



Food and Agricultural Education in the United States

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Foreword

AGree drives transformative change by connecting and challenging leaders from diverse communities to stimulate policy innovation and develop initiatives that address critical challenges facing the global food and agriculture system. AGree believes we must elevate food and agriculture policy as a national priority.

AGree's work addresses four broad challenges facing the global food and agriculture system:

- Meet future demand for food;
- Conserve and enhance water, soil, and habitat;
- Improve nutrition and public health; and
- Strengthen farms and communities to improve livelihoods.

We have taken a deliberative, inclusive approach to develop a policy framework and ongoing, complementary initiatives to meet these challenges. To overcome traditional obstacles to change, we engage a broad array of stakeholders whose insights and commitment contribute to meaningful solutions. AGree's work, building on our research to better understand problems and assess options, aims to stimulate creative ideas and encourage new perspectives while fostering the linkages that are key to catalyzing effective action.

This AGree backgrounder was written by Stephanie Mercier, former Chief Economist of the U.S. Senate Agriculture Committee and currently with the Farm Journal Foundation. The paper traces the history of food and agriculture education in the United States with a focus on elementary and secondary learning opportunities and describes how educational approaches have changed over time. It outlines public and private investments (based on publicly available information) and available curricula and suggests ideas for improvements that would strengthen the delivery of K-12 food and agriculture education and ensure a steady pipeline of students into food- and agriculture-related careers.

The paper was borne from AGree convenings on the *Next Generation: Attracting young people to food and agriculture*. Our discussions focused on opportunities for building common ground and conditions for increased collaboration, support, and message coherence about why these fields of study are important for the future of our food and agriculture system and our national security. This work was made possible through generous support from the CHS Foundation. We look forward to their continued leadership to explore opportunities for discussion and collaboration around the future of food and agriculture education in the United States.

We hope you find this paper a helpful resource.



Deborah M. Atwood
Executive Director

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Introduction

Food and agricultural education in the United States has changed over the nation's history, starting in the 18th century as a means of providing farmers with the basic skills they needed to prosper on their farms. In the 19th and early 20th centuries, traditional agricultural education was focused on increasing production to sustain a growing and increasingly urban and industrial population. Today, the range of issues and subject matters important to agriculture has broadened, and the educational system to provide skilled individuals to fill the needed occupations has scrambled to keep pace. The crucial areas of expertise now encompass not just those trained in production agriculture but also food and nutrition, natural resources, and the know-how to maintain and improve the physical and scientific infrastructure that underlies modern agriculture, including an increased role for information technology with the emergence of "big ag data." For the U.S. food and agricultural sector to be in a position to compete in the global markets of the 21st century, the food and agricultural education system must be expanded and strengthened to address the challenges and opportunities facing the global food system. The world will likely become a much more politically stable place if we can make a further dent in the number of hungry people, estimated at 805 million people in 2014 by the UN's Food and Agriculture Organization. This paper examines the evolution of U.S. food and agricultural education over time, its current structure, and how it must adapt to meet the challenges facing the sector.

Modern food and agricultural education takes many forms, ranging from children in grade school classrooms learning from "Agriculture in the Classroom" modules to undergraduate and graduate students enrolled in Colleges of Agriculture at land-grant universities and other schools with agricultural programs (such as Texas Tech and Southern Illinois Universities) to agricultural leadership programs

available for adult professionals in farming and agribusiness in 42 states.¹ This paper focuses primarily on food and agricultural education provided to students in elementary and secondary schools around the country (K-12), both inside and outside the classroom, and in community college programs. These programs are a means of exposing young people to careers in agriculture, and they are also a critical delivery mechanism to educate the general population about agriculture and food systems. The subjects covered in these educational settings have broadened in recent years to include health and nutrition and natural resource issues. The need for better knowledge in these areas has arisen as the general public has become more conscious of the health impacts of the food they eat and natural resource constraints such as water and arable land.

Today there are two primary reasons to support U.S. food and agricultural education activities for young people. First, we need to build a cadre of next generation farmers and ranchers as well as career seekers interested in food and agriculture. The 2012 Census of Agriculture reports that the average age of principal operators on U.S. farms is 58.3 years of age, with only 8.1 percent of all operators below the age of 35. U.S. agriculture would likely continue to produce abundant amounts of food and fiber if older farmers were not replaced as they retire, but the farm size composition of the sector could become further concentrated. To ensure that the social and economic stabilizing role of family farming is preserved, the U.S. government has for many decades taken steps to provide access to the two most important things a young farmer needs to get started: 1) adequate capital to buy or lease equipment and land to farm, and 2) adequate education so young people and other new entrants will have the know-how to farm. Today's farmers must have an expanded technological skill set—for example, if they want to maintain their own farm equipment they need to have computer programming skills as well as be handy with a wrench and a screwdriver.

The need to facilitate the creation of a continuing supply of students with training to go into the food and agricultural sector applies not only to crop and livestock production, but also related occupations that serve the businesses in the agricultural supply chain and agricultural and food science disciplines. A 2015 study commissioned by USDA's National Institute of Food and Agriculture (NIFA) found that the U.S. economy will generate more than 57,900 openings for individuals with college degrees in food, renewable energy, and environmental specialties every year between 2015 and 2020.² The study found that there would be a 41 percent shortfall of U.S. graduates in those fields to meet the demand, especially graduates to work as plant geneticists and plant breeders, climate change analysts, and food safety and security specialists.

Second, most Americans do not understand food and agriculture systems. The shrinking human footprint of agricultural production in the United States over the last century, especially as a share of U.S. population, along with a productive food system, has led to a diminution among the general public of understanding of what goes on in the U.S. agricultural sector and its vital importance to the nation in terms of abundant, affordable, and nutritious food that is safe and secure.

Few Americans equate food and agriculture with national security as periods of broad-based scarcity fade into history. According to USDA data, the share of the U.S. workforce employed in agriculture declined from 41 percent in 1900 to less than 1.5 percent in 2012.^{3,4} A survey conducted by the U.S. Farmers and Ranchers Alliance in 2011 found that 72 percent of consumers report that they know little or nothing about farming or ranching,⁵ even though in general Americans have favorable impressions of agriculture and farming – with a 60 percent positive rating in a recent Gallup poll.⁶ Because of the importance of maintaining a secure food supply for the American public, improving the general understanding of the food and agricultural system, or 'agricultural literacy' among both civic leaders and the general public has become a significant objective among supporters of U.S. agriculture in recent years, and an effort has been made to incorporate such a focus within the U.S. food and agricultural education system as well. The importance of this matter prompted the American Farm Bureau Federation to begin developing their Pillars of Agricultural Literacy, a framework to enable continual enhancement of the public's agricultural literacy, starting in elementary school but persisting through adult interactions.⁷

Box 1 | What is Agricultural Literacy?

The term 'agricultural literacy' was first coined in the 1970's as a short-hand way to describe the state of knowledge about agriculture among the non-farming population in the United States. In 1988, a committee established by the National Academies of Science envisioned that "an agriculturally literate person's understanding of the food and fiber system includes its history and current economic, social, and environmental significance to all Americans."ⁱ



ⁱ Board on Agriculture, National Research Council. *Understanding Agriculture: New Directions for Education*. National Academy Press, Washington, DC: 1988.

History of K-12 Agricultural Education in the United States

Origins of Traditional Agricultural Education

Even before the United States became a country, colonial Americans recognized the need to make knowledge of agricultural techniques and practices widely available. The broad concept of a scientific society came first, with the establishment of the American Philosophical Society in Philadelphia in 1744, founded by Benjamin Franklin, which published many essays on agricultural topics in its early years. The 1754 prospectus of King’s College in New York City (now Columbia University) included ‘agriculture and merchandise’ in the course of study. By the dawn of the 19th century, most of the states in the original American colonies had their own scientific societies focused specifically on agriculture.⁸

In the early 19th century, there were agricultural schools established in several states with primarily private funding, such as the Gardiner Lyceum in Maine in 1823, the Cream Hill Agricultural School in Connecticut in 1845, and the Farmers College in Ohio in 1846. In 1856, the Maryland state legislature granted a charter to several prominent businessmen to establish a privately-run Maryland Agricultural College. The college opened in 1859, received land-grant status in 1864, but went bankrupt in 1866. The state legislature took over half-ownership of the institution; it was re-opened in 1867 and eventually became the University of Maryland.⁹

Federal Legislation

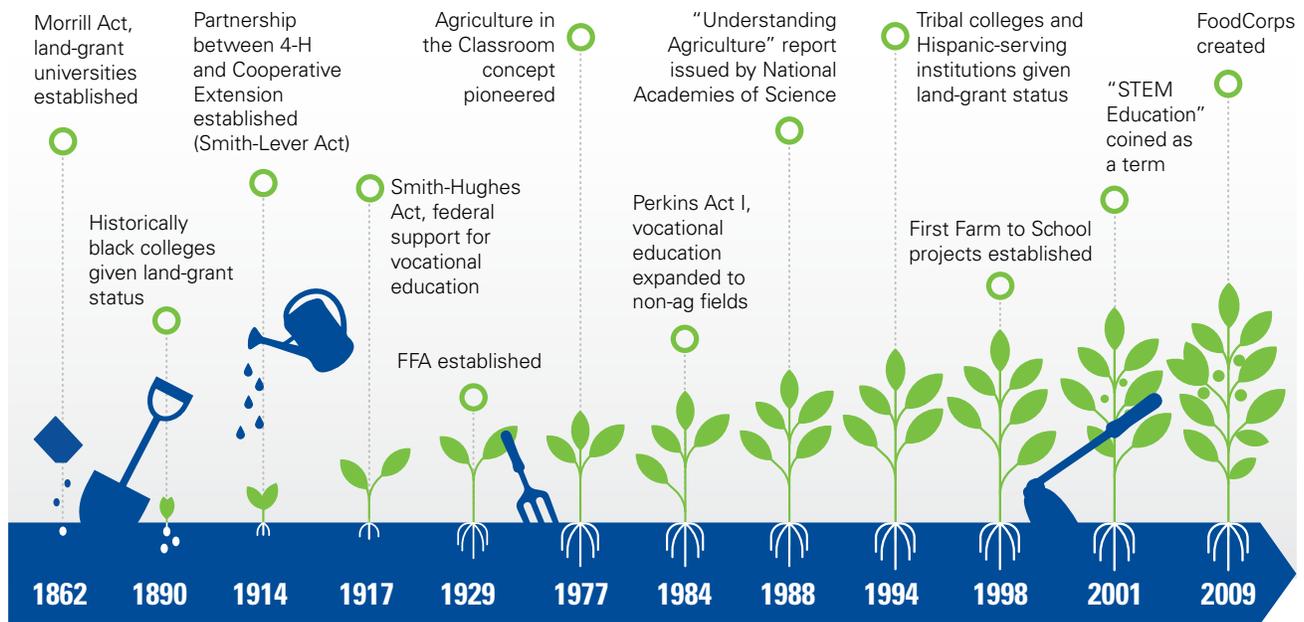
Broad-based public involvement in traditional agricultural education in the United States started at the college level in 1862, with the passage of the Morrill Act, which established the land-grant university system.¹⁰ The mission of these institutions was “to teach agriculture, military tactics, and the mechanic arts as well as classical studies.” The original legislation provided that

each state would receive the income from 30,000 acres of public land to support the new college or university, and the state would pay for the buildings and their upkeep—hence, the origin of the phrase ‘land-grant’.¹¹ All states (plus the District of Columbia and U.S. territories) have at least one land-grant college or university, and several have more than one, because subsequent legislation added provisions giving land-grant status and associated federal support to historically black colleges in 1890, and for tribal colleges and Hispanic-serving institutions in 1994.

Even though the Morrill Act focused on agricultural education at the college level, there was also a significant amount of traditional agricultural education in both elementary and secondary schools going on in the late 19th and early 20th centuries. Seventeen states mandated the teaching of agriculture in their rural schools as of 1917, primarily in the Midwest and the South.¹² The passage of the Smith-Hughes Act (P.L. 64-347) in 1917, also known as the Vocational Education Act, expanded federal support to secondary schooling.¹³ The legislation provided federal funding and authorization for specific programs and educational methods in both agricultural education and home economics.¹⁴ These included methods that were once known as “supervised practices” in farming which are now described as “supervised agricultural experiences” (SAE), which amount to providing hands-on teaching of various techniques and practices in agriculture.¹⁵ Such projects were viewed as a mandatory part of traditional agricultural education curriculums until 1968, when the requirements were relaxed.

The demand for better farmer knowledge of agricultural practices exploded in the wake of the Dust Bowl, as the role that poor cultivation practices played in making the land vulnerable to the high winds of the period was recognized. The Bankhead-Jones Act of 1935 (P.L. 74-320) doubled funding for agricultural research at land-grant universities to address this need, and the urgency for better teaching and dissemination of new agricultural research to the farm level eventually percolated to secondary schools, bolstering agricultural education opportunities.¹⁶

Figure 1 | U.S. Food & Agricultural Education Timeline: An Expanding Landscape



Over the last several decades, the scope of knowledge needed to be conveyed through traditional agricultural education expanded as there were many jobs with technical dimensions that did not require four years of college education to undertake. A key provision of the Vocational Education Act of 1963 (P.L. 88-210) expanded the purposes for which the funding could be used to include work study and demonstration programs. In 1984, the Carl D. Perkins Vocational and Technical Education Act (P.L. 98-524) (dubbed 'Perkins I') was enacted, which expanded the type of training to be supported to include technical training in other industrial fields. The 1990 reauthorization of these programs (Perkins II) sought to coordinate secondary and post-secondary vocational educational activities. In 1998, the reauthorization (Perkins III) increased the share of funds to be distributed to the local level by states and established accountability standards, and the 2006 reauthorization (Perkins IV) took the phrase 'vocational' out of the program entirely by renaming it 'Career and Technical Education' (CTE), and linked CTE programming with the overall standards for educational funding established under the Elementary and Secondary Education Act.¹⁷ All of the federal funds for CTE programs are disbursed by the U.S. Department

of Education (USDE), although the programs are run at the state or local level.

The National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. 3121) established the U.S. Department of Agriculture as the lead agency for research, extension and teaching in the food and agricultural sciences. The original authorization was amended in the 2008 farm bill to give the Secretary of Agriculture the authority to award grants to "*(a) promote and strengthen secondary and 2-year post-secondary agriculture and agribusiness education, and agriculture in the K-12 Classroom, in order to help ensure the existence in the United States of a qualified workforce to serve the food and agricultural sciences system; and (b) promote complementary and synergistic linkages among secondary, 2-year post-secondary, and higher education programs in the food and agricultural sciences in order to attain excellence in education and to encourage more young Americans to pursue and complete a baccalaureate or higher degree in the food and agricultural science,*"¹⁸ subject to annual appropriations. These grants are now administered under USDA's National Institute of Food and Agriculture (NIFA) as Secondary and Two-Year Post-secondary Agricultural Education Grants (SPECA grants).¹⁹

Current Structure of K-12 Food and Agricultural Education in the United States

Formal Secondary Food and Agricultural Education Opportunities

The National Association of Agricultural Educators (NAAE) estimates that 1 million students are currently enrolled in food and agricultural education programs around the country, taught by 12,000 agricultural educators at the secondary and community college level.²⁰ In addition, there are growing numbers of teachers incorporating agriculture in their lesson plans in elementary and middle schools around the country, but outside of the formal agricultural education system. According to the Bureau of the Census, there were 24.9 million students enrolled in grades 7-12 in 2013,²¹ plus about 6.8 million students enrolled in community colleges, either full-time or part-time.²² In 2010-11, a survey by the U.S. Department of Education indicated that about 1.5 million students were dual-enrolled in high school and community college or college courses.²³ Using these figures, it appears that formally enrolled food and agricultural education students make up about 3.3 percent of the total enrollment for secondary and community college educational institutions in the United States. As a point of comparison, about 2.1 percent of individuals in the U.S. population in 2012 lived in farm households.²⁴

Most formal food and agricultural education programs are found in small towns and rural areas across the country. There have been a few breakthroughs in recent decades, however, that are bringing these opportunities to young people in urban settings. One of the earliest efforts was in 1985, when the Chicago Public School District opened the Chicago High School for Agricultural Sciences.²⁵ Now in its 20th year, the school draws students from all over the city, who apply for admission based on results from a standardized aptitude test. The agricultural program includes courses in animal science,

agricultural mechanics, food sciences, horticultural and landscape design, and agricultural finance. The school's total enrollment in 2014-15 was 696 students in 9th through 12th grade. It should be noted that there are also programs conducted in charter schools and private secondary schools that focus on agriculture.

Food and Agricultural Learning Opportunities

Many of these secondary school and community college students are also involved outside of school hours in programs and activities associated with either 4-H clubs or Future Farmers of America (FFA) chapters (described further below), which provide them with further opportunities to expand their knowledge and experience related to agriculture. These organizations have been around for many decades and have been viewed as complementary to formal in-school food and agricultural education programs almost since they were established. The 4-H Youth Development Program is part of USDA's Cooperative Extension Service and focuses primarily on out-of-school activities (though it does have some in-school programs) for students aged 5 to 19, while FFA chapters run in tight conjunction with food and agricultural education programs in local school districts, with activities conducted both within and outside of school hours.

Both organizations seek to develop agricultural and leadership skills among young people, but the FFA's efforts are closely linked to food and agricultural education programs. Students in school districts without formal food and agricultural education programs cannot join FFA (although some districts allow students from neighboring districts to take courses and engage in FFA across district lines). Many 4-H members do not pursue formal food and agricultural education study in their schools, making this one distinction between the two programs. These FFA activities are funded primarily from corporate and foundation sources at the national level, while 4-H is funded through a variety of public (both state and USDA) and private sources. There are other large (i.e., millions of participants) out-of-school programs such as Boy and Girl Scouts, the YMCA, and Boys and Girls Clubs of America that do not have

strong food and agriculture roots but deliver educational programs, some of them focused on healthy lifestyles and nutrition.

4-H

Out-of-school ‘clubs’ to promote vocational agriculture in rural schools started in 1902 in Ohio, and similar clubs were established in nearly all states by 1914. The name was coined in 1911, as a four-leaf clover with 4 ‘H’s’ representing ‘head, heart, hand, and health’ was adopted as the organization’s national emblem, although they did not patent the name and emblem until 1924.²⁶ The patent protection was superseded in 1939 when Congress passed a law (18 U.S.C. 707) providing enhanced protection to the 4-H emblem, similar to that provided to the Olympic emblem. Both boys and girls were involved in the clubs from the beginning, although they were given very different projects from which to learn. Early on, the girls engaged in projects on topics such as clothing, home management and improvement, and food and nutrition, while boys’ projects focused on soil conservation, tractors, engineering, electricity, and agricultural production.

The passage of the Smith-Lever Act in 1914 (P.L. 63-95), which established the Cooperative Extension Service at USDA, led to the involvement of county extension agents in founding local clubs, although such alliances had already been forming on a state-by-state basis for a few years. U.S. participation in 4-H clubs reached 1.6 million in 1943. The concept spread internationally, with clubs in 23 countries in Asia, Europe, and Latin America by 1953. The organization claims 6 million young people as members today, with 540,000 adult volunteers and 3,500 Cooperative Extension professionals (from NIFA, which is the current successor agency to the Cooperative Extension Service)²⁷ helping run 4-H clubs in every one of the 3,067 counties in the United States.

Today, 4-H has three mandates: science, citizenship, and healthy living. Although its roots are in agriculture and it still helps youth “learn by doing,” it is focused on positive youth development across a variety of disciplines including building youth capacity and interest in the STEM disciplines (Science, Technology, Engineering and Math). In 2013, the National 4-H Council, the national private non-profit partner for 4-H, reported revenues

of \$39.5 million, primarily from non-federal sources,²⁸ although they reported administering certain grant programs under inter-agency agreements through USDA, with the Department of Health and Human Services, the Department of Justice, and the Department of Defense. The major revenue categories were \$23.1 million from contributions and grants, \$10.6 million generated through the National 4-H Youth Conference Center located in the Maryland suburbs of Washington, DC, and \$4.6 million from the 4-H Mall (an online store). Major contributors giving \$1 million or more included several charitable organizations, such as the Bill and Melinda Gates Foundation, the Walmart Foundation, the New York Life Foundation, and the Noyce Foundation, and several large corporations —Altria (food processing), DuPont (agro-chemicals), J.C. Penney (retail), Lockheed Martin (aerospace), Phillip Morris (food processing), and the Tractor Supply Company (agricultural equipment).²⁹

In addition to Smith-Lever funds, state Cooperative Extension programs also receive funding from their state legislatures, which are then allocated to 4-H and other extension activities. The amounts tend to be greater in states with large agricultural sectors than in those with smaller sectors. For example, the Ohio legislature provided \$22 million for its 4-H programs in 2014,³⁰ while the Georgia legislature contemplated but decided against eliminating its \$6.3 million in funding for its 4-H programs in 2010.³¹

National FFA Organization (FFA)

The National FFA Organization (Future Farmers of America) was founded in 1929 by a group of 33 high school students attending the American Royal Livestock Show in Kansas City, MO. The organization merged with a similar organization for African American boys (the New Farmers of America) in 1965, and girls were allowed to become full members on a national basis in 1969, although some FFA chapters had allowed girls to join earlier. As with food and agricultural education through other outlets in the United States, the mission of the National FFA Organization has also changed to reflect the modern face of U.S. agriculture. According to its founder, Henry Groseclose, the early focus of the organization was to “give farm boys a greater opportunity for self-expression and for the development of leadership. In this way they will develop confidence in their own ability and pride in

the fact that they are farm boys.”³² Today, it encourages its members to “develop their own unique talents and explore their interests in a broad range of agricultural career pathways.”³³ Every active member is encouraged to be involved in their own supervised agricultural experience (SAE), as part of FFA. The name was officially changed to the National FFA Organization in 1988.

FFA was first made eligible to receive federal support for travel expenses of its members in the George-Barden Act of 1946 (P.L. 80-402). The FFA received a Congressional charter in 1950 (P.L. 81-740), to strengthen the relationship between the organization and school-based agricultural education. There are about 650,000 registered FFA members in 7,665 chapters in all 50 states plus Puerto Rico and the U.S. Virgin Islands. The FFA Foundation was created in 1944 to raise funds to support FFA programs and related organizations and makes awards and funds scholarships as directed by the National FFA Board of Directors. The Foundation had total revenue of \$19.8 million in 2012, 94 percent of which was donated by corporations. Of the remainder, roughly equivalent amounts (3 percent or \$600,000) came from governments or foundations, and from an array of individual donations.³⁴ Substantial donations of \$1,000,000 or more came from the following entities: CHS Foundation (foundation for an agricultural cooperative), CSX Transportation (freight railroad), Deere and Co. (agricultural equipment), Monsanto (seeds and agro-chemicals), RFD-TV (farm media), Tractor Supply Company, and Zoetis Inc. (animal health). Sponsors in the \$500,000 to \$999,999 range include Syngenta AG (seeds and agro-chemicals), DuPont Pioneer (seeds and agro-chemicals), the Ram Trucks division of Fiat Chrysler Automobiles, CF Industries (fertilizer), and the Louisville, Kentucky Convention and Visitors Bureau. In addition, there are hundreds of individuals across the country providing financial support through the FFA Foundation.

Most state FFA associations have their own separate sources of funding, both from their state legislatures and from charitable giving through associated foundations. For example, the Tennessee FFA receives \$250,000 annually from the state legislature and roughly the same amount from private donations.³⁵

In-School Opportunities for Elementary and Middle School Students

Today, at the elementary school level, there are relatively few in-school food and agricultural education programs being delivered, as teachers in public elementary schools tend to focus on subject areas covered in state standards and testing. To the extent that younger students are exposed to agricultural and food information, it is often taught in the context of science education, for example as part of biology lessons (e.g., a classroom garden). A 2007 survey of elementary and junior high teachers in eight Illinois counties found that some teachers did not integrate agriculture in their classrooms because they did not view it as appropriate for their situation, because it took time away from preparing students for state proficiency tests, or they did not have access to good instructional resources on the subject.³⁶ Of those who did attempt to incorporate agriculture in their teaching, they cited ‘connectedness’ and ‘authenticity’ as key themes for that decision. Access to better curricula resources and agricultural-related projects and activities were concerns of these teachers as well. This was a small study, but it highlights a number of issues teachers face integrating food and agriculture topics into existing curricula.

Agriculture in the Classroom

The concept of Agriculture in the Classroom was pioneered by an Illinois teacher in 1977, who developed a program to teach students about agriculture’s role in the U.S. economy, and the concept spread quickly to other states.³⁷ In 1981, the widespread interest in this effort prompted the U.S. Secretary of Agriculture to invite representatives of farm groups and educators to Washington, DC, to discuss agricultural literacy. Out of that initial meeting, a task force was formed, which conferred and recommended that USDA serve as the coordinator for a national classroom agricultural literacy effort—hence, the birth of the national Agriculture in the Classroom (AITC) initiative. Each state sets up its own organization, which then addresses agricultural education in its own way—some set up all-volunteer networks, some chose the non-profit route, others hired full-time personnel or assigned state employees to support AITC

efforts. In 2010, it was estimated based on a survey of programs in 35 states that nearly 3.9 million students, primarily in elementary schools nationwide, were reached with AITC programs or curriculum during the previous year, either directly by AITC staff or indirectly through teachers trained through AITC programs.³⁸ That amounted to about 12 percent of all students enrolled in elementary and middle schools in that year.³⁹

In terms of funding for Agriculture in the Classroom activities, aside from being eligible for grants under the USDA SPECA grant program described above and \$1 million in funding annually for the national organization,⁴⁰ the bulk of the funds that support these activities come from outside the federal government, from a variety of sources. In most states, financial resources come from a mixture of state monies, some from general revenue and others from dedicated sources like the proceeds from sales of a specialty license plate issued by states such as Idaho⁴¹ and Maine,⁴² as well as donations from agribusinesses and state or local farm and commodity groups. State AITC organizations typically award grants to teachers and/or schools to conduct activities, with the size of each grant ranging from a few hundred to a few thousand dollars. Data collected from 42 states by the National Agriculture in the Classroom Organization (NAITCO) tallied total funding for the program in 2013 at just over \$11.2 million, the most recent year reported.⁴³

Funding for Food and Agricultural Education in the United States

Public Sector Funding

Under the authority of the Perkins Act described above, the U.S. Department of Education will provide \$1.12 billion in funding for Career and Technical Education (CTE) programs in all states and territories in fiscal year 2015, the division of funding determined by formulas based on each state’s population in certain age groups and per capita income. California is the largest recipient of Perkins Basic Grant funds (\$122 million in 2014), followed by Texas (\$92 million), Florida (\$61 million), and New York (\$51 million).⁴⁴ Perkins Act funds can be used to purchase occupation-specific equipment for student use, curriculum development, professional staff development, career and guidance counseling for students.⁴⁵ States then have some leeway as to how the funds can be distributed among local school districts. No data are available that separate out Perkins Act funding for food and agricultural education as opposed to other CTE programs available in secondary or post-secondary schooling.⁴⁶ Food and Agriculture is one of 16 designated clusters eligible for Perkins Act funding.

Table 1 | Funding for Key Food and Agricultural Education Programs in the United States, K-12

Program	Number of participants (recent estimate)	Share of total U.S. enrollment	Funding level (most recent year available)
Agriculture in the Classroom	3.9 million elementary and middle school (2010)	12 percent	\$11.2 million (2013)
Secondary and Post-secondary Food and Agricultural Education	At least 1 million in secondary and post-secondary (community college)	3.1 percent	\$8.3 million plus unknown share of \$1.13 billion CTE funding (federal) (2015) plus state and local funding
4-H	6 million in elementary and secondary schools	10.5 percent	\$100 million in federal funding—\$60 million from USDA, the remainder through inter-agency agreements
National FFA	650,000	2 percent	\$19.8 million (2012)—funding for national organization only

The SPECA grant program run by USDA, described above, was funded at \$900,000 in fiscal year 2015. Other USDA programs with youth education components include the Youth Farm Safety Education and Certification program (about \$450,000), the Children, Youth, and Families at Risk Program (about \$6.5 million), the Beginning Farmer and Rancher Development Program (about \$18.5 million available, awarded competitively but not limited to K-12), all through NIFA, and Risk Management Education for Youth (through the Risk Management Agency, about \$500,000). State and local funds for CTE programs cover items such as teachers’ salaries, any special equipment needed by the teacher for the course work, and educational facilities for CTE courses. Most states provide CTE funds to their local school districts based on a formula established under law—the allocation approaches used by most of the states fall into one or more of the following categories:⁴⁷

- Number of CTE students served in previous school year;
- Set percentage of operating costs for CTE programs;
- An add-on weight for students enrolled in CTE programs; and
- Number of CTE instructional units per student.

As with Perkins Act funding, there is no national tracking of state-by-state CTE funding to break out funding for food and agricultural education, as all allocation decisions are made by local school districts. Because of the special earmark for agricultural education in California that Governor Jerry Brown tried unsuccessfully to eliminate in 2014, it is known that the state provides \$4.1 million to local school districts for food and agricultural education programs, which they must match with other funds, either from their Perkins CTE grants or from local property taxes, so total public sector funding in California is at least \$8.2 million annually.⁴⁸ Other states also provide specific funding to agricultural education, including but not limited to Georgia, Illinois, South and North Carolina, Virginia, New Jersey, and Montana.⁴⁹

Table 2 | Examples of Foundations and Non-profits Funding Food and Agricultural Education Activities

3M Foundation
Aetna Foundation
Bill and Melinda Gates Foundation
Cedar Tree Foundation
CHS Foundation
Claneil Foundation
David and Lucile Packard Foundation
David Rockefeller Fund
Draper Richards Kaplan Foundation
Epstein Roth Foundation
Howard G Buffett Foundation
IAA Foundation
Illinois Toolworks Foundation
Kearney Wornall Charitable Trust
Land O’Lakes Foundation
Monsanto Fund
Motorola Foundation
New Profit Inc.
New York Life Foundation
Newman’s Own Foundation
Noyce Foundation
Orfalea Foundation
Rachel Ray’s Yum-0
Rosenthal Family Foundation
Stanley H. Durwood Foundation
Stone Family Foundation
Surdna Foundation
The Anderson’s Inc. Charitable Foundation
The Betsy and Jesse Fink Foundation
The Charles Engelhard Foundation
The Samson Foundation
The Samuel Roberts Noble Foundation
The Sosland Foundation
Toyota Foundation
Walmart Foundation
Walton Family Foundation through Southern Community Partners
Whole Foods Foundation
William K. Bowes Jr. Foundation
W.K. Kellogg Foundation
Woodcock Foundation

Non-Public Funding

As noted above, there is significant private funding of food and agriculture education in the United States by companies, foundations, and individuals. While a number of prominent foundations and companies fund these organizations with large donations, there is also significant investment by smaller foundations and companies in food and agricultural education. Investments range from traditional agricultural education to community-based food system projects that support garden-based education to healthy eating initiatives in public schools. Table 2 was compiled through publicly available information including web searches of agricultural education organizations and the foundations themselves. It is not an exhaustive list, but representative of the philanthropic and agribusiness sectors' interest in supporting these activities.

Food and Agricultural Education Curricula

Scope of Available Curriculum Material

For most of the organizations included in Table 3 below, the breadth of topics covered in the materials provided is quite extensive. While the lesson plans for elementary schools are fairly basic and focus on aspects of production agriculture, the material for secondary schools is more sophisticated and explores natural resource and health issues in addition to production agriculture. For example, the Tennessee Farm Bureau provides a 6th through 8th grade curriculum package, developed under a grant with the U.S. Environmental Protection Agency that explores water pollution issues.⁵⁰ As an example, on the

Table 3 | Sample Food and Agricultural Education Curriculum Resources

Organization	Resources
American Farm Bureau Foundation for Agriculture	Food & Ag Resource Guide includes a curated list featuring ten recommended resources for each age group aligned to the Pillars of Agricultural Literacy
National Agriculture in the Classroom Organization (NAITCO)	Online, searchable, standards-based curriculum map for K-12 teachers (the National Agricultural Literacy Curriculum Matrix); bimonthly secondary educator “e-zine” that shares resources and contextualizes learning; agricultural literacy “test questions”
National Association of Agricultural Educators (NAAE)	National initiative of school-based agricultural education. CASE Curriculum includes materials and professional development opportunities that provide content, context, and strategies for teachers to use to teach agriculture curriculum in school; also host “Communities of Practice” where teachers and administrators connect best practice and strategies
4-H Council	4-H Directory
National FFA	Middle School Food and Agricultural Literacy Curriculum
State Boards of Education	Varies by state; example: Texas Education Agency
State Farm Bureaus	Varies by state; examples: Iowa Farm Bureau , Iowa Agricultural Literacy Foundation and Tennessee Farm Bureau

health/nutrition side, the NAITCO matrix contains an elementary school lesson entitled “Who Grew My Soup?” and provides lessons on food safety and nutrition for middle school students.

There are additional sources which provide educational curriculum material that focus on sustainable agricultural approaches, such as the website for the Center for Integrated Agricultural Systems at the University of Wisconsin⁵¹ and a guide to sustainable agriculture education opportunities assembled under a grant from the Sustainable Agriculture Research and Education (SARE) program.⁵²

Other innovative approaches to bringing food and agriculture to public schools have emerged in recent years. FoodCorps was established as a component of AmeriCorps in 2009, with the goal of placing young people in schools around the country to improve students’ knowledge about food and nutrition.⁵³ In 2014-15, there were 182 FoodCorps service members in place at 500 schools in 16 states and the District of Columbia, setting up community garden projects and improving the quality of students’ diets at school and at home. The National Farm to School Network provides information and

resources to assist local school districts in bringing more locally-produced foods into school cafeterias for meals, educating students about food choices, and providing menus and recipes for school nutrition staffs.⁵⁴ In 2012, the USDA Farm to School Census estimated that 23.5 million students benefited from the farm to school efforts across the country (Table 4). Other innovative approaches identified include the Wellness in the Schools initiative and My American Farm computer app, created with funding from the American Farm Bureau Foundation for Agriculture.

STEM

In recent years, there have been some scattered efforts to connect agricultural education with Science, Technology, Engineering and Math (STEM) disciplines and the broader STEM movement that links student learning to integrated projects that address real world challenges. There is a sense that the real world nature of food and agriculture lends itself to this learning model and that agriculture education should capitalize on the STEM focus in education. But based on an assessment of publicly available programs and resources, this seemingly natural connection has yet to be fully realized.

Table 4 | Examples of New Food and Agricultural Education Programs

Program	Established	Schools participating in program (year)	Students engaged (recent year)	Notes
FoodCorps	2009	400 (2014)	120,364 ⁱⁱ (2014)	Corps members help with efforts such as school gardens, nutrition education about healthy food and where it comes from, school wellness committees, and classroom field trips.
National Farm to School Network	2007	40,328 (2012)	23.5 million (2012)	Programs include procurement (local foods are purchased, promoted and served in the cafeteria or as a snack or taste-test), education (students participate in education activities related to agriculture, food, health or nutrition), and school gardens (students engage in hands-on learning through gardening).
My American Farm	2011	Not applicable	1.5 million (2014)	Online educational game disseminated by American Farm Bureau Foundation for Agriculture. Free app on I-Tunes and for Android devices.
Wellness in the Schools	2008	50	30,000 in New York City, Kentucky and Florida	Food, fitness, and wellness programming. Focus is on public schools with a poverty rate of 70 percent or higher. Through public/private partnerships with school leadership, teachers, chefs, coaches, parents, and kids, WITS develops and implements programs that provide healthy foods, healthy environments, and opportunities for regular play.

ⁱⁱ10,000 students received at least 10 hours of hands-on food- and garden-based education.

NAAE provides agricultural educators a process and products that integrate STEM education through their CASE Curriculum. CASE includes specific content pathways that cut across STEM disciplines to allow educators to connect agriculture and science through instruction, exploration, and activities. CASE is supported through professional development and NAAE's Communities of Practice.⁵⁵

STEMconnector was established in 2011 by a consortium of companies, non-profits, and professional societies to try to provide a central clearing house for institutions and efforts involved in enhancing STEM education in the United States.⁵⁶ One of their projects, the Food and Ag Council, consisting of top officials from the public and private sectors in agriculture, released a report at the 2014 World Food Prize events in Iowa in October 2014 that highlighted some of the employment opportunities that will be available in the sector over the next decade or so.⁵⁷ That report focused on the Millennial Generation that is now in college, but recommends that the movement to interest young people in agricultural science disciplines start long before that decision is made. There is a limited selection of STEM resources available on the NAITCO website⁵⁸ and in a handful of states, such as Georgia, Oregon, and Minnesota.

Defining Success in Food and Agricultural Education

Formal Accountability Measures

Under the Perkins Act, secondary school programs that receive federal funding under the Act's CTE Basic Grant program must report on how well their students perform with respect to core indicators that include academic achievement (as reflected on results of standardized tests), graduation rates, college placement, and training for nontraditional careers.⁵⁹ The states receiving the funds have been diligently reporting their core indicator results back to the U.S. Department of Education since the requirements went into effect. In

2014, USDE reported to Congress how the state CTE programs performed in the 2010-11 school year, the most recent year available.⁶⁰ This report is the 12th such report submitted, required since the most recent reauthorization of the Perkins Act.

That report found that there were 12.05 million secondary school students enrolled in CTE programs in the 2010-2011 school year, a 7.5 percent decrease from the recent high enrollment in 2006-07. Overall U.S. high school enrollment also declined between those two school years, although by a lesser amount, about 3.4 percent.⁶¹ In the 2010-11 school year, 287,242 of those students were studying in the agricultural and natural resources cluster, a 15 percent decline from the previous year. The gender composition in the agriculture-natural resources cluster was 67 percent male, 33 percent female.

Among the performance highlights, 87 percent of the states reported that their CTE students had higher secondary graduation rates than for students overall. Forty-four percent of states reported meeting at least 90 percent of their targeted performance levels for their core indicators. The remaining states are required to develop and submit plans to improve their core indicator performance in the area(s) in which they had fallen short.

Academic Evaluation of Agricultural Education Effectiveness

For professionals in the agricultural education field, it appears that they sometimes find it difficult to decide if they should be classified as an agricultural discipline or an educational one. In part due to the lack of survey or longitudinal data about agricultural education programs at the national or state level, the research into the effectiveness of agricultural education efforts appears to be programmatically and geographically driven. There are a plethora of studies with small sample sizes that examine only a single aspect of the system, such as trying to define the components of a successful SAE⁶² or using a cheeseburger in an elementary school classroom setting to test students' understanding of the U.S. food system

(a model used in three states).⁶³ What is not readily available is any overarching analysis of the effectiveness of components of the system (e.g., elementary education) let alone the entire agricultural education system. There is a considerable body of research about the impact of farm to school activities on school children's food preferences and knowledge about gardening and healthy eating habits resulting from participation in such programs, but these results do not necessarily apply to the entire food and agricultural education system.⁶⁴

As of this writing, the Career and Technical Education programs just completed their review of their standards for agriculture, food and natural resources education (AFNR) to ensure that they are as relevant to future careers in food and agriculture as possible. Once disseminated and put in place, these standards should lend clarity and direction to the development of curriculum and over time, it should be easier to evaluate the effectiveness of CTE programs.

In terms of how the system works in terms of agricultural literacy of the general population, an early study on agricultural literacy found that only 30 percent of more than 2,000 Kansas students surveyed in 1986 displayed good knowledge of agriculture.⁶⁵ A 2013 article in the *Journal of Agricultural Education* provided a synthesis of recent research into the issue of agricultural literacy.⁶⁶ Of 49 studies identified within relevant academic journals over a 23-year period (1988-2011), 10 surveyed teacher populations, 33 surveyed student populations, and 6 surveyed non-teaching adult populations. Of the total universe of studies identified, 23 actually sought to evaluate the agricultural literacy of the target population. Results were mixed—six studies found their participant groups to be agriculturally literate, ten studies found their survey groups to have some knowledge of agriculture, and the remaining six found their participant groups to be agriculturally illiterate. In a separate category, 19 studies tested the effectiveness of literacy programs. These studies generally found that agricultural literacy programs are successful in increasing knowledge of agriculture to targeted populations, but existing programs' reach are limited. One shortcoming of the synthesis was that

the authors made no attempt to evaluate whether the definition of agricultural literacy used in the various studies cited was applied consistently or not. There were no studies linking agricultural education and student matriculation into food and agriculture careers.

Key Indicators on the U.S. Agricultural Workforce

Given the lack of any broad-based empirical analysis of how well agricultural education works in attracting young people into the U.S. food and agricultural sector, as farmers, to positions in the agribusiness community, or work in the agricultural sciences and food-related professions, we should also take a look at recent trends on entry into those employment areas. Young people's interest in and preparation for work in U.S. agriculture plays a role in these decisions, but it is likely not the sole determining factor. Recent reports suggest that students' perception of the financial prospects of the food and agriculture sector and the job openings in the sector probably contribute to their decision making process as well.^{67,68}

With respect to young people entering farming on a full-time basis, the best data available are found in the U.S. Census of Agriculture, which provides a snapshot every five years as to the age composition of farm operators in the United States. According to the 2012 Census, the average age of the principal operator on U.S. farms continues to increase, estimated to be 58.3 years in 2012.⁶⁹ However, that rate of increase has slowed compared to the last several censuses, suggesting the age composition of the U.S. farm population has begun to stabilize. The Census tracks not only principal operators, but also up to three operators on the farm (if applicable)—in 2012, there were 3.18 million farmers in all categories.⁷⁰ In that year, 8.1 percent of all operators (not just principal operators) were under the age of 35 years as tallied in the Census, a slight uptick from the 8 percent in 2007. The Census question was worded somewhat differently on this topic in previous Census years, but the 2002 Census recorded only 6 percent of all operators under the age of 35 years.

As to student enrollment in agricultural science fields in U.S. universities, data collected by the Food and Agricultural Education Information System (FAEIS) at USDA indicates that the number of students enrolling in baccalaureate degree programs in those fields increased by 40 percent between 2004 and 2012, and the number of degrees awarded rose by 36 percent.⁷¹ The data covered 22 different fields or majors, including agricultural economics, animal science, natural resource management, and food science and technology.⁷² Enrollment in these fields for graduate degree programs also rose between these two years, although less sharply, at a rate of 18 percent, and the numbers of graduate degrees awarded rose about 28 percent. The share of U.S. citizens among students in the agricultural disciplines remained fairly stable over the time period, at about 81 percent for baccalaureate programs and about 60 percent for graduate programs.

Ideas for Improvement

There are myriad programs underway to provide food and agricultural education or enhance agricultural literacy for young people in the United States, both within and outside formal school settings. However, the lack of coordination, both in terms of curriculum development, program implementation, and monitoring program success, are likely reducing the potential for impact. Better data collection about what works in terms of creating agriculturally literate graduates and inspiring and preparing students for careers in the field will be crucial to enabling the creation of an improved system. In addition, improved understanding of current resourcing as well as programmatic gaps would allow funders to work with educators and other grantees to ensure that collaboration is taking place and duplication of effort is kept to a minimum.

Curriculum Consistency

Teachers have a lot of curricular resources to choose from to help them build their own food and agricultural education program, but there is no system that ranks available resources or provides feedback on what works

that would narrow down the best choices for their purposes. One investment that would help in this area would be to expand course offerings in curriculum development and training on how to access and evaluate existing resources, and provide funds for scholarships for more teachers to participate in such instruction, so they would have a firmer basis for determining which material is most useful and how best to convey it to their students. Another tool that might be utilized to good effect in this area is to set up a series of Massive Online Open Courses (MOOC's) in the area of food and agricultural education, and make them available to both teachers and students.⁷³ Since most elementary and secondary school teachers have an obligation to periodically take courses in their field as part of their continuing education requirements, courses in this area could serve such a purpose.

In 2015, the American Farm Bureau Foundation for Agriculture established a 'Food & Ag Resource Guide' which includes tools and resources judged helpful to improving agricultural knowledge. This online guide provides recommended resources by age group aligned to the Pillars of Agricultural Literacy. It relies on users of agricultural education materials to voluntarily submit ratings as well as new resources as they are developed. The best entries submitted will be recognized annually at the American Farm Bureau Federation Convention.^{74, 75} It is too early to evaluate the efficacy of the Foundation's effort, but it is definitely a laudable objective. However, a more extensive system that relies on vetting or review by experts is probably needed in the end.

A related effort would be to develop a nationally recognized certification process for agricultural and food education in secondary schools, a process that is already underway for several other fields in Career and Technical Education. Such an effort would need to be undertaken in consultation with the land-grant universities and agribusiness sector, so that skills developed to achieve certification would also be of value later in each student's career. Significant work was done in this area by the National Council for Agricultural Education in 2009 in developing a set of career cluster standards for Agriculture, Food and Natural Resources.⁷⁶

Building Stronger Linkages to STEM Efforts

If the global agricultural system is going to meet the needs of the global population of 9 billion by 2050, investments in agricultural research and extension are going to have to play a strong role in that effort. Recent studies on U.S. economic competitiveness have brought a renewed focus on improving the U.S. educational system and doing a better job of attracting young people to technical and scientific training in the so-called STEM disciplines. The U.S. agricultural sector needs to do a better job of making the case that these two sets of demands are in fact linked, that the U.S. economy will prosper with strong productivity gains in both the agricultural and industrial sectors with better trained professionals, and that work must begin in elementary and secondary schooling and include food-related as well as agriculture-related topics. Some parts of U.S. agriculture have embraced the notion that agricultural and food education needs to be embedded in the STEM effort, but that viewpoint is not universally held.

Rewarding Effective Programs

While state departments of education submit data on student performance in CTE programs to the U.S. Department of Education under the Perkins Act, there is little incentive for school districts to be identified as top performers because the funding available is provided under formulas at both the federal and state levels. It might be useful to consider establishing a ‘Perkins Plus’ program that offers additional funds to programs deemed to be top performers to help them expand their reach, either using the performance data already mandated to make the awards or setting up a separate competition. Because of current constraints on federal spending which suggests dim prospects of additional funding, it might be wise to consider a modest shifting of funds from the Perkins Basic Grants, which could serve as seed money for the ‘Perkins Plus’ endeavor, perhaps to be matched by funds from private sources such as foundations, farm groups and/or agribusinesses. An additional performance indicator that could be used in such a competition might be the rankings of states by USDA on their participation in Farm to School programs.

Key to this effort would be defining what constitutes success. If the primary goal is to create a stable and educated workforce for U.S. agriculture, moving students from secondary schools into post-secondary agricultural and agri-science fields should be the main performance indicator for this proposed competition.

National Survey of Agricultural Literacy

Although agricultural literacy of the general population is a significant focus of food and agricultural education in the United States today, there appears to have been no survey conducted on a national basis that probes this matter as the complex set of issues that it deserves. Such a national effort should be initiated, using the resources of USDA’s National Agricultural Statistics Service, which can help separate out farmers from non-farmers in establishing the survey sample, and perhaps involve the agricultural education staff at the Office of Career and Technical Education at USDE to help frame the survey questions. If the agriculture sector sees this is an important problem to address, it would serve that effort well to have a better grasp of where the gaps actually are in the general public’s knowledge of agriculture. One of the goals of this survey should be to examine whether or not the 1988 definition of agricultural literacy from the NAS report needs to be updated.

Establish a Committee to Review Food and Agricultural Education’s Progress

The National Academies of Science established a Committee in 1985 to “to assess the contributions of instruction in agriculture to the maintenance and improvement of U.S. agricultural productivity and economic competitiveness here and abroad.” A report on that assessment was issued in 1988.⁷⁷ The W.K. Kellogg Foundation funded a “Reinventing Agricultural Education for the Year 2020” project between 1996 and 1999.⁷⁸ Now might be a good time to bring together a new Committee, either set up through the National Academies or another convening entity, to take a fresh look at what has been done to implement the 1988

and 1999 recommendations, how the U.S. food and agricultural environment has changed over the last few decades, and how these endeavors might be improved by taking advantage of new digital and telecommunication technologies. That new Committee should include representatives of USDA and USDE, colleges and universities, 4-H and FFA, practitioners of food and agricultural education at the elementary and secondary levels, and farm groups and agribusinesses, as well as representatives of some of the novel approaches to food and agricultural education described above.

In that effort, the new Committee might want to examine the following questions:

- What strategies/techniques can be used to incorporate food and agricultural education into other more “typical” in-school subjects?
- What techniques and/or approaches are most effective in drawing students into secondary food and agricultural education programs?
- How can we keep students interested enough to study agricultural disciplines in post-secondary or university institutions?
- How can we channel these students into the agricultural sector when they complete their educations? and
- Would establishing a national scholarship program for students entering post-secondary agricultural and agri-science fields be an effective use of limited resources in this field?

Concluding Remarks

Food and agricultural education in the United States has taken steps in recent years to adjust its curriculum to the modern agricultural reality, but most of its energy is currently focused in the rural and non-metropolitan regions of the country. In order to expand the pool of young people who might consider a career in a food and agricultural field, more should be done to teach children in elementary school in urban and suburban settings as well about the basic facts of food and agriculture in a way that holds their attention and interest. If basic knowledge about food and agriculture becomes more widely held, there will be opportunities to hold onto the interest of more of these students as they move through secondary school and into college. There’s an urgent need for better data collection on program performance and funding at the national, state, and local level for food and agricultural education, in order to be able to examine these issues in a more rigorous manner.

Traditional partnerships and programs will continue to play a key role in promoting food and agricultural education across the United States. Alternative mechanisms for promoting food and agricultural education should also be explored, such as through charter schools and innovative food education efforts. By incorporating more agricultural science across a variety of STEM fields, there will be new ways to touch students in every classroom across the country. There’s no time to lose, as the massive baby boom generation in this country begins to enter retirement years, today’s millennials will be the ones who will fill the jobs of tomorrow, in food, agriculture, and agribusiness as well as the rest of the economy.

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AGree seeks to drive positive change in the food and agriculture system by connecting and challenging leaders from diverse communities to catalyze action and elevate food and agriculture policy as a national priority. AGree also recognizes the interconnected nature of agriculture policy globally and seeks to break down barriers and work across issue areas.

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