Agenda

INTRODUCTIONS

REVIEW PROJECT OBJECTIVE

DESK RESEARCH OUTPUT

INTERVIEW OUTPUT

STRATEGIC OPPORTUNITIES AND CHALLENGES
The Context Network® is the premier global agribusiness consulting firm helping each client achieve remarkable results and advance agriculture.

**Practice Areas We Serve**
- AG Sustainability
- Food Manufacturers
- AG Development
- Food Manufacturing
- Foodservice & Retail
- AG Outputs Distribution
- Technology Providers
- Industry and Trade Organizations
- Local, Regional and National Governments
- NGOs, Private Institutions and Charitable Organizations

**Clients We Support**
- Multinational Agribusiness Companies
- Technology Providers
- Local, Regional and National Governments
- Multinational Food Companies
- Industry and Trade Organizations
- NGOs, Private Institutions and Charitable Organizations

**Services We Provide**
- Strategic Consulting
- Management Consulting
- Insights
**Project Objective, Scope and Methodology:**

**OBJECTIVE**

The **PRIMARY OBJECTIVE** of this **LANDSCAPE ANALYSIS** is to identify the opportunities and challenges in agronomy, crop, soil and environmental science that can **INFORM ACSESS STRATEGIC PLAN** (e.g., novel science, knowledge transfer, impact, and strategic relationships).

**SCOPE**

The landscape assessment will cover the following issues specific to agronomy crop, soil, and environmental sciences performed by **DESK RESEARCH** and up to **12 INTERVIEWS:**

1. **Industry trends and market changes** – Agricultural industry trends and market dynamics related to agronomy, crop, soil, and environmental sciences
2. **Consumer and Non-governmental organization (NGO)** – Consumer and NGO awareness, activation and engagement strategies related to crop, soil and environmental sciences
3. **Integrated technologies and partnerships** – Investments, alliances, and advances in integrated technologies to enhance data and information flow related to crop, soil and environmental sciences
4. **Policy (federal and state)** – Persistent and emerging trends in lobbying and policy development specific to crop, soil, and environmental sciences
Project Timeline & Deliverables:

### Timeline

- **January 9th**
  - Project Kick-off
  - Begin Desk Research
  - Initiate Interview Requests

- **February 3rd**
  - Schedule and facilitate interviews
  - Distil insights from desk research and interviews
  - Put together final deliverable materials
  - Identify potential next steps
  - Final Deliverable Meeting

### Deliverables

- **Landscape assessment of issues specific to crop, soil and environmental sciences**
- **12 interviews**
- **Executive summary and supporting appendix in PowerPoint**
Desk Research: Industry Dynamics Findings

On-Farm Sustainability:
Soil health is becoming a big focus and practices such as cover crops and reduced tillage are increasing in popularity.

Alternative Proteins
Alternative protein is not just a fad, but it also has significant hurdles to displace conventional meat.

Local and Clean Label Food:
While these categories are not well-defined, consumers view “natural” and “clean label” as important in buying decisions.

Organic/Specialty Products
The retail-level organic food market value has increased fivefold over the past fifteen years as consumers value differentiation.

Food Waste
Huge amounts of food are lost or wasted in the US annually – estimated at nearly 1/3 of the food supply.

CSR / Sustainability
86% of S&P 500 companies have CSR reporting, driven by their consumers – this is being passed along to the farm level.

STEM Career Trends
Ag graduates have been in short supply in recent years and are projected to remain in short supply compared to annual demand.

Protein Demand
Global protein and meat consumption has risen sharply in past decades and is expected to continue.
Desk Research: NGO Findings

Resource Investments

TNC is the most well-funded of the three NGOs and likely devotes the most resources to agriculture. 50 – 70% of the three NGOs’ funding is spent directly on conservation activities.

Organization Priorities

EDF, TNC, and WWF’s organizational priorities are very similar; all three focus on climate, water, and land. TNC and WWF also focus on food.

Agriculture Priorities

All three NGOs focus on eliminating ag-related deforestation. Otherwise, their ag focus areas and approaches to sustainable agriculture are diverse and varied.

Strategies

There are six primary ways through which the three NGOs affect change: business and economics, investments, partnerships, policy, science, and technology.

Partnerships

Each NGO’s partnerships vary, reflecting their priorities. However, several are universally popular: Dairy Sustainability Alliance, Field to Market, and The Sustainability Consortium.

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**Organization Priorities**

- Climate and Energy
- Oceans
- Agriculture
- Natural Resources
- Health
- Others

**Agriculture Priorities**

- Agriculture
- Forestry
- Water
- Biodiversity
- Healthy Cities
- Business

**NGO Strategies**

1. Partner with the private sector
2. Support local leadership and communities
3. Educate and engage stakeholders
4. Legal and regulatory
5. Science and technology
6. Policy and advocacy
7. Business and economics

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**NGO & Advocacy Partnership Involvement (1/3)**

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<thead>
<tr>
<th>NGO</th>
<th>EDF</th>
<th>TNC</th>
<th>WWF</th>
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<tbody>
<tr>
<td>Climate and Energy</td>
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<tr>
<td>Oceans</td>
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<tr>
<td>Agriculture</td>
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<td>Others</td>
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</table>
INVESTMENTS

- Investments in agri-food tech have increased at a 37% CAGR since 2012 and are expected to continue to rise.
- Major market include U.S., China, and India
- Relevant sectors include biotech, midstream technologies, farm management software, sensing & IoT

Alliances

- Most major partnerships are at least 50% composed of industry members, giving ACSESS the opportunity to be a leading scientific voice
- Major partnerships span the international, national, and regional domains, providing opportunity for engagement at various levels
**Advanced Breeding:**
Advanced breeding techniques, such as CRISPR, are gaining momentum, but consumer acceptance and industry impact is generally unclear.

**Climate Change / GHGs:**
Agriculture is a noteworthy contributor to GHG emissions, but the industry also has the potential to reverse this effect through sustainable farming practices.

**Water Quality / Flood Mitigation**
Nutrient run-off, water quality issues, and unplanted acreage due to extreme weather events are major issues – BMP’s, policy recommendations and healthier soils can help.

**Urbanization / Rural Decline**
Policy issues to combat rural population loss and economic decline include broadband access, housing availability, business and workforce development, and health care.

**Research Funding Trends**
While funding for several NSF topic areas has decreased over the years, NIFA grants in the areas of sustainable ag production systems and environmental systems remains a large focus.
Interview Findings: Background and Key Themes

INTERVIEW BACKGROUND

Interviews were conducted across industry, commodity associations, academia, NGO, and government organizations to better understand opportunities and challenges in agronomy, soil, crop, and environmental sciences. Interviews were held with senior leaders within each of these organizations.

KEY THEMES

Across interview questions 1a, 1b, 1c, 3, and 5a, sustainability concerns and opportunities were extremely common themes. Stakeholder engagement and partnerships was also a major theme.

Number of Mentions by Topic Area
## Interview Results: Agriculture Industry Tailwinds and Headwinds

<table>
<thead>
<tr>
<th>TAILWINDS</th>
<th>HEADWINDS</th>
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<tbody>
<tr>
<td>Interest in sustainability topics due to consumer and industry concern (soil health, water quality, nutrient management, GHG, carbon sequestration) — economically feasible in the long run due to more efficient use of resources</td>
<td>Unrealistic sustainability pressure from misinformed consumers</td>
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<td>Increasing partnership opportunities and spirit of collaboration throughout the value chain</td>
<td>Low commodity prices / poor ag economic environment</td>
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<td>New technologies, including sensors, artificial intelligence, and research technology</td>
<td>Not enough tactical knowledge on sustainability implementation</td>
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<td>Emphasis on data collection and analysis, providing next-level, real-time insights</td>
<td>Research funding pressure, demise of extension</td>
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<td>Advances in next generation plant breeding and advanced breeding techniques</td>
<td>Attracting talent to agriculture</td>
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<td></td>
<td>Knowledge gap surrounding how to use/implement new technologies</td>
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<td>Research communication – the research exists, but largely inaccessible to industry and public</td>
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## Opportunities & Challenges for ACSESS

### Opportunities

<table>
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<tr>
<th>INCREASED COLLABORATIVE ACTION</th>
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<td>Additional engagement and partnership suggested almost unanimously – Industry/brands, commodity organizations, NGO's, other multi-stakeholder groups, etc.</td>
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<tr>
<th>SCIENTIFIC VOICE IN SUSTAINABILITY</th>
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<td>Given consumer pressures, lack of implementation-based knowledge, fact that many commercial organizations are still struggling, partnership opportunities</td>
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<tr>
<th>REVIEW MESSAGING/ PRESENCE</th>
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<td>Right platforms? Social media presence appropriate? Right conferences and trade show presence?</td>
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<tr>
<th>BIG CHALLENGES IN AGRICULTURE NEED RESEARCH/ SCIENTIFIC SOLUTIONS</th>
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<tr>
<td>Long list!</td>
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### Challenges

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<tr>
<th>DISCONNECT WITH AGRICULTURE</th>
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<td>The expanding gap between farmers and the rest of society continues to impact expectations within our food systems</td>
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<table>
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<tr>
<th>COMMUNICATION OF SCIENTIFIC RESEARCH</th>
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<tr>
<td>Scientific research is viewed as too nuanced, contradictory at times, and not readily applicable to the industry or stored in solos. Better communication of the &quot;so what?&quot; is needed.</td>
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<table>
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<tr>
<th>AGRICULTURE AS A CAREER</th>
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<td>Many young people don’t understand the unique and exciting careers that can be built in agriculture today and tomorrow</td>
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<tr>
<th>PROBLEM OR SOLUTION TO CLIMATE CHANGE?</th>
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<tr>
<td>Society doesn’t understand if modern agriculture is the problem or solution to climate change</td>
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<tr>
<th>AWARENESS &amp; UNDERSTANDING</th>
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<td>Very few people outside of ACSESS membership are aware of who you are and the role you play in the food systems</td>
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Strategic Recommendations

STRATEGIC INITIATIVES TO PURSUE

IDENTIFY YOUR SUSTAINABLE COMPETITIVE ADVANTAGE

Identify the unique role(s) ACSESS plays in the current and future state of agronomy, crop science, soil science and environmental science. The opportunities are bigger than the current role as an association of scientists with limited stakeholder awareness, relevance and value to commercial industry sectors.

ADJUST YOUR BUSINESS MODEL

Develop a clear, concise and comprehensive business plan that evolves your structure, value capture, function and strategic alliances to bring your sustainable competitive advantage to life, while leveraging your core competencies and staying true to your membership, mission and values.

INCREASE STAKEHOLDER ENGAGEMENT

Develop and execute a clear, concise and comprehensive engagement and partnership plan while establishing ACSESS as a more relevant thought leader in shaping and addressing the critical issues of our time – climate change, farm resilience, soil health, water quality and quantity, etc. This involves more than words. It will require internal assessments of resource allocation, competencies and deliverables.
Strategic Recommendations – ACSESS 2.0

STRATEGIC BETS TO PLACE

IDENTIFY YOUR SUSTAINABLE/COMPETITIVE ADVANTAGE
Identify the unique role(s) ACSESS plays in the current and future state of agronomy, crop science, soil science and environmental science. The opportunities are bigger than the current role as an association of scientists with limited stakeholder awareness, relevance and value to other industry sectors.

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Thank you

CONTEXT PROJECT MANAGEMENT:

Matt Sutton-Vermeulen
Catherine Isley
Tyler Uden

www.contextnet.com
Desk Research Output
Industry Dynamics

TOPICS:

On-Farm Sustainability
Issues: Soil health, GHG footprint, Water quality
Practices: Reduced tillage, Cover crops, Edge of field, Environmental markets

Alternative Proteins

Local and Clean Label Food

Organic/Specialty Products

Reduced Food Waste

CSR / Sustainability
Issues: Accountability, Risk mitigation, Finance
Practices: Supply chain pressures, Reporting

STEM Career Trends

Protein Demand (FAO Stat)
On-Farm Sustainability

Cover Crop Acreage by Year and Region

Cover crop acreage has tripled since 2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Acres</th>
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<tr>
<td>2011</td>
<td>100K</td>
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<tr>
<td>2012</td>
<td>150K</td>
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<td>2013</td>
<td>200K</td>
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<td>2014</td>
<td>250K</td>
</tr>
<tr>
<td>2015</td>
<td>300K</td>
</tr>
<tr>
<td>Upcoming 2016</td>
<td>350K</td>
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USDA Region
- Delta
- Pacific
- Southern Plains
- Northern Plains
- Southeast
- Mountain
- Lake States

# of farms planting cover crops in 2012: 133,124
# of farms planting cover crops in 2017: 153,402
15% increase in farms planting cover crops

No-till Prevalence by Farm Size

Since 2005, no-till prevalence has increased amongst small and large farms

<table>
<thead>
<tr>
<th>Year</th>
<th>&lt;250</th>
<th>250-999</th>
<th>1000+</th>
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<tbody>
<tr>
<td>2005</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
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<tr>
<td>2010</td>
<td>15%</td>
<td>25%</td>
<td>35%</td>
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<tr>
<td>2015</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
</tr>
<tr>
<td>2016</td>
<td>25%</td>
<td>35%</td>
<td>45%</td>
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<tr>
<td>2017</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
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</tbody>
</table>

Producers spent $257 million on seed for cover crops in 2017

In 2017, 61% of cover crops were planted on farms of over 1,000 acres

Studies are finding that conservation helps farmland be more resilient to variable weather. In 2019, fields where reduced tillage and cover crops had been used drained more quickly and allowed for normal planting. Many non-conservation acres remained too wet and remained unplanted.

KEY TAKEAWAYS
1) Soil health matters – Resilience, Water quality, GHG opportunity
2) The adoption of cover crops is increasing at a rapid rate
3) The prevalence of reduced and no-till has been variable, but it may increase given recent societal emphasis on carbon sequestration
4) Cover crops and reduced tillage provide long-run agronomic benefits, but producers often face short-term hurdles (economics, knowledge) that keep them from realizing the full benefits
Alternative Protein

**MARKET VALUE**

- Current alternative protein market value: $2 billion - $4 billion globally
- Annual alternative protein market growth rate: 9-16%
- Future market estimates: $6.6 billion in 2024, $18 billion in 2025, $140 billion in 2030 worldwide
- Current meat market value: $1.4 trillion - $1.7 trillion worldwide

**MARKET DRIVERS**

- Animal welfare concerns
- Sustainability and environmental concerns
- Perceived by some consumers as a healthier alternative to traditional meat
- Allows food companies to diversify supply chains and spread risk
- Optionality and versatility – soy, whey, insect, pea, cultured, and fungi-based protein

**MARKET BARRIERS**

- Price not competitive currently with traditional meat
- Inferior flavor and texture; generally limited to ground beef-style products
- Some regulatory progress made, but confusion and conflict remains, especially surrounding labeling
- Concerns surrounding high level of processing – “fake food”
- Cell-cultured and fungi-based protein are more promising, but have years until commercial viability

**MARKET VALUE**

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- Current meat market value: $1.4 trillion - $1.7 trillion worldwide

**CONSUMER STATISTICS**

- 89% - 98% of alternative protein buyers also buy meat
- 22% of U.S. households purchased meat alternatives in 2019.
- Around 30% of U.S. consumers are “very or extremely likely” to eat lab grown or plant-based meat
- Around 25% of U.S. consumers are “not at all likely” to eat lab grown or plant-based meat

**KEY TAKEAWAYS**

1) Alternative protein is not a fad, but it also has significant hurdles to displace conventional meat
2) About as many consumers aren’t likely to eat alternative protein as those who are; it’s not for everyone
3) The space still faces many challenges, such as price, flavor, texture, and the perception of “fake food”. However, alternative protein is expected to convert up to 10% of the meat market share by 2030

Local and Clean Label Food

“Local food” has no set definition; its definition varies by individual consumer and type of food product. For statistical purposes, USDA defines “local food” as food sold direct to consumer or through regional intermediaries.

Local versus Non-local Food Market Value (Billions, 2012)

- Local Food: $6.1 B
- Non-Local Food: $643.9 B

In 2012, only 1% of food consumed in the U.S. (by value) was considered local.

Like local food, “clean label” doesn’t have a set definition. But “clean label” generally indicates natural, whole, and unprocessed ingredients.

In 2015, global sales of clean label foods reached $165 billion.

52% of consumers in North American and Europe say that recognizable, natural ingredients is an important factor when purchasing food.

In 2012, farms with income below $75,000 accounted for 85% of local food farms but only 13% of sales.

In 2012, 67% of local farm food sales came from farms with sales greater than $350,000.

When we think of local food, we usually think of small farms. However, data shows this association is largely incorrect.

KEY TAKEAWAYS

1) Local and clean food is a hot topic for consumers. But, in reality, these categories compose as little as 1% of U.S. food consumption.
2) There is no one definition for local or clean food—these definitions vary by person and type of food product.

https://www.agmrc.org/markets-industries/food/food-consumption-trends
https://www.foodinsiderjournal.com/clean-label/75-consumers-will-pay-extra-clean-label-ingredients
Organic and Specialty Products

Organic acreage held relatively constant between 2008 and 2014, but has since increased significantly.

The retail-level value of the organic food market has been steadily increasing since 2003.

In 2016, $7.6 billion (farm-level) worth of organic ag products were produced in the U.S.

In 2016, 0.6% of the U.S.’s 911 million acres of farmland were certified organic.

Fruit and vegetables are by far the largest organic crop by value.

KEY TAKEAWAYS

1) The retail-level organic food market value has increased fivefold over the past fifteen years and will continue to grow. Organic acres have not increased as steeply.

2) Vegetables and Fruit are the largest organic crop categories by value. Organic dairy and meat are also popular.
Reduced Food Waste

In 2010, retail- and consumer-level food loss and waste in the U.S. was 31% of the food supply, equaling 133 billion pounds and almost $162 billion.

In 2015, USDA and EPA set a goal to cut the nation's food waste by 50% by the year 2030.

Fruit, vegetables, and leftovers have the highest amount of waste.

Top fresh F&V in terms of loss volumes and rates in food stores

Volume in 2016, million pounds

Rate in 2011-12, percent

Potatoes, tomatoes, romaine lettuce, watermelon, apples, and pineapple are the most wasted fruit and vegetables in food stores.

CONSUMER VIEWS

Saving money is consumers’ largest motivator for reducing food waste.

83% of people say the top reason for food waste at home is spoiled or stale food.

34% of consumers always consider food waste while grocery shopping, 28% while eating at home, and 19% while eating out.

WHAT’S BEING DONE?

USDA has started the Food Loss and Waste Champion program, which organizations can join to publicly commit to reducing food waste.

USDA has also partnered with various food-related trade associations in helping their members reduce food waste.

KEY TAKEAWAYS

1) Huge amounts of food are lost or wasted in the US annually – nearly 1/3 of the food supply in 2010.
2) This problem is mainly relevant to the fruit and vegetable industry – commodities and animal protein have less incidence of loss and waste.
3) Many initiatives are underway to improve the situation, including several USDA initiatives.
Corporate Social Responsibility (CSR) Reporting

86% of S&P 500 companies published sustainability or CSR reports in 2018

84% of S&P 500 total valuations are intangible assets not captured on a balance sheet. This has resulted in shareholders using ESG ratings to assess and manage risk associated with their investments

47% of US consumers say they would pay more for a sustainable product

As of 2017, about 25% of dollars under professional investment management in the US were invested according to SRI strategies. This equates to about $12 trillion dollars

WHAT DO CSR REPORTS CONTAIN?
- Usually focused around the three pillars of corporate sustainability: economic, environmental, and social
- Key issues related to ACSESS include: GHG footprint, Water quality & quantity
- Many reports align with the United Nation’s 2030 Sustainable Development Goals
- CSR reporting is often integrated with a company’s annual report

This emphasis on social and environmental responsibility has been driving trends towards farm-level transparency. Technology facilitating traceability, reporting, and verification from farm to table is becoming more widely used.

CSR reporting has increased greatly over the past decade. The prevalence in sustainable, responsible, and impact investing (SRI) is a major driver of this increase

Key Takeaways
1) The vast majority of publicly traded companies publish CSR reports – this was not the case just a decade ago
2) This trend is driven by shareholder risk management expectations due to unprecedented levels of intangible assets regarding stock valuations
3) The need for corporate-level sustainability metrics is driving a trend towards increased farm-level sustainability and product traceability
There are **mixed views** on whether we are facing a surplus or shortage of STEM graduates. Whether there's a shortage or surplus varies by the **specific STEM discipline** and the **level of education** (bachelor's, master's, PhD).

For example, there is a **surplus of biology graduates** but a **shortage of computer science graduates**. We are generally seeing a shortage of agriculture-focused science grads. About **58,000** jobs in ag are expected to open annually through 2021, but ag grads are expected to fill only **60%** of those positions.

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**STEM Graduates by Year (bachelor's level)**

The number of STEM grads has been increasing steadily over the past decade, both in absolute terms as a percentage of all graduates.

**Starting Salaries of Select Non-Ag and Ag Majors**

For example, there is a **surplus of biology graduates** but a **shortage of computer science graduates**

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**KEY TAKEAWAYS**

1) Supply and demand for STEM grads is specific to individual disciplines
2) Ag graduates have been in short supply in recent years and are projected to remain in short supply
3) Biosystems Engineering and Agronomy are the only ag majors with starting salaries comparable to those of the top earning STEM majors

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Additional resources:
- [Visualizing Salaries of College Degrees](https://www.visualcapitalist.com/visualizing-salaries-college-degrees/)
- [STEM Crisis or STEM Surplus: Yes and Yes](https://www.nytimes.com/2017/11/01/education/edlife/stem-jobs-industry-careers.html)
- [Career Surveys and Salaries](https://www.career.cals.iastate.edu/files/page/files/salary_survey_2018_regional_final.pdf)
- [Federal and State Policy](https://nces.ed.gov/programs/digest/d18/tables/dt18_322.10.asp)
Protein Demand

Global protein consumption has risen 40% since 2000, with more than half of the increase being driven by Asia.

Through 2025, China is expected to contribute 30% of the total global increase in total meat consumption and 50% of the global increase in pork consumption.

In 2025 China is expected to account for 35% of the global protein market in both value and volume.

Growth in meat consumption has been highest in countries that have seen strong economic growth—China, Japan, and Brazil, for example. This trend is expected to continue.

However, some Asia-Pacific countries, including India, have cultural preferences for less meat-based diets and will likely not follow this pattern.

Poultry has seen the largest increase in consumption over the past 50 years (5x). Pork has also seen a substantial increase (2x).

**KEY TAKEAWAYS**

1) Global protein and meat consumption has risen sharply in past decades
2) China will lead the future increase in meat consumption, composing 35% of the global protein market by 2025
3) Most of this growth will come from pork and chicken.
## Impact / LOS Exercise

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>On Farm Sustainability</th>
<th>Alternative Protein</th>
<th>Local/Clean Label Food</th>
<th>Organic / Specialty Products</th>
<th>Reduced Food Waste</th>
<th>CSR Reporting</th>
<th>STEM Career Trends</th>
<th>Worldwide Protein Consumption</th>
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**Ability for ACCESS to IMPACT**

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<tr>
<th>Ability for ACCESS to IMPACT</th>
<th>Likelihood of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

**KEY**

- High
- Moderate
- Low
NGO Advocacy — NGOs are the scientific and social Kevlar to brands in the global food systems

ORGANIZATIONS:

- Environmental Defense Fund
- The Nature Conservancy
- World Wildlife Fund
- Soil Health Initiative
- Soil Health Partnership

TOPICS:

- Resource Investments
- Organization-Level Priorities
- Agriculture Priorities
- Strategies
- Partnerships
2019 EDF Expenses
- Climate and Energy: $7M
- Fundraising: $6M
- Education: $20M
- Ecosystems: $22M
- Oceans: $27M
- General and Admin: $30M
- Purchases of Conservation Land and Easements: $2M
- Health: $2M

2019 TNC Expenses
- Conservation Activities and Actions: $113M
- General and Admin: $143M
- Fundraising: $162M
- Purchases of Conservation Land and Easements: $520M

2019 WWF Expenses
- Conservation Field and Policy Programs: $18M
- Public Education: $41M
- Fundraising: $101M
- General and Admin: $148M

KEY TAKEAWAYS
1) In 2019, nearly half of EDF’s spending went towards its Climate and Energy focus area. 11% of spending went towards Ecosystems, the focus area of which agriculture is a part.
2) TNC is the most well-funded of the three NGOs, but it also spends the largest percentage of its resources on administrative and fundraising. Over half of its funding goes towards conservation programming. 12% goes towards directly purchasing conservation land and easements.
3) Compared to the other NGOs, WWF has a large focus on public education, with 1/3 of its 2019 spending going towards this area.
### Organization Priorities

<table>
<thead>
<tr>
<th>EDF Areas of Focus</th>
<th>TNC Priorities</th>
<th>WWF Goal Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate and Energy</td>
<td>Tackle Climate Change</td>
<td>Climate</td>
</tr>
<tr>
<td>Oceans</td>
<td>Protect Land and Water</td>
<td>Food</td>
</tr>
<tr>
<td>Ecosystems</td>
<td>Provide Food and Water Sustainably</td>
<td>Forests</td>
</tr>
<tr>
<td>Health</td>
<td>Build Healthy Cities</td>
<td>Fresh Water</td>
</tr>
</tbody>
</table>

#### EDF Areas of Focus
- Climate and Energy
- Oceans
- Ecosystems
- Health

#### TNC Priorities
- Tackle Climate Change
- Protect Land and Water
- Provide Food and Water Sustainably
- Build Healthy Cities

#### WWF Goal Areas
- Climate
- Food
- Forests
- Fresh Water
- Influencing Policy
- Oceans

#### SHI Goals
- Recruit a network of demonstration farms
- Establish research protocols
- Publish findings and recommendations
- Support networking and technical assistance
- Provide a research funding pool
- Be a centralized hub of soil health information
- Conduct research gap assessments
- Provide best expertise
- Be an unbiased authority on soil health
- Facilitate researcher collaboration
- Support soil health researchers
- Promote soil health
- Rehabilitate soils in developing countries

#### SHP Goals
- Establish research protocols
- Publish findings and recommendations
- Support networking and technical assistance
- Recruit a network of demonstration farms

### Key Takeaways
1. Each NGO has climate-related, water-related, and land-related focus areas. TNC and WWF also have food focus areas.
2. Additionally, EDF prioritizes human health, TNC prioritizes creating healthy cities, and WWF prioritizes influencing policy.
3. Most of SHI’s goals are research- and information-oriented, while most of SHP’s goals are boots-on-the-ground action-oriented.
NGO’s Agricultural Priorities

**DEFORESTATION**
- EDF: Eliminate deforestation
- TNC: Eliminate deforestation
- WWF: Eliminate deforestation

**WILDLIFE AND BIODIVERSITY**
- EDF: Protect wildlife on working lands
- TNC: Protect biodiversity

**WATER QUALITY**
- TNC: Improve water quality
- WWF: Improve water quality

**WATER SCARCITY**
- EDF: Rebalance water use in the American West. Reverse groundwater depletion. Reward farmers for smart water use
- TNC: Tackle water shortage
- WWF: Make water usage more efficient

**AG LAND**
- EDF: Foster sustainable land use
- EDF: Utilize nature-based solutions on working lands
- TNC: Improve soil health and store carbon
- TNC: Preserve wetlands and grasslands. Utilize conservation easements

**OTHER**
- EDF: Get harmful chemicals out of our food
- TNC: Advocate for Farm Bill conservation
- TNC: Support smallholder farmers

**COMMODITY AG**
- EDF: Improve sustainability of commodity crop production
- WWF: Make beef, dairy, palm oil, soy, and sugarcane production more sustainable

---

**KEY TAKEAWAYS**

1) All three NGOs prioritize the elimination of deforestation and addressing water scarcity.

2) WWF takes a very broad and commodity-focused approach to ag sustainability. The organization focuses specifically on beef, dairy, palm oil, soy, and sugarcane, not necessarily more crosscutting issues like soil health, biodiversity preservation, etc.

3) TNC takes the most specific, issue-based approach to ag sustainability. They focus specifically on soil health, carbon storage, and land preservation.

---

### NGO Strategies

<table>
<thead>
<tr>
<th>STRATEGY</th>
<th>Business / Economics</th>
<th>Partnerships</th>
<th>Policy</th>
<th>Science</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDF</td>
<td>Harness the <strong>pursuit of profit</strong></td>
<td>N/A</td>
<td>Work with <strong>strategic partners</strong>, such as landowners and businesses</td>
<td>Utilize <strong>non-partisan and collaborative policymaking</strong></td>
<td>Use the latest science to identify the most serious problems and their solutions</td>
</tr>
<tr>
<td>TNC</td>
<td>Work with the <strong>private sector</strong></td>
<td><strong>Invest in nature</strong> (NatureVest unit)</td>
<td>Work with the <strong>private sector</strong></td>
<td>Drive policy in a <strong>nonpartisan way</strong></td>
<td>Center on <strong>evidence-based science</strong></td>
</tr>
<tr>
<td>WWF</td>
<td>Protect places and species while creating <strong>opportunities for business</strong></td>
<td>N/A</td>
<td>Leverage strengths of <strong>collaborations</strong> to achieve success</td>
<td>Secure <strong>transformative change</strong> at all levels of government in the U.S. and overseas</td>
<td>Ground conservation in science – biology, hydrology, oceanography, and social sciences</td>
</tr>
</tbody>
</table>

**KEY TAKEAWAYS**

1. There are six primary ways through which the three NGOs affect change: business and economics, investments, partnerships, policy, science, and technology.
2. All three rely on business and economics, policy, partnerships, and science.
3. Additionally, TNC emphasizes investments (through their NatureVest unit) and technology and innovation.
# NGO & Advocacy Partnership Involvement (1/3)

<table>
<thead>
<tr>
<th></th>
<th>4Rs plus</th>
<th>Big Pine Watershed Partnership</th>
<th>Cargill partnership</th>
<th>CDP</th>
<th>Dairy Sustainability Alliance</th>
<th>Field to Market</th>
<th>Forward Farming</th>
<th>Global Harvest Initiative</th>
<th>Global Roundtable for Sustainable Beef</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Defense Fund</td>
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<tr>
<td>The Nature Conservancy</td>
<td>✔</td>
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<tr>
<td>Soil Health Institute</td>
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<td>World Wildlife Fund</td>
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<tr>
<td>NGO &amp; Advocacy Partnership Involvement (2/3)</td>
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</table>

<table>
<thead>
<tr>
<th>Institute for Ag and Forest Management and Certification</th>
<th>Land Stewardship Target Initiative</th>
<th>Midwest Agriculture Water Quality Partnership</th>
<th>Midwest Row Crop Collaborative</th>
<th>Monarch Collaborative</th>
<th>Precision Conservation Management</th>
<th>Pro-Natura</th>
<th>Roundtable on Responsible Soy</th>
<th>Salt and Verde Alliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Defense Fund</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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## NGO & Advocacy Partnership Involvement (3/3)

### Key Takeaways

1. Several partnerships have high participation among the five organizations researched: Field to Market (5 orgs), Dairy Sustainability Alliance (4 orgs), and The Sustainability Consortium (4 orgs).
2. In addition, all three NGOs are involved with the Midwest Agriculture Water Quality Partnership, Midwest Row Crop Collaborative, and Precision Conservation Management.
3. The three NGOs each have direct, custom partnerships with individual corporations, including Cargill, Smithfield, Syngenta, and Walmart.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Smithfield partnerships</th>
<th>Soil Health Institute</th>
<th>Soil Health Partnership</th>
<th>Sporting Sustainability</th>
<th>SUSTAIN</th>
<th>Syngenta partnership</th>
<th>The Sustainability Consortium</th>
<th>US Roundtable for Sustainable Beef</th>
<th>Walmart collaboration</th>
<th>World Water Day Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Defense Fund</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>World Wildlife Fund</td>
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</tr>
</tbody>
</table>

Source: Context Analysis
Partnership and Initiative Glossary, 1/2

1. **4Rs Plus**: The 4R Plus initiative / partnership focuses on improving soil health and water quality through the 4R’s (right source, right time, right rate, right place), plus conservation practices.

2. **Big Pine Watershed Partnership**: Engage the power of the supply chain and the trust of agronomy retailers to further conservation in Indiana’s Big Pine watershed through the targeted implementation of nutrient and sediment reducing practices.


4. **CDP**: Focuses investors, companies and cities on taking urgent action to build a truly sustainable economy by measuring and understanding their environmental impact. Sustainability rating body for corporations and organizations.

5. **Dairy Sustainability Alliance**: The Dairy Sustainability Alliance is a multi-stakeholder group that provides a forum for member organizations to share knowledge, collaborate on issues affecting the dairy industry at large and accelerate progress toward common sustainability goals.

6. **Field to Market**: Field to Market's vision is to harness the collective action of the value chain to increase sustainability. Their work is grounded in science-based tools, collaboration, and increased supply chain transparency.

7. **ForwardFarming**: In partnership with independent farmers, Bayer ForwardFarming creates opportunities for demonstration, dialogue, and collaboration on farms around the world.

8. **Global Harvest Initiative**: Global Harvest Initiative (GHI) is a private-sector policy voice for productivity growth throughout the agricultural value chain to sustainably meet the demands of a growing world. Works in the US and internationally.

9. **Global Roundtable for Sustainable Beef**: The GRSB mission is to advance continuous improvement in sustainability of the global beef value chain through leadership, science and multi-stakeholder engagement and collaboration.

10. **Institute for Ag and Forest Management and Certification**: Encourage and promote changes in the forestry and agricultural sectors, aiming at the conservation and sustainable use of natural resources and the generation of social benefits.

11. **Land Stewardship Target Initiative**: Tyson Foods commitment to support improved environmental practices on two million acres of corn by the end of 2020. This supports Tyson Foods' recently announced goal of reducing greenhouse gas (GHG) emissions 30 percent by 2030.

12. **Midwest Agriculture Water Quality Partnership**: Diverse group of committed partners that engage farmers and help scale-up water quality efforts in targeted watersheds.

13. **Midwest Row Crop Collaborative**: Diverse coalition working to expand agricultural solutions that protect air and water quality and enhance soil health while remaining committed to producing enough food to feed the growing global population. Focusses on Illinois, Iowa, Nebraska.
Partnership and Initiative Glossary, 2/2

14. **Monarch Collaborative**: Diverse group of stakeholders, including scientists, conservationists, farmers, and the private sector, working to find collaborative solutions to strengthen monarch populations and habitat.

15. **Precision Conservation Management**: Initiative to increase conservation using precision farming technology and farm business management principles.

16. **Pro-Natura**: Tackles the social, economic and environmental problems that face rural communities in the developing world.

17. **Roundtable on Responsible Soy**: Encourage current and future responsible soybean production to reduce social and environmental impacts while maintaining or improving the economic status for the producer.

18. **Salt and Verde Alliance**: Alliance of communities, corporations, farmers, and other organizations working to replenish the water supply of the Salt and Verde rivers.


20. **Soil Health Institute**: Vision is to be “the primary resource for soil health information and research”.

21. **Soil Health Partnership**: Network of farmer orgs and industry companies working to make soil health practices a reality.

22. **Sporting Sustainability**: Alliance of organizations supporting the reduction of food waste in the Midwest.

23. **SUSTAIN**: Goal is to work with farmers along all points along the food supply chain to reduce fertilizer runoff, safeguard the environment, and ensure farm productivity.

24. **Syngenta partnership**: Have worked with TNC for over a decade on various projects supporting sustainable agriculture. New project surrounding soil health, resource efficiency, and habitat protection.

25. **The Sustainability Consortium**: Group of diverse stakeholders working to improve the sustainability of the consumer packaged goods sector.

26. **US Roundtable for Sustainable Beef**: Goal is to advance, support and communicate continuous improvement in the sustainability of U.S. beef production by educating and engaging the beef value-chain through a collaborative multi-stakeholder effort.

27. **Walmart collaboration**: Goal is to reduce Walmart's impact on the environment and the impact of its suppliers and distributors.

28. **World Water Day Project**: With PepsiCo. Goal is to conserve and replenish water in the Southwestern US.
Partnerships, Investments, and Technologies

Topics:

Ag Funder & Crop Life Reports on Deals
#, $, and By Type

Alliances and Partnerships
AgriFood Tech Investing: Global AgriFood Tech Funding reached $16.9B in 2018

Global AgriFood Tech financing has increased at a CAGR of ~37% since 2012

AgriFood Tech is a growing segment of the startup and venture capital universe that’s aiming to improve or disrupt the global food and agriculture industry.

(categorization described on following slide)

**ANNUAL AGRIFOOD TECH FINANCING**

<table>
<thead>
<tr>
<th>Year</th>
<th>Billion USD</th>
</tr>
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<tbody>
<tr>
<td>2012</td>
<td>$2.6</td>
</tr>
<tr>
<td>2013</td>
<td>$2.1</td>
</tr>
<tr>
<td>2014</td>
<td>$5.4</td>
</tr>
<tr>
<td>2015</td>
<td>$8.5</td>
</tr>
<tr>
<td>2016</td>
<td>$8.2</td>
</tr>
<tr>
<td>2017</td>
<td>$11.8</td>
</tr>
<tr>
<td>2018</td>
<td>$16.9</td>
</tr>
</tbody>
</table>

**DEALS BY GEOGRAPHY**

- **$7.9B** in Upstream Deals
- **$3.5B** in Downstream Deals
- **$2.4B** in Largest Deal

82% of agrifood funding occurred in the U.S., China, and India

**INDUSTRY DYNAMICS**

**NGO ADVOCACY**

**PARTNERSHIPS, INVESTMENTS, & TECHNOLOGIES**

**FEDERAL AND STATE POLICY**
Investment Categories

## AgriFood Tech Category Definitions

<table>
<thead>
<tr>
<th>Category</th>
<th>#Deals</th>
<th>Upstream</th>
<th>Downstream</th>
<th>Up+Down</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG BIOTECHNOLOGY</td>
<td>119</td>
<td></td>
<td></td>
<td></td>
<td>$1.5B</td>
</tr>
<tr>
<td>On-farm inputs for crop &amp; animal ag including genetics, microbiome, breeding, animal health.</td>
<td></td>
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</tr>
<tr>
<td>MIDSTREAM TECHNOLOGIES</td>
<td>167</td>
<td></td>
<td></td>
<td></td>
<td>$1.3B</td>
</tr>
<tr>
<td>Food safety &amp; traceability tech, logistics &amp; transport, processing tech.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>FARM MANAGEMENT SOFTWARE, SENSING &amp; IoT</td>
<td>177</td>
<td></td>
<td></td>
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<td>$945M</td>
</tr>
<tr>
<td>Ag data capturing devices, decision support software, big data analytics.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGribusiness MARKETPLACES</td>
<td>69</td>
<td></td>
<td></td>
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<td>$852M</td>
</tr>
<tr>
<td>Commodities trading platforms, online input procurement, equipment leasing.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BIOENERGY &amp; BIOMATERIALS</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td>$701M</td>
</tr>
<tr>
<td>Non-food extraction &amp; processing, feedstock technology, cannabis pharmaceuticals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>NOVEL FARMING SYSTEMS</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td>$596M</td>
</tr>
<tr>
<td>Indoor farms, aquaculture, insect, &amp; algae production.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>INNOVATIVE FOOD</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td>$516M</td>
</tr>
<tr>
<td>Cultured meat, novel ingredients, plant-based proteins.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FARM ROBOTICS, MECHANIZATION &amp; EQUIPMENT</td>
<td>83</td>
<td></td>
<td></td>
<td></td>
<td>$368M</td>
</tr>
<tr>
<td>On-farm machinery, automation, drone manufacturers, grow equipment.</td>
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<tr>
<td>RESTAURANT MARKETPLACES</td>
<td>91</td>
<td></td>
<td></td>
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<td>$3.9B</td>
</tr>
<tr>
<td>Online tech platforms delivering food from a wide range of vendors.</td>
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<td></td>
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</tr>
<tr>
<td>eGROCERY</td>
<td>153</td>
<td></td>
<td></td>
<td></td>
<td>$3.6B</td>
</tr>
<tr>
<td>Online stores and marketplaces for sale &amp; delivery of processed &amp; un-processed ag products to consumer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN-STORE RETAIL &amp; RESTAURANT TECH</td>
<td>247</td>
<td></td>
<td></td>
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<td>$1.7B</td>
</tr>
<tr>
<td>Shelf-stacking robots, 3D food printers, POS systems, food waste monitoring IoT.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>ONLINE RESTAURANTS AND MEAL KITS</td>
<td>91</td>
<td></td>
<td></td>
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<td>$752M</td>
</tr>
<tr>
<td>Startups offering culinary meals and sending pre-portioned ingredients to cook at home.</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>HOME &amp; COOKING TECH</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td>$130M</td>
</tr>
<tr>
<td>Smart kitchen appliances, nutrition technologies, food testing devices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MISCELLANEOUS</td>
<td>15</td>
<td></td>
<td></td>
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<td>$118M</td>
</tr>
<tr>
<td>e.g. fintech for farmers</td>
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</table>
Field to Market’s vision is to harness the collective action of the value chain to increase sustainability. Their work is grounded in science-based tools, collaboration, and increased supply chain transparency. 

**Member Composition**

Field to Market

80 members

The Sustainability Consortium (TSC) is a global organization transforming the consumer goods industry to deliver more sustainable products. TSC’s stakeholders work collaboratively to build science-based decision tools & solutions.

**Member Composition**

Sustainability Consortium

43 members

COOL FARM ALLIANCE

53 members

The Cool Farm Alliance (CFA) enables growers to make more informed decisions that reduce environmental impact. CFA offers the Cool Farm Tool, which helps farmers assess GHG, biodiversity, and water use.

**Member Composition**

The Cool Farm Alliance

Field to Market's vision is to harness the collective action of the value chain to increase sustainability. Their work is grounded in science-based tools, collaboration, and increased supply chain transparency. 

**Member Composition**

Field to Market

43 members

The 4R Plus initiative / partnership focuses on improving soil health and water quality through the 4R’s (right source, right time, right rate, right place), plus conservation practices.

**Member Composition**

4R Plus

The Sustainability Consortium is a global organization transforming the consumer goods industry to deliver more sustainable products. TSC’s stakeholders work collaboratively to build science-based decision tools & solutions. 

**Member Composition**

Sustainability Consortium
Major Partnerships (2 of 2)

The Soil Health Institute (SHI) strives to be “the primary resource for soil health information and research.” It serves as a research funding pool, centralized hub of soil health information and expertise, and as a soil health promotor.

**Member Composition**
- 21 members

The Soil Health Partnership (SHP) is a farmer-led initiative that seeks to improve soil health, benefiting farmer profitability and the environment. SHP is more outreach- and implementation-based than SHI.

**Member Composition**
- 17 members

Global Harvest Initiative (GHI) is a private-sector policy voice for productivity growth throughout the agricultural value chain to sustainably meet the demands of a growing world. Works in the US and internationally.

**Member Composition**
- 18 members

Midwest Row Crop Collaborative is a partnership driving environmental change in the upper Mississippi River Basin. The group works to accelerate innovation and scalability of conservation practices & strengthen research.

**Member Composition**
- 14 members

Source: Context Analysis
Federal and State Policy

TOPICS:

- Advanced Breeding Techniques
- Climate Change / GHGs
- Water Quality / Flood Mitigation
- Urban Encroachment / Rural Economic Decline
- Trends in Research Funding (NSF, NIFA, DOE)
### Advanced Breeding Techniques

Genome editing is a powerful new toolset for plant breeders, allowing the precise **deletion**, **editing**, or **replacement** of target genetic sequences.

The technology has potential to increase **yield**, improve **nutrition**, fight chemical **resistance**, and reduce the amount of **inputs** applied.

Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) – Cas9 is one of the most popular gene editing tools and is already being tested in **24 crops**.

<table>
<thead>
<tr>
<th>Crop</th>
<th>How CRISPR is being used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>Productivity improvements</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>Prevent browning and elongate shelf life</td>
</tr>
<tr>
<td>Rice</td>
<td>Improved crop yield and reduced plant stress</td>
</tr>
<tr>
<td>Citrus</td>
<td>Create resistance to “citrus greening” disease</td>
</tr>
<tr>
<td>Cacao</td>
<td>Enhanced disease resistance</td>
</tr>
<tr>
<td>Wheat</td>
<td>Creating wheat strands that do not contain gluten</td>
</tr>
</tbody>
</table>

Products generated by gene-editing techniques have historically **not been subject to the same regulatory rules** as GMO crops.

In March 2018, the U.S. Department of Agriculture announced it **would not regulate gene edited plants** that could have otherwise been developed using traditional breeding techniques.

However, gene edited plants **must receive FDA approval** for food and feed safety. The FDA is working on a regulatory framework for gene edited plants and has not yet approved any for consumption.

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**KEY TAKEAWAYS**

1) Gene editing is a fairly recent scientific development; CRISPR research has exploded in prevalence the last 5 years.

2) Regulatory steps are still largely unclear and depend on the crop, the extent of its modifications, and its intended use.

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Climate Change/GHGs

Agriculture is a noteworthy contributor of GHGs, including carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). The ag industry released approximately 650 million MT of CO₂ in 2017.

However, ag also holds potential to reverse climate change, through carbon sequestration and regenerative farming practices.

The National Sustainable Agriculture Coalition (NASC) is a key advocate in climate policy formulation, and has recently released a position paper to identify priorities for federal policy and USDA programming.

California is a significant agricultural player and is widely known for its progressive climate policy, including goals for economy-wide carbon neutrality by 2045 and agriculture-focused carbon sequestration.

KE Y TA K E A W A Y S
1) Agriculture is a noteworthy contributor to GHG emissions, but the industry also has the potential to reverse this effect through sustainable farming practices
2) Compared to many developed countries, the US has lagged in the implementation of federal climate policy. The most progressive US policies are implemented at the state level on the east and west coasts
Water Issues – Water Quality and Flood Mitigation

**Background**

1972: the Clean Water Act established the basic structure for regulating quality standards for surface waters. Under this rule, the EPA has implemented pollution control programs and developed national water quality criteria recommendations. It’s estimated that, between 1972 and 2001, the share of waters unsafe for fishing decreased 12% because of these measures.

2010: the EPA instituted a Total Maximum Daily Load (TMDL) for the Chesapeake Bay as a “pollution diet” to restore clean water to the region.

2019: Minnesota’s progressive Groundwater Protection Rule goes into effect. It aims to minimize potential sources of nitrate pollution to the state’s groundwater, restricting fall application of nitrogen in vulnerable areas.

*Relatively few federal water quality regulations exist. Many states set their own water quality rules based on regional priorities. CA and MN have been two of the leaders when it comes to state-level action.*

**Policy**

Flooding is increasingly common and extreme, with many river gauges in the Midwest reporting peak water flow 10,000-30,000+ cubic ft/second higher in 2017 than in 1917.

Flooding and water quality are issues agriculture can help fix. For example, converting 1/3rd of Iowa’s farmland to **perennial crops** or row crops with a **winter cover** would reduce water runoff and flood frequency by 20%.

**KEY TAKEAWAYS**

1) Over the past 100 years, flooding in the Midwest has become more frequent and extreme. Runoff is linked to floods; hypoxia has also become a concern during this time.

2) The Clean Water Act has been the main vehicle for implementing federal-level water quality action. States tend to set their own rules targeting regional priorities. Furthermore, many ag-centric water quality measures are voluntary.

Urban Encroachment and Rural Economic Decline

Background

Urban land use has expanded nearly fivefold since 1945. Between 1992 and 2012, almost 31 million acres of agricultural land was lost to development. 11 million of these acres were prime farmland acres.

Policy

Current federal rural development programs and priorities include broadband access, rural housing availability, rural business and workforce development, and health care. Much rural development policy is introduced at the state level. Broadband was a priority in 2019, with 15 states introducing rural broadband policies.

Key Takeaways

1) Urban development has expanded fivefold in the past 70 years; rural economic conditions have simultaneously declined.
2) Federal priorities surrounding rural development do exist, but the onus of improving rural economic development and restricting urban sprawl is largely on states.
Trends in Research Funding (NSF, NIFA, DOE)

2018 Research Funding by Agency (Millions)

- NSF: $909
- NIFA: $353
- USDA: $5,370

2018 NIFA Funding by Research Area

- Agroclimate Science: 11%
- Bioeconomy-Bioenergy-Bioproducts: 6%
- Education and Multicultural Alliances: 7%
- Environmental Systems: 15%
- Family & Consumer Sciences: 4%
- Food Safety: 6%
- Human Nutrition: 9%
- Sustainable Agricultural Production Systems: 11%
- Youth Development: 40%

Total Funding by Agency (Millions)

- DOE
- NSF
- USDA
- EPA


KEY TAKEAWAYS

1) NSF funding for Geosciences, Engineering, Social Sciences, Biological Sciences, and Education and Human Resources has increased since 2017. Funding for Math and Physical Sciences and Environmental Sciences has decreased.

2) NSF funding is significant—in 2018, NSF funding was 4x greater than NIFA and ARPA-E combined.

3) NIFA has a large emphasis on sustainable agriculture and environmental systems—in 2018, 2/3 of research funding went to these areas.

# Impact / LOS Exercise

## SCIENCE

<table>
<thead>
<tr>
<th>Advanced Breeding Techniques</th>
<th>Climate Change / GHGs</th>
<th>Water Issues: Water Quality</th>
<th>Water Issues: Flood Mitigation</th>
<th>Urban Encroachment and Rural Decline</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability</td>
<td>Success</td>
<td>Ability</td>
<td>Success</td>
<td>Ability</td>
<td>Success</td>
</tr>
</tbody>
</table>

### Agronomy
- Ability: High
- Success: High
- Comments: 

### Crop
- Ability: Moderate
- Success: Low
- ACSESS team to complete

### Soil
- Ability: Low
- Success: Low
- Comments: 

### Environmental
- Ability: Low
- Success: High
- Comments: 

### Ability for ACSESS to IMPACT
- High
- Moderate
- Low

### Likelihood of Success
- High
- Moderate
- Low
Interview Insights
Q 1a) What significant drivers are you feeling within your organization and broader sector that are changing business?

1. **Advances in breeding** in the next 2 - 3 years is going to be big.
2. **Not many tailwinds……sustainability could be a tailwind** as we’re able to redefine ag and connect customers to food.
3. **The headwinds (next slide) need funding** for research to address/combat them.
4. **Soil health** is an area where ag has not fully tapped into its messaging to consumers – this can be a driver. Big buying driver to many consumers based on recent studies.
5. **Food security and water security** – how do we support 9 billion humans? Drive new ways for agriculture and the way we produce food. (challenge also but creates opportunity) – **science is going to be needed**.
6. **SHP/SHI/NRCS** – upswell of **soil health priorities and focus** in agriculture.
7. **Climate Change** – helps us focus our engagement with our farmers and leaves enough room so we can customize with them and engage and not be top-down.
Q 1b) What significant pressures are you feeling within your organization and broader sector that are changing business? (1/2)

1. **Struggling with the sustainability question**: What it means? How we farm? How we market our product? How we differentiate?
2. **Low commodity prices**: it's tough for farmers to try new/regenerative type practices on their farm.
3. **Regulatory freedom** of our important CP is important – threat of losing those is a big deal.
4. **Commodity prices, rural struggles** compounding.
5. **Confusion around soil carbon sequestration** (could be an opportunity) – will we find a buyer and monetize the market?
6. **Bio-diversity loss** → focused on ag production systems and monoculture and viability of our food production system – consumer pressure here.
7. **Poor messaging** / consumers believing poor science or fads; factory farms vs story books images.
8. **Funding for research and the demise of the extension system** have been big problems for academics.
9. **Attracting science/grad school talent to ag** has been difficult.
10. **Consumer disconnect** between desire for differentiated products but not wanting to pay.
11. **Talent leaving the farm** – lack of diverse thinking on the farm – at time lack of technologists on the farm.
12. **Lower levels of state funding** and the transition to more federal dollars has been a big challenge within academia.
13. **Uncertainty of funding** is a challenge and can be disruptive to research.
14. On the fundamental science side there is **pressure for funding**.
15. The public in general struggles to accept sound science.
16. Cost and operational pressures of what a field looks like; difficult to modify practices to direct carbon back into the soil – getting the data you need is cost prohibitive at times.
17. **Environmental issues** are huge pressures in ag: climate change, soil health, and water quality.
Q 1b) What significant pressures are you feeling within your organization and broader sector that are changing business? (2/2)

1. Consumer companies get **questions involving sustainability** - GHG, how food is grown, pesticide use, non-GMO, organic, story behind everything, etc.

2. **Availability and price** – we buy minor crops that aren’t as readily available and overall receive less resources.

3. **Balance of consumers wanting things but not always wanting to pay**… maybe it’s just table-stakes (either we participate or we’re not at the table).

4. Do we have the **right reporting and quantifying mechanisms** to know if we are making progress? Once those are in place, will we find we are **doing enough** to meet our 2030 goals and beyond?

5. Consumer pressures surrounding **animal welfare, sow housing, antimicrobials**, and the **environment** (watersheds, air, soil impacts).
Q 1c) What actions are you taking to address these drivers and pressures?

1. **We have to create a market for soil carbon credits** – people and companies need to represent it.
2. **Launched technology platforms** to use technology to guide the farmer and inform the food buyer.
3. Tried to take a strong path toward **active engagement with those who the consumers trust** (dieticians, NGOs, associations, etc.).
4. **Next generation** of consumers and technologists are critical – new ways of getting K-12 students onto farms in a way that matters to them – **nontraditional ways**.
5. **Sustainability is a brand anchor** – fund soil health research on a regular basis and soil sequestration.
6. Many organizations moving towards more of an **open access publication model** to better facilitate government grant requirements and collaboration.
7. Forming **strategic partnerships** in sustainability topics that are important.
8. Portfolios of **training and technical assistance grower programs** that sometime cost share (e.g. equipment) for things like soil health, water outcomes, climate, etc.
9. **Sustainably pressures** – restructuring staff and budget surrounding sustainability and trust. These issues are no longer just “bolt on’s” to our business. We need to be part of the solution to environmental impacts.
Q 1d) For other associations: As open access to publications and other shifts have occurred, what changes or pivots have you made to preserve your organization’s value for members and economic viability?

- **No one has done this well yet.** Everyone is struggling. The speed at which open access is coming has caught everyone off guard.
- Other societies have made the shift to open access journals. 24 months after journal articles are published, they are available to everyone. **Partnerships can open up** other markets and countries.
1. I’m sure there are things that I’m just not aware of. **We have no problems investing with private companies**

2. Government is a big part of that. **New farm bill – ~25 million** (either annually or over the course) for innovation/data management

3. Good question – **table stakes for many in the ag input space**

4. **The cash it requires to generate the required scale** is almost limiting even - from the society perspective, how do you aggregate and get to scale? Hard to see how academia and societies can keep pace here.

5. Hopefully, there is room for **private and public sector working together in the future** and improving the lives of the customers they serve.
Q 2c) Related to crop, soil and environmental sciences and data/information flow – what are the most significant FUNDING MECHANISMS?

1. A lot of space, room to lean into this and partner up – stop fighting based on history or nuances of the groups (e.g. industry vs association) - reverse the funnel – get money collaboratively

2. Demonstrate value to grow and expand corporate and industry members...non-traditional membership
Q 2d) Related to crop, soil and environmental sciences and data/information flow – what are the most significant General Advancements?

1. Sharing of data – may have to accept the fact that we may have to **compromise a bit of data privacy for the greater good** of ag and society.

2. **Farmers are overrun with data** and generally do not have a problem with data flow – **problem is using the data effectively**. Significant number of farmers are not using the data to make real time or even annual decisions. We are interested in helping the farmer shift through to help them know what is important and what is not important.

3. Some societies make those that publish with them make the data publicly available.

4. **No one has figured out the data space well yet.** There isn’t a lack of data – **there is a lack of understanding on how to use it** and how to connect it across the value chain

5. **Partner** with universities and companies with farmer facing software and who have a footprint in our regions. Trying to be early adopters of **data analysis**
Q 3a) What are the most promising emerging efforts to create value within agronomy, crop, soil, and environmental sciences?

1. **Breeding techniques** (CRISPR) are going to make a big difference in our crops and add value
2. Increased focus on studying the **root systems** of our crops should pay dividends in the future
3. **Big Data** (Transparency) and **blockchain / mapping** out the full **DNA** of all crops
4. **Carbon market** will create value if it gets going
5. **Biologica**ls is an interesting space that has value – yield and value and drives **soil health**
6. **Education** – a lot of these **new practices and technologies will need training**
7. **Ecosystems services market** (carbon, water quality, nutrient loss mitigation, etc.) – society today doesn’t necessarily think that they should be paying for these things….yet
8. **Biological approaches** – anything that removes chemistry from the equation
9. Long way to go in **value-based marketing but could be a game changer**. Products specific for certain uses; haven’t tapped our potential here.
10. **New technology, sensing, and research tools** will allow for huge advances in these areas of science
11. **Microbes** in soil and understanding this more thoroughly
12. **The carbon economy** will continue to be driven by the private sector and can provide an additional revenue stream for farmers
13. Promising research into **cover crops’** impact on level of prevent plant acres. Things like this that really show the importance of sustainability are impactful
14. **Advanced breeding** (but not sure if that is a direct benefit to a food company yet)
15. Untapped resources in **soil health and microbiome**
Q 3a) What are the most promising emerging efforts to create value within agronomy, crop, soil, and environmental sciences? (cont’d)

1. **Minor crops and plant based protein spaces** – legumes, pulse, etc.
2. **Carbon markets**
3. **Technology** is huge. In-barn, in-processing plant, in-field technology. Sensors and AI in particular. A lot still in development that we need to put into use.
4. **Sustainability is becoming real**, and it’s a profit driver. Reducing energy and water, for example, saves resources and also money.
5. Looking at **manure as an asset to build soil health**. Used to be a waste, but now it’s a valuable product. Same with biogas.
Q 3b) What are the most important scientific research gaps that need to be closed for these emerging efforts to be successful long term?

1. Low focus on **MOA in weed control**
2. More resources for **spot treating** could be of benefit (drone, not treating the whole field – just the weed etc.)
3. Suggestions to drive energy and **resources toward strengths** (previous slides) and not the weaknesses/perceived gaps
4. **Scientific literature is contradictory in many cases**—for example, sequestration depends on site, management, and location. Synthesizing these nuances in a way that’s digestible is a huge opportunity
5. **Crop science and human nutrition gap** needs to be bridged – we can make plants more nutritious but need input from nutritionists
6. **Climate change** is not going away. There is a lot of research in this area but we need more
7. **Skill gap surrounding big data analysis.** Most agronomists and crop, soil, and environmental scientists don’t have these skills
8. **Useable Data** – knowing what you need and what you don’t need - cheap broad data vs expensive granular data - need specific data due to heterogeneity of fields
9. Gap when it comes to the tactical and **practical knowledge of sustainability.** Have the high-level research but don’t have the knowledge from CCAs and other tactical advisors on how to implement
10. Need to create **cost-effective soil health measurement standards and tools**, develop operational management strategies to integrate soil health practices and systems, and advance the science of soil health benefits
11. See potential to **integrate soil health with the social sciences** to actually figure out how to get people to do these practices
12. **Gap in how research is disseminated and communicated.** Many different studies with too much nuance for the public to digest. Scientists need to talk and synthesize results into comprehensive, generalizable, actionable reports
13. **Carbon Sequestration** – how do we execute and scale it
14. Unknowns surrounding **antimicrobial use/resistance/residues.** Specifically, how much of this makes it to the field in manure, and what does it do to the land?
15. Not clear on the **definition of soil health.** Need better measurements and metrics surrounding this.
Q 4ai - iii) What organizations are playing the most important leadership roles in agronomy, crop, soil, environmental sciences?

• ***Overall this question was difficult for many of the interviewees to give granular answers per science discipline given their role and familiarity. Many of them view these sciences connected rather than stand-alone. With that said, selected aggregated responses are in the following slide
Q 4c) What organizations, in any of the disciplines above, are doing a good job of connecting the public with science in general and next generation (students, early career individuals, public etc.) and what are they doing to keep them engaged?

1. **Good question!**...not sure if anyone is doing a great job that I can point to

2. **I don’t see others doing a good job**...A function of engagement, value, a **culture of support from employers**, find something **meaningful for them to do**. Guessing that the younger members who are quitting the tri societies are the master’s/PhD students that go into industry. Need to target these folks. **The societies need to offer something these members can't get elsewhere, or career development.**

3. Older people join organizations/societies for the good of industry... **younger people want immediate value** – such as solving problems, prove value and **individual offerings that they can pick and choose, hands on and see results.**

4. **No organizations are really good at this.** Membership is mostly a function of if your research area is “hot”. These areas of research are not popular right now

5. **Additional and diverse offerings** outside of the traditional offerings

6. **No one effectively engaging the next generation in ag**
Q 5a) What could ACSESS or the tri societies that make up ACSESS (ASA, CSSA, SSSA) do to become more relevant and potentially move visible to key stakeholders?

1. Not sure if they **participated in the Commodity Classic** last year? Having a presence there may not be a bad idea – presentations or appetizers/drinks

2. Not sure the answer to this question – but are you getting you **message out via the right platforms**?

3. **Be a liaison** to make **connections between need in industry and members in their network** and their research and their publications. World Business Council for example—get involved with these types of groups and direct them towards the expertise of individual tri society members and the societies’ journal articles. Adds value for the organizations, researchers, universities, and the individual societies.

4. **ACSESS is a non-biased source of info** which is a differentiator/benefit – **promote this**!

5. Would love to see an organization **differentiate themselves by being collaborative rather than being in silos** or having strictly proprietary programs.

6. **Get active** on the board of societies’ presidents and any other “society of societies”. This is a **great way to get the ACSESS name out** and build partnerships
Q 5a) What could ACSESS or the tri societies that make up ACSESS (ASA, CSSA, SSSA) do to become more relevant and potentially move visible to key stakeholders? (continued)

1. **Leadership training** for the leaders of ASA, CSSA, SSSA is important
2. Not sure I know enough to give you an answer…much more about **partnerships and collaborations**
3. **Social media presence** may be something to look into
4. Demand and support for **conference presentations, networking opportunities**, etc. is a huge driver and opportunity for ACSESS
5. **Engagement on farmer programs with commercial entities** – data sharing, should we be standardizing certain things, direction toward applicable research, opportunities for involvement with commercial companies - lift all ships together
6. May be **too academic in nature**. If you want to increase reach and relevance, think about how to **communicate research to customers and ultimately consumers**. Also think about how to make research more **applied and impactful** to the entire supply chain.
1. Important that the Tri-societies **work closely with the commodity groups**. Need to be in lock step, in sound science, particularly in the sustainability arena. Messaging from there needs to be sound.

2. Being more engaged and **collaborate with private business** – find the common ground and make it happen. E.g. Public/Private Sector

3. Yes, **potentially outside of their traditional partners** – full ag chain including industry

4. Alignment with the **big trade/checkoff organizations based on the commodities they service**

5. Get out of the silos

6. Partner with the **big input companies**… but don’t partner with one at the exclusion of the others

7. **Crop-specific conferences and groups** would make good partners

8. A lot of the energy and momentum in sustainability right now is in industry and the supply chain. **Partner with those folks to bridge their knowledge gap**, and also take cues on the type of research they need in order to be successful

9. **Look for partnerships with food companies** to help with our sustainable sourcing programs

10. Partnerships with crop associations and trade associations are important – Allows ACSESS to share research results and to get feedback on what research areas are useful.