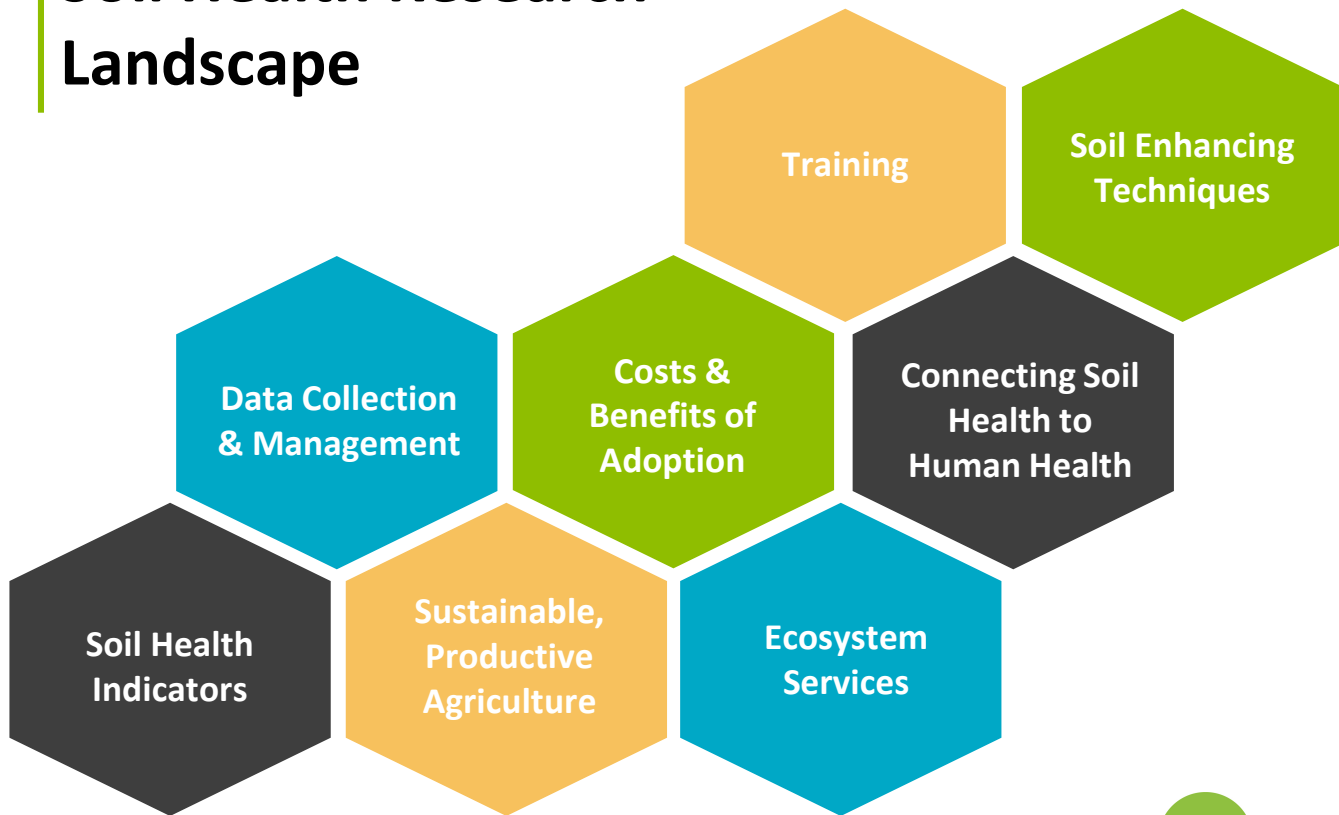


Soil Health

Soil health is complex



Soil Health Research Landscape



**How do we continue to
make advances in soil health
research?**

Burgeoning Fields in Soil Health

Our understanding of soil health is expanding from physical chemistry to complex biological and ecological sciences.



Photo courtesy TNS Sofries

- **Big Data**
- **Microbiome**
- **Standardized Measurements**
- **Multiple Biological Systems Analysis**
- **Economic Impacts**
- **Improving Plant Efficiency**
- **Soil Health => Animal Health**
- **Soil Health => Human Health**

National Cover Crop Initiative

A FFAR Strategic Priority

\$6.6M investment with Noble Foundation to:

- Enhance the health and future **productivity** of U.S. soils
- Increase profitability and sustainability for thousands of farmers across the U.S.
- Yield a host of environmental benefits.





A Milestone for U.S. Farmers



\$20 Million to Improve Soil Health

What's next for soil health?

**Let's work together to support and apply
agriculture research that spurs the innovation
we need for human, environmental and
economic health in the future.**

Connect with FFAR

**Text FFAR to 22828 or
visit <http://bit.ly/ffarnewsletter>**



Thank You

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