Charles Valentine Riley Memorial Foundation

Agriculture, Food and Natural Resources

Cooperative Extension and Public Outreach: Advancing Agriculture and Improving Lives

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PDFs are available for download at ***www.rileymemorial.org*** or U.S. Department of Commerce National Technical Information Service (Accession No. PB2019-101109, ***https://ntrl.ntis.gov/NTRL/***)

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About the Charles Valentine Riley Memorial Foundation. The Charles Valentine Riley Memorial Foundation (RMF) is committed to promoting a broader and more complete understanding of agriculture and to building on Charles Valentine Riley's legacy as a "whole picture" person with a vision for enhancing agriculture through scientific knowledge. RMF, founded in 1985, recognizes that agriculture is the most basic human endeavor, and that a vibrant, robust, food, agricultural, forestry and environmental-resource system is essential for human progress and world peace. RMF's goal is to have all world residents involved in creating a sustainable food and agriculture enterprise in a responsible rural landscape.

RMF's Commitment to Increased Federal Investment in Research and Education. RMF supports growing each of the key components of the agricultural research and education funding portfolio that supports the national system delivering results for the public good: **competitive grants,** which take advantage of innovation at public and private universities, and other organizations with scientific and technical expertise; **capacity funds**, for state (universities) and federal agencies such as USDA's Agricultural Research Service, Economic Research Service and Forest Service, to continue to provide a stable scientific workforce and research sites that conduct research requiring long-term commitment and potential high-risk/high-payoff solutions, while maintaining the capacity to rapidly address emerging and sometimes crisis situations**;** and **public-private partnerships**, such as the Foundation for Food and Agricultural Research, a nonprofit corporation that matches public funds with private funds to conduct research on problems of national and international significance. As part of its effort to obtain additional support for research and education, RMF promotes a broader and more complete understanding of agriculture by sponsoring the annual **Riley Memorial Lecture** through the American Association for the Advancement of Science. Other program activities support strengthening federal research, education, extension and outreach efforts — essential work that touches every American and contributes to the public good.

About this Report. RMF is sponsoring this report to highlight the special and unique functions associated with Extension programs administered by the land-grant universities and the outreach functions of the non-land-grant colleges of agriculture and nongovernmental organizations. This report is intended to increase general understanding of how these programs and functions engage stakeholders to best contribute to the development and distribution of scientific knowledge related to agriculture, food and natural resources, and to the improvement of lives of residents of all ages in rural and urban communities. During the preparation of *Cooperative Extension and Public Outreach: Advancing Agriculture and Improving Lives*, considerable insight was obtained on the progress that has been made in the pursuit of a unified message. That insight will be recorded in a separate working document, *Increasing Support for Food, Agricultural and Natural Resources Research, Education, Extension, and Outreach: Building on the Unifying Message Effort.*

Disclaimer. *Although a major goal of RMF is to increase federal investment in agricultural, food and natural resources research and education, the primary purpose of this report is to document what has been done with existing resources. However, some comments on opportunities and the status of the unifying message effort are included here that may not reflect the views of all contributors or those of RMF.*

Foreword

Extension is America's educational partner for life. That sentence, taken from this special report from the Charles Valentine Riley Memorial Foundation, speaks volumes. It's right on target as an overarching theme.

Extension and public outreach play a fundamental role in helping America put science into practice. They happen in many forms and through many collaborations and partnerships. Both of us know it best from our land-grant university perspective and our deep roots, professionally and personally, in the land-grant mission of education, access, research and extension.

We both believe that Extension — engaging our land-grant universities with the people they serve — is one of our nation's most extraordinary accomplishments. When President Woodrow Wilson signed the Smith-Lever Act of 1914 that created the Cooperative Extension System at the nation's land-grants, he said it was "our greatest contribution to the national welfare."

We both have served as deans of agricultural colleges, with Extension expertise and programs hardwired into every county of our states, border to border. We've marveled at the unique county-state-federal partnership that provides the capacity to continue fulfilling the Extension mission.

We know intimately how research results made possible by our agricultural experiment station programs are delivered statewide by our Cooperative Extension programs. We know what science-based knowledge means to the livelihoods and the daily decisions made by farmers, businesses, families and communities.

And we know our experiment station research benefits greatly because Extension's finger is always taking the pulse of our communities, as are our teaching programs, led by those who take this direct stakeholder experience and use it to shape their classrooms and the next generation of talent.

But we understand that outreach efforts made possible by non-land-grant colleges of agriculture and nongovernmental organizations of all stripes also play a significant role in the lives of our stakeholders, targeted audiences and communities. As land-grants, we especially know the benefits of amplifying outreach through cooperation and partnership with NGOs in our states and regions — indeed, globally.

For over 100 years the work of extension and outreach, through our land-grant universities and these colleagues and partners at non-land grant institutions and nongovernmental organizations, has helped free people from the constraints of limited knowledge.

Today it goes far beyond that.

Extension and outreach provide trusted knowledge — objective, earned and validated through science from a proven source. That kind of knowledge is golden. It's truly invaluable in the modern world's often-overwhelming surfeit of information and, unfortunately, misinformation from dubious sources.

Trustworthiness is at the heart of extension and outreach. So is the steadfast ability to change with the times, reinventing delivery methods and modes of expertise to match the changing needs of people and communities. Knowing this, and armed with this brand of trusted knowledge, the potential of our stakeholders and of society can be unlimited.

Trust and reputation always comes with a face. From our land-grant experience, we know that in every state, mentioning "extension" to someone evokes a face. It's the face of the field agronomist helping farmers overcome soggy fields and troublesome pests to grow a crop that makes its way down the road and around the world. It's the face of family and community specialists helping rural communities take action against the opioid crisis by reaching the young and old with substance abuse prevention programs. It's the face of the local mentor sparking the creativity and entrepreneurial spirit of youthful 4-H club members, whether discussing a county fair project or their future career path.

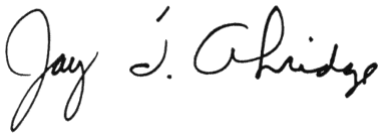
And so much more. It's a tapestry of knowledgeable faces, with hands and minds prepared to help. It's true for our outreach colleagues at the non-land-grants and the NGOs. One and all act as change agents, well connected to their clients. They are bridge builders.

We have both been deeply involved in the recent activities and efforts of the Charles Valentine Riley Memorial Foundation, partnering with many organizations and leaders to consider a key question: How can the agricultural community come together with a unifying approach and message on making increased federal funding of food, agricultural, and natural resources research and extension a much higher national priority?

Through those efforts, we consistently emphasized that a significant part of the public good derived from broadly defined agricultural research is the delivery of unbiased, research-based information and education to the public.

That's what extension and outreach does, and is doing. We hope this special report provides you with a snapshot of the brand of knowledge and insight we speak of. We hope it sends you searching for more information from these trusted institutions. We hope you tell your local, state and federal decision-makers and thought leaders about the value you find in Cooperative Extension and the outreach programs of the non-land-grants and NGOs.

Extension and public outreach truly represent "*America's educational partner for life.*" Every day these efforts deliver. Every day they make powerful contributions vital to the future of our food and agricultural and natural resource systems. After reading this report, we believe you will be as enthusiastic about the continued importance and impact of extension and public outreach as we are.



Wendy Wintersteen
President, Iowa State University,
and Former President, Charles Valentine Riley Memorial Foundation, 2015-2018

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Highlights

The Farm Bill and related legislation and appropriations acts are a social contract between the federal government and the agricultural community to foster discovery of new innovations and translate them into meaningful impacts for farmers, entrepreneurs and workers in the food and agricultural industry, the communities they work in, the allied industries they support and the families they support. Educational outreach is a core of activity in the translation of discovery to impact. Led by Cooperative Extension, non-land-grant colleges of agriculture (NLGCAs), and nongovernmental organizations (NGOs), extension and outreach have a primary role in engaging the research and knowledge from their respective institutions and translating it into a meaningful — if not life-changing — program, through which an individual can grow and thrive in his or her capacity to better serve the needs of community, family and industry. Each of these institutions have their own unique partnership with society and with each other. Working in an integrated and collaborative fashion, they translate and transport research and discoveries into meaningful engagement that builds agricultural enterprise and innovation, skilled labor workforces, thriving industry and healthy, resilient communities.

Together, Cooperative Extension, NLGCAs and NGOs translate research into community action, leaving communities stronger and healthier. While the traditional role of public university education is changing, the evidence-based approach of scientific agricultural research and rural and business economic development will always be a vital component in the outreach of Extension, NLGCAs, and NGOs. Each are advocates for residents of their states, with forces joined in the mission of enhancing the quality of life in their various communities in whatever educational effort is required — mental health access; teaching youth science, technology, engineering, and mathematics (STEM) skills through 4-H; or addressing environmental issues, farm and food safety, or workforce preparedness. Some of these successful efforts include:

- Boosting agricultural productivity
- Educating farmers on soil health
- Increasing water use efficiency and protecting water quality
- Building diverse and sustainable food systems
- Making healthy food choices
- Teaching STEM skills to youth
- Revitalizing rural and urban communities

Seventy-six land-grant institutions receive funding for Extension associated with the Morrill Acts of 1862 and 1890 and the Smith-Lever Act of 1914. In addition, 58 NLGCAs and numerous NGOs across the United States work in conjunction with colleges of agriculture and have related programs in the life sciences. All are steadfast in their efforts to provide educational outreach in every county and state in the nation, on campus in university facilities and off campus in third-party facilities. This synergistic sharing of knowledge, translated from scientists at institutions of higher learning to the front door and backyards of urban and rural communities, is the shared fiber that has united the land-grant universities, NLGCAs and NGOs in their endeavor to deliver practical and liberal education to people and communities for more than 150 years.

A showcase of outstanding national accomplishment is provided in 22 success stories from Extension and eight success stories from NLGCAs and NGOs, which demonstrate how these organizations work — and work together.

Boosting Agricultural Productivity
Mitigating Bacterial Leaf Streak Disease in Corn
Teaching Best Practices for Herbicide Use
Building Nutrient Management Plans
Swine Production Efforts Keep Industry Competitive
Supporting Beef Production through Education
Improving Management Efficiency of Rangelands
Assisting Beginning Farmers and Ranchers
Improving Water Efficiency in Greenhouses and Nurseries
Enhancing Urban Water Quality
Managing Invasive Species in Forestry Ecosystems
Making Healthy Food Choices on a Limited Budget – SNAP-Ed Works
Reducing Sugary Drink Consumption
Expanding Fruit and Vegetable Consumption
Teaching STEM Skills in Youth through 4-H
4-H Builds Entrepreneurial Skills in Youth
4-H, Habitat and Tech Wizards
Building Resilience in Military Youth
Revitalizing Rural Communities
Enhancing Small Farm Profitability
Building Sustainable, Diverse, and Resilient Food Systems
Strengthening Virginia's Produce Food Safety Culture
Improving Strawberry Production
Improving Food Processing
Increasing Water Use Efficiency
Food Safety and Sanitation Training
Cover Cropping Systems for Corn and Soybeans
Educating Farmers on Soil Health
Small Farmers and Food Safety
Training Successful Beginning Farmers

These 30 success stories demonstrate the vast array of issues addressed and served by Cooperative Extension, NLGCAs and NGOs. They demonstrate how farmers, families, businesses and communities benefit from these educational programs delivered for all residents in every community across the nation. Extension, NLGCAs and NGOs, perhaps more than many others as demonstrated in the success stories, also have served small and beginning farmers and rural communities. Still, there are opportunities to do more for these groups as well as other socioeconomically disadvantaged agricultural and food interests.

The success stories also demonstrate how Cooperative Extension and public outreach programs have developed synergistic interrelationships and effective partnerships in delivering research/evidence-based educational programs to a wide range of clientele. Land-grant universities, NLGCAs and nonprofits have recognized that societal education program needs exceed the individual capacity of any single organization. Each organization has leveraged financial and human resource investments in working collaboratively. Likewise, these joint efforts ensure that unbiased information is available to all that are being served.

Extension and public outreach programs emerge from the synergistic interrelationships and effective partnerships among universities and nonprofits, industry groups and stakeholders. Embedded in our communities, Extension, NLGCAs and NGOs are uniquely positioned to collaborate with stakeholders to lift up educational needs of our local communities. By bringing campus and community together, a cycle of identifying needs, co-creating and delivering educational programs, and evaluating impact launches universities and nonprofits into a continuous cycle of growth and development. Land-grant universities, NLGCAs and nonprofits recognize the benefits of collaboration, leveraging the individual capacity of any single organization. Three of the success stories — Cover Cropping Systems for Corn and Soybeans, Small Farmers and Food Safety, and Training Successful Beginning Farmers —are exemplary representations of just how land-grant universities, NLGCAs and NGOs have worked together to create lasting, life-changing programs, whose legacy continues to transform lives today. The synergy between universities, NGOs, industry groups and community stakeholders is the core scaffolding that allows education to advance agriculture and improve lives.

Introduction

The United States is in danger of losing its competitive advantage in agriculture. Beyond its impactful role in the national economy, the food and agriculture system is a critical component of America's infrastructure, essential for life and health. For more than 150 years, the U.S. has given priority to agricultural research. Advances in agriculture are highly dependent on science and innovation to maintain high productivity and provide resilience to emerging pest and disease threats and severe weather events. Publicly funded agricultural research led to innovations that helped farmers respond to those threats and also laid the scientific knowledge base for the development of national and international companies that contribute employment and economic activity. Yet in recent years, federal and state governments have reduced funding for this critical field of science. The United States' preeminence in this field of science is being challenged as other countries ramp up investments in agricultural research. Rising competition from China, the European Union and other regions signals a risk to the U.S. global leadership in agriculture. The U.S. may no longer be in the forefront.

The Riley Memorial Foundation (RMF) launched an effort in 2014 to develop a unifying message to increase support for food, agricultural and natural resources research. An initial report, *Pursuing a Unifying Message: Elevating Food, Agriculture and National Resources Research as a National Priority*, was released during an event at the National Press Club in late 2014. Subsequently, five stakeholder events and a special event on federal agencies were conducted and associated reports prepared. The stakeholder events focused on universities; scientific societies; food, nutrition and health; natural resources; and commodities. As these events were conducted and reports were being prepared, it became obvious that some institutions needed additional attention, and special reports were prepared on the Agricultural Research Service (ARS), Forest Service (FS), Economic Research Service (ERS) and the NLGCAs. Reports on all of the efforts are available online at ***https://rileymemorial.org/.***

This report is another key step in the RMF's unifying message effort. During the process of developing the current report, the authors recognized the nascent power of greater unity in the outcomes of the most recent farm bill and federal appropriations cycles. Going forward, an even higher degree of substantive and strategic unity to support major increases in funding through USDA holds great promise to accelerate recent gains. RMF's vision is that such an alliance, we hope, would include the Association for Public and Land-Grant Universities, Friends of ARS, Non-Land-Grant Agriculture and Renewable Resources Universities, AgForward, Association of Agricultural and Applied Economics, American Statistical Association, National Coalition for Food and Agricultural Research, Supporters of Agricultural Research and the AFRI Coalition. By working together on a comprehensive strategy beyond each group's focus on one or more particular programs, great progress could be made toward fulfilling the vision of a unified message and approach.

Although the unifying message effort has focused primarily on programs within the research, education and economics mission area research and development function of the Forest Service in the USDA, it is important to emphasize the contributions made by other federal agencies, including the National Science Foundation, U.S. Geological Survey, Department of Energy, U.S. Agency for International Development, National Oceanic and Atmospheric Administration and Department of Defense. Partnerships involving those agencies whose roles are described in the

special report, *Raising the Profile of Federal Research*, make a major contribution to increasing scientific knowledge relating to agriculture, food and natural resources. Examples of partnerships involving many of those agencies are also provided in an earlier report published by RMF in 2011, *Agriculture, Food, Nutrition, and Natural Resources R&D Round Table: Research Partnerships Yield Greater Societal Returns*. Subsequently a consolidated report, *A Unifying Message: Pulling Together, Increasing Support for Food, Agricultural and Natural Resources Research*, was released at the 2018 Charles Valentine Riley Memorial Leadership Breakfast that June:

https://rileymemorial.org/files/files/RMF%20A%20Unifying%20Message%20Pulling%20Together%20June%202018.pdf

As discussions continued, it became obvious that the efforts of Extension and institutions that perform public outreach activities are an important part of a vibrant and robust food, agricultural, forestry and environmental resource system. Therefore RMF is sponsoring this report to highlight the special and unique functions associated with Extension, NLGCAs and NGOs. This report is intended to increase the general understanding of how these programs and functions engage stakeholders to best contribute to the development and distribution of scientific knowledge related to agriculture, food and natural resources, and to the improvement of lives of youth and families in rural and urban communities.

Although this report focuses on Cooperative Extension in the 1862 and 1890 land-grant universities and outreach activities of the NLGCAs and NGOs, it is important to note that cooperation between the 1862 land-grant universities and the 1994 Tribal Colleges and Universities (TCUs) is reflected in two of the success stories included in this report. The reader is referred to the websites for the National Institute for Food and Agriculture (NIFA) Tribal Programs, ***https://nifa.usda.gov/program/nifa-tribal-programs***, and the American Indian Higher Education Consortium (AIHEC), ***www.aihec.org***, for additional information on programs of the TCUs.

RMF has focused on federal support for agricultural, food and natural resource research and education programs, it is important to recognize that private funds make important contributions to private universities that conduct related research and grant-related degrees. Likewise, there are nonprofit organizations usually not considered to be NGOs that are funded primarily through endowments from private sources and that conduct important research and outreach activities. Further, when considering advancing agriculture, the role of some 20 commodity checkoff programs, funded by agricultural producers and receiving some oversight from USDA, need to be part of the total process. These programs are designed to promote and provide research and information for a particular agricultural commodity without reference to specific producers or brands. Building on the roundtable on *Pursuing a Unifying Message: Elevating Food, Agricultural and Natural Resources Research as a National Priority: A Commodities Research Perspective* may be an opportunity for doing that. However, in this current report special attention is given to the role of Cooperative Extension, NLGCAs and NGOs in advancing agriculture and improving lives.

https://nationalaglawcenter.org/research-by-topic/checkoff-programs/
https://rileymemorial.org/files/files/UnifyingReport7_3.pdf

Cooperative Extension

Introduction

Cooperative Extension is a nationwide education system that operates through land-grant universities in partnership with federal, state and local governments. Extension has a presence in every county, parish and borough across America on issues relevant to agriculture, communities, families and youth. Extension programs are associated with 76 land-grant universities that are at work in all 50 states, the District of Columbia and five territories (Appendix A).

Founded in the early 20th century and building its legacy around 4-H, agriculture and home economics educational programs, Extension was and continues to be responsive to both local and national interests by engaging people and helping them transform U.S. communities and the food, agricultural and other industries they serve.

The profitability and sustainability of America's food and agricultural producers have become increasingly interdependent with youth and families in both rural and urban communities. Extension's work is foundational, with an emphasis on teaching technical, professional and life skills, as well as building communities where these skills can flourish. In Extension's beginnings, youth were trained to go back to the farm. Now Extension also trains youth and adults to adopt a new generation of science, technology, engineering and mathematics (STEM) skills for a new set of careers in food and agriculture, and more.

As the needs of economies and society change, it is vital that Extension maintains a robust focus on workforce development that includes preparedness and resilience, broadening its reach into today's more diverse communities — a pathway that will further demonstrate Extension's relevance and value in the 21st century. For more than a century Extension has utilized food and agriculture as the mechanism to teach vital STEM skills and work with researchers to develop new technological innovations. Stakeholder partnerships allow Extension to bring innovations to life. Extension training also equips people with the ability to think critically, work together, communicate, accept feedback, meet deadlines and be punctual — a workforce development effort that has always been present in our agricultural and 4-H programs.

Extension's programs have evolved, with a heightened focus on building positive life skills in families, like parenting techniques that help prevent substance abuse and education about living habits that promote physical, behavioral and financial health. Fostering healthy family behaviors also helps avoid spillover workforce issues, thus benefiting the economic health of the community. Extension's attention to community development is a vital component in revitalizing rural and urban communities, where individuals can flourish with the new skills they have learned. Extension works on broadband issues to overcome the geographic isolation found in our rural areas, and also within our urban areas, in an effort to overcome the social isolation that inhibits the well-being of our communities.

The ability of Extension and public outreach to advance agriculture and improve lives is increasingly recognized internationally. Extension has a long history of working with other countries in building their capacity to deliver educational programs. In other nations Extension and public outreach programs emerged from government ministries and then developed strong

partnerships with universities and NGOs. Currently several international initiatives are emerging to create university-based Extension and public outreach programs. Extension services, especially those located at universities, provide local and regional platforms for more timely intervention. For example, university-based Extension is emerging as a global network for technology transfer, pathogen detection and intervention, and collaborative applied research on climate change and rural development. From South America, Africa, Eastern Europe, Southeast Asia and China, international universities are looking at the U.S. structure as *the* model for Extension and public outreach that build collaborations among universities, government agencies, NGOs, industry groups and community stakeholders to advance agriculture and improve lives.

Extension was designed to teach the technical, professional and life skills needed to build vibrant communities, strong families and profitable businesses at the farm gate and on Main Street. The power of education is its ability to create, develop and deploy new technology and innovations that enhance the quality of life for the people and communities served by its programs. Extension provides the educational network to bring education to our communities, industries and families. The food and agriculture industry is a natural environment for how Extension provides the information, resources and insights to help people make better life decisions for their communities, industries and families. By reaching both the young and young at heart, Extension is America's educational partner for life.

Success Stories

Success stories representing accomplishments by Extension were selected to cover a range of subjects including agriculture, natural resources, food, nutrition, health, youth, business development and communities. At least three stories were selected from the 1862 land-grant universities in each of four regions — Northeast, North Central, South and West — and from the 1890 land-grant universities.

Many of the following success stories were gathered from the contents of the Land-Grant Impacts database, ***https://landgrantimpacts.org/***. These stories are among many that reflect Extension's important local relationships and partnerships that lead to issue identification, program goal development and impact evaluation. The database is populated with impacts and success stories submitted by Extension administrators and directors from the 76 land-grant universities that comprise the nationwide Extension network.

Agriculture

University of Georgia

Boosting Agricultural Productivity. Cotton and peanuts are among the leading crops in Georgia and have been for more than a century. With the nation's second highest production of cotton and third highest production of peanuts, ensuring the solvency of these crops is vital for high yields. Georgia Extension is leading the way to make sure cotton and peanut growers face and defeat the challenge of growing these crops, since growers of each depend on high yields to be solvent.

Georgia Extension educators are working together to recommend fertilizer rates that increase cotton yields, which increases profits, using research-based fertilizer recommendations. Georgia Extension's recommendation for nitrogen, potassium and foliar fertilization for three-bale cotton produced higher yields with a $24.08 return on investment.

Peanut growers face their own unique challenges, especially in the battle against diseases, which is exacerbated by the majority of growers using the same Georgia-06G variety. This leads to battling the tomato spotted wilt virus that overcomes the resistance traits of this particular variety. To sustain peanut production in the state, Georgia Extension specialists are identifying peanut varieties that possess the disease resistance, growth and vigor, and superior yield and quality growers need. This research and associated field trials have given growers a variety of options to choose from in the coming years.

Georgia Extension's efforts contributed to success in 2017, with Georgia farms harvesting 820,000 acres of peanuts. The use of superior tested varieties including Georgia-06G resulted in an increase of $100 per acre compared to more disease-susceptible varieties. Cotton acreage also benefited from the help of Georgia Extension, with acreage yielding more than $31 million in increased profits for the state's cotton growers.

Contacts: *Walter Scott Monfort (smonfort@uga.edu, 229-386-3696), associate professor, Department of Crop and Soil Sciences, University of Georgia Extension; William Tyson (wtyson@uga.edu, 912-871-6130), county Extension coordinator*

Collaborators: *UGA Crop and Soil Sciences, Cromley Farms, Bulloch Gin*

Source: *Land-Grant Impacts,* ***https://landgrantimpacts.org***

University of Nebraska

Mitigating Bacterial Leaf Streak Disease in Corn. In August 2016 bacterial leaf streak disease of corn caused by *Xanthomonas vasicola* pv. *Vasculorum* was reported in Nebraska — the first occurrence in the United States. Since 2016, the disease has spread to 74 of 93 Nebraska counties. By 2018, it was confirmed in 10 states (Nebraska, Colorado, Kansas, Illinois, Iowa, Texas, Minnesota, South Dakota, Oklahoma, Wisconsin). Leaf symptoms can be confused with the common fungal disease gray leaf spot and other diseases. Because the disease is bacterial, fungicides cannot effectively manage it, making exact identification critically important for effective and economical management.

In 2016, Nebraska Extension specialists and educators quickly assembled the bacterial leaf streak programming team to provide programming and resources to stakeholders. During the initial weeks following the report, team members conducted seven Extension corn disease updates and five industry-sponsored events across Nebraska in an effort to teach diverse audiences about bacterial leaf streak, including growers, crop consultants, cooperative employees, agricultural industry representatives, Extension faculty and state/federal government regulatory officials.

Sixty-eight survey respondents of the 185 attendees at the Nebraska Extension events, estimated an average value of $11.44 per acre gained due to content from these meetings. This increase in knowledge resulted in an estimated value of $236 million across 20.7 million acres represented by the participants. Through 2018, bacterial leaf streak educational content was presented during 60 events with more than 5,200 attendees statewide, 88 percent of whom reported improved disease identification and management skills.

Participants reported the meetings were conducted in a timely manner with excellent presentations and audience interaction. The most important aspect, many reported, was learning to distinguish bacterial leaf streak disease from gray leaf spot.

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Collaborators: *United States Department of Agriculture Animal Plant Health Inspection Service (USDA APHIS), Nebraska Department of Agriculture, Iowa State University, Colorado State University*

Source: ***https://cropwatch.unl.edu/bacterial-leaf-streak***

Purdue University

***Teaching Best Practices for Herbicide Use*.** The adoption of soybean varieties resistant to dicamba-containing herbicides triggered a national surge in drift damage reports on neighboring crops and other non-target vegetation. In response, the Environmental Protection Agency and manufacturers of dicamba products created federal label-mandated training requirements for users of dicamba-containing herbicides. In addition, the Indiana Pesticide Review Board classified all pesticide products containing at least 6.5 percent dicamba with agricultural use labels as restricted use pesticides (RUPs), which restricted their sale to certified applicators deemed competent and licensed to handle and use such RUPs. Between January and April 2018, Purdue Extension, in collaboration with the Office of the Indiana State Chemist, delivered 193 training sessions in person and via webinar to train and certify users of dicamba products.

The workshops provided information on best practices to reduce drift and volatilization and discussed weed management practices that would minimize the development of dicamba-resistant weed populations. More than 8,000 private pesticide applicators (currently certified in Indiana) attended the training. Applicators learned how to use buffers and to account for wind direction and speed, and about application timing, temperature, rain, recordkeeping, nozzles, boom height, ground speed, sprayer cleaning and spray volumes for application of dicamba products. In addition, attendees were encouraged to utilize the lessons learned from the abuse of the glyphosate-resistant soybean production (Roundup Ready) system; specifically, to utilize diverse weed control practices to slow the evolution of dicamba-resistant weed populations.

Evaluations showed statistically significant knowledge gains regarding dicamba issues and practices among the attendees. Most attendees demonstrated accurate knowledge of proper boom height, causes and effects of dicamba volatilization, buffer and wind restrictions, and locating dicamba-sensitive crops. In 2018 the number of dicamba product complaints held steady, even as the use of dicamba-resistant soybeans doubled. The potential adoption of best practices related to dicamba use are expected to improve regulatory compliance with dicamba herbicide and injury to non-target vegetation.

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Collaborators: *Office of Indiana State Chemist, Purdue Extension, Purdue Agricultural Research and Graduate Education, Purdue Pesticide Programs, Office of the Indiana State Chemist*

Sources: *Robinson, A. P., V. M. Davis, D. M. Simpson, and W. G. Johnson*. 2013. Response of glyphosate-tolerant soybean yield components to dicamba. Weed Sci. 61:526-536.*
https://www.oisc.purdue.edu/pesticide/pdf/2019_dicamba_faq.pdf
https://ppp.purdue.edu/wp-content/uploads/2017/12/PPP-119.pdf

University of Missouri

Swine Production Efforts Keep Industry Competitive. In a 2016 economic impact study by the Missouri Department of Agriculture, hogs ranked second only to oilseed production in the added value from the state's crops, livestock, forestry and fishing industries. With the swine industry in the United States growing, and Missouri contributing to the abundance of breeding animals to further this effort, enhanced reproductive efficiency to capture genetic value became increasingly important for the state to maintain its competitive advantage in swine production.

University of Missouri Extension (MU Extension) directed its efforts to support the state's swine production. The Midwest Boar Stud Managers Conference (BSMC) in Missouri provided Extension with an opportunity to connect with 80 percent of the boar representatives in the county. This program now serves as a centerpiece for other male-related efficiency training efforts. The BSMC Facebook page provides examples of how their efforts have helped the industry use semen doses with fewer sperm cells — two-thirds less than 10 years ago. Other programmatic efforts with the Missouri Pork Association (MO-Pork) include helping farms implement emerging reproductive technologies and troubleshooting systemic reproductive performance issues. Outreach also is coordinated with other industry partners to amplify these efforts.

MU Extension and MO-Pork continue to coordinate educational programming for producers statewide, allowing wider dissemination of semen from top-tier boars. MU Extension's efforts to help in the reduction of sperm numbers resulted in significant savings, with collection from fewer boars. Ultimately the lasting impact of the spread of genes from superior boars across more progeny is greater efficiency of growth and reproduction.

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Collaborators: *Midwest Boar Stud Managers, Missouri Pork Association, Pork Quality Assurance Plus (PQA Plus)*

Sources: ***http://bsmc.missouri.edu***
http://mupqaplus.missouri.edu

Texas A&M University

Supporting Beef Production through Education. Livestock producers face serious threats from pervasive and invasive vector-borne diseases. Concerns over variable prices, uncertain weather conditions and increasing production expenses spurred demand for the sound management practices and decision making that are key to optimizing production efficiency and competitiveness.

The Texas A&M AgriLife Extension Service delivers educational programs focused on research-based livestock production and management practices, evaluation of technologies, improved decision making and water-use efficiency. Efforts focus on training for 21st century jobs and jobs of the future for agriculture careers. Programs for livestock operations focus on improved reproduction strategies, animal health, feeds and nutrition, forage production, breeding-stock replacement strategies, livestock marketing and financial risk management. In 2017 AgriLife Extension made more than 2 million contacts through 10,900 educational events, planning meetings and workshops.

Impacts were measured by the increase in net returns associated with adoption of management practices taught in 2017. Extension programs focusing on managing livestock and crop financial risk led to estimated gains of $39 million. The increase in net returns resulting from the adoption and implementation of selected beef cattle management practices taught at the Texas A&M Beef Cattle Short Course and Ranch Management University resulted in an economic benefit of $7.4 million. For dairy operations, benefits from the adoption of heat abatement and other management strategies were an estimated $26.8 million. Net returns from the implementation of selected beef cattle management practices from the Cattle Trails Stocker and Wheat Conference, Beef Quality Assurance trainings and Hemphill County Beef Conference resulted in $7.9 million, with Beef Cattle Reproduction Management schools earning $622,000. Additionally, Beef Quality Assurance trainings, Feedyard Camp and the Feedyard Technician Program provide an annual wage base of $7.7 million, supporting 218 Texas jobs.

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Collaborators: *Capital Farm Credit, Purebred Cattle Alliance, American Breeds Coalition, Texas and Southwestern Cattle Raisers Association, Independent Cattleman's Association, Houston Livestock Show and Rodeo, San Antonio Livestock Show and Rodeo, Gulf Coast Cattleman Magazine, The Cattlemen Magazine, Texas Hereford Association, Nolan Ryan All-Natural Beef, Graham Land and Livestock, Oklahoma State University Cooperative Extension, Texas Cow-Calf and Stocker Cattle, Texas Beef Council, Canadian Chamber and Visitors Bureau, Bovine Elite, LLC., American Breeders Service, COBA/Select Sires, Texas Beef Safety and Quality Assurance, Texas Cattle Feeders Association*

Source: ***https://agrilifeextension.tamu.edu/about/economic-impact-briefs/livestock-production/***

University of Wisconsin

Building Nutrient Management Plans. Farmers in Wisconsin face increasing regulatory pressures concerning agricultural nutrient contributions in water resources, as government agricultural programs, zoning, livestock siting ordinances and animal feeding operation permits all require nutrient management (NM) plans.

In 1999, University of Wisconsin Extension (UWEX) responded by leading a team to develop and distribute the nutrient management farmer education (NMFE) curriculum. In partnership with several Wisconsin agencies and USDA, the curriculum was developed, funding for local delivery was acquired, and collaborations with several private and public partners were established. The philosophy was to educate farmers on the methods of improving NM practices from an economic and environmental perspective and help them design their own NM plans.

After numerous revisions, the curriculum now includes classroom instruction, individual consultation and on-farm field trials. Since 2000 more than 7,600 producers farming approximately 2.2 million acres in 55 counties have received in-depth education on NM planning. During 2018, approximately 465 farmers in more than 18 Wisconsin counties participated in the county-based NMFE programs. An estimated 85 percent of these farmers developed or assisted in the development of NM plans for their operations. An estimated 130,100 acres of Wisconsin cropland also were planned, with the major agricultural enterprises including dairy, cash grain and beef.

This popular collection of nutrient management education and evaluation tools has improved practices on farms in Wisconsin and reduced the detrimental impact of nitrogen and phosphorus in water. UWEX maintains an ongoing effort to evaluate and update the NMFE curriculum, which includes an evaluation plan of pre- and postworkshop assessments, along with comprehensive, long-term assessments.

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Collaborators: *Wisconsin Department of Agriculture Trade and Consumer Protection, Wisconsin Department of Natural Resources, USDA Natural Resources Conservation Service*

Sources: ***https://ipcm.wisc.edu/blog/2017/01/nutrient-management-farmer-education-curriculum-revis/***
https://datcp.wi.gov/Pages/Programs_Services/NMFEGrants.aspx
https://minds.wisconsin.edu/bitstream/handle/1793/74003/JaneAnklam.pdf?sequence=1

University of Wyoming

Improving Management Efficiency of Rangelands. In Wyoming rangelands comprise more than 80 percent of the land base, which means sustainable rangeland management is a key component of economic stability in many parts of the state. Forage-based animal agriculture is the only basic industry found in all 23 Wyoming counties, and marketing of livestock and livestock products account for approximately 80 percent of statewide agricultural cash receipts. Stockpiling forages and extending the grazing season while maintaining acceptable livestock performance can lead to major economic benefits for a ranch.

Instituting management-intensive grazing can improve the harvest efficiency of grazing livestock and, subsequently, the productive capacity of the grassland. Wyoming Extension educators set forth to help farmers improve their management practices by hosting grazing schools, a four-day, hands-on workshop implementing a management-intensive grazing program to improve forage and livestock production. Through the grazing schools, participants learn to incorporate management-intensive grazing practices into their plans and to use the tools necessary for successful grazing.

So far the schools have provided hands-on experience to 50 farmers. Every participant surveyed reported an increase in knowledge about the topics covered in the class. Participants indicated they would save an average of $30 per animal as a result of attending the workshop, collectively saving approximately $419,000 each year.

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Collaborators: *Amazing Grazing Lands Services LLC*

Sources: *Land-Grant Impacts,* ***https://landgrantimpacts.org***
https://portal.nifa.usda.gov/web/areera/plans/2017-2021/2017-University-of-Wyoming-Combined-Research-and-Extension-Plan-of-Work.pdf

New Mexico State University

Assisting Beginning Farmers and Ranchers. Food and agriculture is at the core of New Mexico's history. Maintaining an agriculture sector that can serve the needs of the state and that is resilient in the face of change is vital to its staying power. New challenges include an aging population of farmers and ranchers; increasing pressure on water and natural resources; and rising costs for land, energy, equipment and other production needs.

For the past six years the New Mexico Extension Rural Agricultural Improvement and Public Affairs Project, in collaboration with the 1994 land-grant serving Institute of American Indian Arts (IAIA), has helped ensure economic survival for American Indian Pueblo farmers in northern New Mexico through a USDA National Institute of Food and Agriculture (NIFA) Beginning Farmer and Rancher Development Program grant.

The beginning farmers and ranchers program has trained 102 people and led to significant improvements in a variety of farm management practices. The Pueblo agricultural producers were made aware of USDA programs that can assist their efforts to own and operate their family farms and ranches; were individually assisted in accessing USDA programs; were helped to develop markets to increase profitability, and utilized research-based educational and technical assistance programs developed specifically for them.

Results have been significant for farmers and ranchers. Soil test participants showed an increase in crop yield of 20 percent, with $4,000 in income per farm. Integrated pest management training resulted in crop loss prevention valued at $18,000. Education on the construction of hoop houses led to a 20 percent increase, or $5,000, in farm income. Beginning farmers and ranchers who became certified in Beef Quality Assurance experienced an average increase of 12 percent in calf price sales, or about $100 more per calf sold. Instruction in herd health and management led to a 25 percent increase in ranch income, along with a bull management program that led to a 10 percent increase in ranch income.

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Collaborators: *Institute of American Indian Arts*

Sources: ***https://newscenter.nmsu.edu/Articles/view/12172/nmsu-receives-usda-grant-to-expand-agricultural-education-program-to-18-pueblos***
Land-Grant Impacts, ***https://landgrantimpacts.org/***

Natural Resources

Clemson University

Improving Water Efficiency in Greenhouses and Nurseries. Most greenhouse and nursery crops rely on irrigation. Drought conditions, pollutants, competition for water resources and concerns about environmental impact make it necessary for greenhouses and nurseries to manage water more effectively.

Researchers and Extension specialists from 21 land-grant universities are leading a multistate research project to develop innovative tools and strategies that help ornamental crop growers conserve water, minimize impacts on the environment and sustain production. The group's research on the water requirements of plants and the effects of different growing media, container types and environmental conditions has led to recommendations for more efficient irrigation timing and amounts.

A newly developed, free mobile app, GroZoneTracker.com, helps growers record, track and share information, making it easier to quickly fine-tune irrigation practices. Growers who used a new wireless soil moisture sensor system reported shorter production cycles, less disease, better plant quality and large water savings. One user reduced irrigation by 50 percent, saving 43 million gallons of water and reducing water pumping costs by $6,500. Michigan's largest nursery expects to reduce irrigation applications by 20 percent and save 50 million gallons of water. Preventing overwatering helps cut fertilizer applications by an estimated 10 percent, sending about 22.3 fewer pounds per acre of nitrate and 4.5 fewer pounds per acre of phosphate in the runoff stream.

Researchers also identified landscape plants and designed sensor systems, rain gardens and artificial wetlands that can be used to filter sediment, chemicals and plant-damaging pathogens out of runoff from nurseries and greenhouses. The project's findings on using alternative sources like laundry water, pond water and salty water for nursery and greenhouse irrigation could save millions of gallons of freshwater for other uses.

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Collaborators: *USDA-ARS, Michigan State University*

Sources: *Land-Grant Impacts,* ***https://landgrantimpacts.org***
https://www.nimss.org/projects/16856

Michigan State University

Enhancing Urban Water Quality. In 2014 city water pipes in Flint, Michigan, began leaching lead, leaving city residents with inordinately high levels of lead in their drinking water. Michigan State University Extension quickly modified programming and mobilized resources in Flint to address the community's critical public health concerns.

Health and nutrition education programs focused on reducing effects of lead exposure to 38,000 Flint families. Through the Supplemental Nutritional Assistance Program (SNAP) education grant and at the Flint farmers market, cooking classes and demonstrations featured lead-mitigating foods. Master Gardener classes taught residents how to grow healthy foods in soils with suspected lead contamination. Today the Michigan State University community food systems team continues to help Edible Flint, a group that supports Flint residents growing their own food, and provides educational resources to gardeners and urban farms around lead-mitigating strategies for foods grown locally. Partnerships with food commodity groups and the local food bank ensure that healthy foods and milk are available to Flint families, including 51,500 gallons of milk since 2016.

Partnerships with the Michigan Department of Health and Human Services and the Michigan Department of Education provided nearly $2.2 million targeted at helping parents, seniors, single people and youth aging out of foster care make better nutrition choices. Local agencies were provided with education, printing and resource materials. These resources helped 20 food pantries and corner stores implement 102 environmental changes that drove customers to healthy food choices. Nutrition and food-budgeting education helped 80 percent of participants (2,120 residents) make improvement in nutrition practices.

Children, Youth, and Families at Risk (CYFAR) grant funding was leveraged to develop and deliver parent/caregiver education classes in two of the neighborhoods hardest hit by lead contamination. This effort focuses on reducing parenting stress, increasing the quality of parent-child relationships and enhancing parents' ability to respond to children's emotions appropriately.

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Collaborators: *Michigan Department of Health and Human Services, Michigan Department of Education, Michigan Department of Agriculture and Rural Development, Michigan Milk Producers Association, the Kroger Company, USDA-NIFA, Hurley Medical Center, the Pediatric Public Health Initiative, MSU College of Human Medicine*

Sources: ***https://engage.msu.edu/about/projects/health-and-wellbeing/response-to-flint-water-crisis***
https://www.canr.msu.edu/lead/

Pennsylvania State University

Managing Invasive Species in Forestry Ecosystems. A new invasive species, the spotted lanternfly (SLF), could threaten Pennsylvania's agricultural industries, including hops, landscape plants, grapes, tree fruit and wood products valued at more than $18 billion. In response, Penn State Extension forged a partnership with the USDA Animal and Plant Health Inspection Service Plant Protection and Quarantine (APHIS PPQ) program and Pennsylvania Department of Agriculture (PDA). Penn State Extension's role in this critical partnership is to increase public awareness, provide broad-based education and conduct applied research on the pest.

Penn State Extension established a website (***https://extension.psu.edu/have-you-seen-a-spotted-lanternfly***) and a call center hotline (1-888-422-3359) where residents can report potential sightings. In 2018 14,098 calls were received, and 7,478 of those were addressed by agents. The Penn State SLF website was visited 342,986 times, and new reports of SLF were immediately directed to the PDA and USDA, who investigated.

Penn State Extension was responsible for approximately 110 SLF news releases, articles and media mentions; radio and television broadcasts; podcasts; and YouTube videos. Penn State Extension contacted 6,855 individuals through 76 face-to-face meetings. During this time, more than 300,000 copies of eight new SLF publications were distributed. An online permit course also was developed to train and certify businesses: ***https://extension.psu.edu/spotted-lanternfly-permit-training***.

The partnership has resulted in greater awareness of the SLF among Pennsylvania residents and those in surrounding states in addition to knowledge about its quarantine regulations. Resident awareness of this new invasive species, along with the infrastructure for rapid reporting of new occurrences, has allowed the PDA and USDA to respond to and prevent establishment of the pest in new areas. The massive educational effort led by Penn State Extension seems to be working: The quarantine zone has not expanded beyond the 13 counties in Pennsylvania and three counties in New Jersey.

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Collaborators: *Pennsylvania Department of Agriculture, United States Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine, Penn State College of Agriculture Extension and Agriculture Research Experiment Station, citizens of Pennsylvania*

Sources: ***https://extension.psu.edu/have-you-seen-a-spotted-lanternfly***
https://extension.psu.edu/spotted-lanternfly-permit-training

Food, Nutrition and Health

University of Missouri

Making Healthy Food Choices on a Limited Budget – SNAP-Ed Works. Many low-income residents of Missouri are recipients of the Supplemental Nutrition Assistance Program (SNAP), with one in five receiving emergency food assistance each year. Yet many recipients lack access to the latest nutrition information about how to lead an active lifestyle and make healthy food choices on a limited budget.

University of Missouri Extension launched an effort to help with this, creating an evidence-based nutrition education program — Supplemental Nutritional Assistance Program Education (SNAP-Ed) — more than 25 years ago. Using the socioecological model to prompt behavioral change, Extension faculty and staff provide classroom education with hands-on, interactive activities and media campaigns in the state's 114 counties. Whether in the classroom or the community, the goal of the Missouri SNAP-Ed program is to educate participants to make positive behavioral changes that lead to lifelong health and fitness.

Educators reach more than 140,000 youth and adults annually and collaborate with more than 1,200 community members, working closely with school food service personnel to make smarter lunchroom changes and reduce food waste. One middle school student reported weight loss of 26 pounds over summer break by eliminating junk food and soda and incorporating a jump-rope exercise plan — skills learned through the SNAP-Ed program. Since its inception, the program has developed 600 school and community gardens that produce more than 7,600 pounds of produce — a $20,748 retail value — utilized by SNAP-Ed families, school food programs and food pantries.

SNAP-Ed continues to be a transformative program in its mission to end hunger, reduce obesity and promote lifelong health. Long-term goals include helping individuals reduce or eliminate reliance on SNAP with long-term food security.

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Collaborators: *Missouri Department of Social Services, Missouri Council for Activity and Nutrition*

Sources: ***http://extension.missouri.edu/fnep***
http://extension.missouri.edu/fnep/reports/FNP2016-AnnualReport.pdf

Alabama A&M University

Reducing Sugary Drink Consumption. Drinking sugar-added soft drinks and juices are raising America's obesity rates for youth and adults. According to the USDA, sugary drinks account for 7 percent of America's grocery budget. A USDA report, *Food Typically Purchased by Supplemental Nutrition Assistance Program (SNAP) Households*, revealed SNAP households spent even more money on sugary drinks than non-SNAP households, sounding an urgent alarm to help develop healthier eating habits in youth and adults.

With Alabama ranking third in national obesity rates, Alabama Extension at Alabama A&M University led the effort to target the reduction of sugary drink consumption to improve health outcomes. Participants learned to stretch the monthly food budget, practice food safety, engage in regular physical activity, and to cook and eat healthy meals and snacks, emphasizing a dramatic reduction in their intake of sugary drinks. During 2017 Alabama Extension at Alabama A&M SNAP-Ed reached more than 2,700 adults and 2,300 youth. Assessment data found that plain water consumption increased by 26 percent with a 17 percent decrease in sugary beverages, as individuals shifted their consumption patterns closer to national dietary and physical activity requirements.

Assessment data also showed significant improvements in adult eating habits, with a 25 percent increase in fruit consumption and 17 percent increase in vegetable consumption. Adults also reported a 21 percent increase in grain consumption and 12 percent increase in protein consumption, in addition to 25 percent who reported switching to low-fat or fat-free dairy products. Another positive outcome was that nearly one-quarter of participants reported significantly reducing the amounts of fat, oil, salt and sugar in their overall diets.

Assessment data on youth eating habits showed remarkable improvement, too, with a 33 percent increase in fruit consumption, 41 percent increase in vegetable consumption, and 35 percent switching to low-fat and fat-free milk products. Moreover, the number of adult and youth participants who engaged in some type of physical activity each day increased sharply, with reports of walking, jogging and swimming.

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Source: *Land-Grant Impacts,* ***https://landgrantimpacts.org***

University of California

Expanding Fruit and Vegetable Consumption. Obesity in childhood increases a child's risk of developing chronic diseases in addition to social and psychological problems. Hayward, California, has the highest prevalence of overweight children in Alameda County's 14 cities, with 50 percent of the district's students identified as overweight or obese. School-based education about healthy eating and fitness habits is a valuable tool to address this issue, but the school district lacked resources and staff to implement an evidence-based nutrition program.

University of California Cooperative Extension continued efforts to combat childhood obesity in Alameda County through the Expanded Food and Nutrition Education Program (EFNEP). In 2016 EFNEP joined Hayward Unified School District's Viva Bien, Coma Bien, Siéntase Bien (VCS!) AmeriCorps program — Live Well, Eat Well, Feel Well! — a three-year collaboration to provide nutrition education training and curriculum materials for the VCS! after-school staff.

Thirty VCS! staff attended four trainings focused on grade-level-appropriate EFNEP nutrition curriculum and evaluation surveys. After VCS! staff were familiar with the lessons and evaluation protocol, they delivered six nutrition lessons to 1,400 students at 20 elementary schools in the Hayward Unified after-school program. Lessons were enhanced with family nights, food tastings and physical activities.

Pre- and post-assessments showed that students improved their food and fitness behaviors, and AmeriCorps staff noted students eating more fruits and vegetables at lunch and dinner. Overall, 72 percent of students improved skills in choosing foods consistent with Dietary Guidelines for Americans, while 33 percent increased their physical activity and 47 percent improved their food safety practices. Additional positive outcomes were reflected in the VCS! staff, who became more knowledgeable about nutrition, reporting food and fitness behavior changes in their own lives.

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Collaborators: *AmeriCorps, Student and Parent Support Programs, Hayward Unified School District, Youth Enrichment Program*

Sources: *Land-Grant Impacts,* ***https://landgrantimpacts.org***
https://ucanr.edu/delivers/?impact=1049&delivers=1

4-H Youth Development

University of Minnesota

Teaching Science, Technology, Engineering, and Math (STEM) Skills in Youth through 4-H. Agriculture and ag biosciences are critically important in finding solutions to challenges facing the United States, including economic growth, food security, human health and environmental sustainability. Unfortunately, the U.S. is falling behind other nations in developing its future workforce of agriculture scientists, engineers and technology experts. Young people in the U.S. are insufficiently prepared with the necessary skills to compete in the 21st century workforce.

Minnesota Extension 4-H tackled this issue by developing the Science of Agriculture Challenge. This program helps youth explore and develop science-based solutions to agricultural issues they have identified in their own communities. Youth in grades 6 through 12 work in small teams to develop a project, create a presentation and report their findings. Participants attend a statewide event to present their projects, which are evaluated by agriculture industry experts and representatives from the University of Minnesota. The top three teams earn scholarship money for postsecondary education.

The foundation of the 4-H Science of Agriculture Challenge projects is rooted in the Pillars of Agriculture Literacy from the American Farm Bureau Foundation for Agriculture. The pillars connect agriculture to crucial topics in society in six categories. Teams select a topic from one of the pillars, then focus on and connect with experts in that field.

Team projects are guided by the Next Generation Science Standards' eight science and engineering practices. Program evaluation results report youth who participate are experiencing 21st century skill development and then using scientific processes to problem-solve. This has led to an increased interest in studying agriculture in college and exploring agriculture as a career. Minnesota Extension's program is now being replicated in states across the country, including Iowa, South Dakota, Kansas and Pennsylvania.

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Source: ***https://extension.umn.edu/4-h-events/4-h-science-agriculture-challenge***

North Dakota State University

4-H Builds Entrepreneurial Skills in Youth. The Standing Rock Reservation in south central North Dakota is remotely located far from major cities, limiting children's exposure to business role models and opportunities to develop entrepreneurial skills. This isolation contributes to low graduation rates and an emerging population that lacks employable skills to enter the workforce.

North Dakota State University Extension partnered with the Solen School District to offer 4-H members in grades 7 through 12 hands-on experience in learning how to operate and proficiently run a business. In 2010 Solen High School launched Sioux Image, an embroidery, print and silkscreen business. Students are taught basic business skills and screen printing. This includes ordering raw materials, how to sell merchandise, receiving and processing orders, maintaining records and interacting with customers. Through these activities, students learn to manage a business, provide customer service and increase profits, which are reinvested in the business and mentoring program. The program was expanded to include training youths to operate a 16-needle embroidery machine, vinyl cutter, ceramic kiln, wood lathe, plasma cutter, jewelry kiln, 3-D printer, 3-D scanner, heat press and sublimation vacuum press.

Since the launch of Sioux Image, more than 300 students have participated in the business at Solen High School. Surveys conducted within grant guidelines show students exhibiting increased confidence and business skills. Graduation rates have increased more than 35 percent, and six students have gone on to pursue higher education. Sioux Image is now listed as a core business class for grades 7 and 8.

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Collaborators: *Solen High School, NDSU Center for 4-H Youth Development*

Source: ***https://www.ag.ndsu.edu/impactstatements/impact-statements/2017-statements/17sioux-isbell-4h.pdf***

Oregon State University

4-H, Habitat and Tech Wizards. Science, technology, engineering, and math (STEM) jobs are important to the nation's economic strength. Hispanics, the largest minority in the public school system, are underrepresented in the STEM fields and insufficiently exposed to STEM subjects at the K-12 levels.

Oregon State University Extension 4-H is helping to change this through a program called Tech Wizards. Launched in 1998, this after-school program teaches technical skills to underserved youth in grades 4 through 12 who are considered at risk of dropping out of school. Tech Wizards engages youth in STEM through out-of-school mentoring. Students meet weekly to produce videos, make computerized maps and participate in habitat restoration projects. The program provides support for them to navigate their way to higher education and STEM careers.

Since the program was first developed in Washington County, Oregon, it has been so successful that in 2009 Tech Wizards was chosen as a Program of Significance by the National 4-H Council. In 2010 national 4-H secured funding from the Office of Juvenile Justice and Delinquency Prevention in Washington, D.C., to provide funds to replicate the program across the nation. In 2017 there were 3,755 youth enrolled in Tech Wizards in 22 states and 134 program sites. Over the years 3,750 youth have participated in Tech Wizards in Oregon, in Washington, Lincoln, Multnomah and Wasco counties. About 95 percent of youth in Tech Wizards have graduated from high school, and about 70 percent of those have pursued additional education in science, technology, engineering or math.

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Collaborator: *Office of Juvenile Justice*

Source: ***https://www2.ed.gov/about/inits/list/hispanic-initiative/stem-factsheet.pdf***

University of Vermont

Building Resilience in Military Youth. In 2008, the Vermont National Guard was preparing to send 1,500 service men and women to Afghanistan for one year. Over the next seven years, Guard members were called on to respond to natural disasters, attend month-long trainings and face deployment again. As a result, 2,000 school-aged children of military families experienced the absence of a parent. A prolonged absence as well as the subsequent return of a parent often causes stress and anxiety in the children, along with a range of challenging emotions.

Operation Military Kids (OMK) was a national program coordinated by University of Vermont Extension that helped the community understand the full cycle of deployment and its impact on children. In a collaborative effort, OMK garnered the support of AmeriCorps members and volunteers and formed partnerships with the National Guard, 4-H, Military OneSource, American Legion, Veterans of Foreign Wars, YMCA, Boy Scouts, Hulbert Outdoor Center and others. In seven years, OMK offered 265 military youth-focused programs, including the distribution of Hero Packs, vacation and summer camps, babysitting trainings, ongoing engagement with a teen speakers bureau, family days, Month of the Military Child celebrations, mobile technology lab workshops and more. Volunteers donated a total of 4,059 hours in service to these efforts. Many of these efforts continue today through Military Kids Vermont.

Staff have witnessed military youth form friendships, learn and use new skills, volunteer in their communities, step into leadership roles and speak publicly about being from a military family. Parents reported that 88 percent of their youth developed positive relationships with other military children, and 68 percent felt more supported in their communities. Parents also reported that 40 percent of their youth acted with more respect, and 60 percent of them exhibited increased confidence.

Contact: *Sara Kleinman (sarah.kleinman@uvm.edu, 802-651-8343 ext. 521), director of 4-H, farmworker and family education programs, South Burlington/State 4-H Office; or Stephanie Albaugh (stephanie.atwood@uvm.edu, 802-656-0873), program support specialist, State Office, University of Vermont Extension*

Collaborators: *Vermont National Guard Child and Youth Program, Greater Burlington YMCA*

Source: *Land-Grant Impacts,* ***https://landgrantimpacts.org/***

Community and Business Development

University of Arkansas

Revitalizing Rural Communities. Rison, a small town in south-central Arkansas, was facing a declining population and stagnant economy, reflected in the lack of downtown business activity and largely vacant storefronts.

In 2012 community leaders joined together to form Rison Shine Downtown Development, a grassroots organization dedicated to revitalizing the downtown. This group created the first Cleveland County Christmas parade, a pocket park and a new farmers market. In 2015, Arkansas Extension worked with the grassroots community groups to further their efforts and facilitated stakeholder meetings to create the Kickstart Cleveland County Blueprint and Action Plan. Since the action plan was created, eight businesses have opened, seven action teams have been formed and downtown business has increased by 25 percent. In addition, two buildings have been restored with more than $20,000 raised to benefit the effort, along with a Pioneer Village Commission that was appointed to restore the village.

Arkansas Extension's help with the city's new blueprint and action plan not only resulted in an upswing in downtown business, but also in the creation of four new events, which engaged more than 10,000 residents and included more than 5,000 volunteer hours in community project work. Local students even joined the effort, assisting with marketing and publicity, and creating a website and videos to advertise the happenings. Three new farmers markets have since been established, along with plans to build a Johnny Cash museum. Arkansas Extension's collaboration with Kickstart Cleveland County has become a statewide model for successful rural community development.

Contact: *Mark Peterson (mpeterson@uaex.edu, 501-671-2253), professor, community and economic development, University of Arkansas System Division of Agriculture*

Collaborator: *Kickstart Cleveland County*

Source: ***https://www.uaex.edu/business-communities/MPKickStartCleveland.pdf***

Virginia State University

Enhancing Small Farm Profitability. The major crops produced by small, limited-resource and socially disadvantaged farmers in Virginia traditionally have been tobacco, cotton, and peanuts. With the advent of the tobacco buyout, increasing production costs and shrinking farm incomes from these crops, most of the farmers were unable to sustain their farm businesses, and some even lost their farms in foreclosures. This vicious cycle of high production costs and unprofitable and unsustainable traditional production practices provides evidence for the need to transition these producers to high-value, sustainable alternative crops and livestock.

In an ongoing effort to improve the quality of life for these disadvantaged farmers and ranchers, the Small Farm Outreach Program at Virginia State University plans and conducts a holistic program that includes planning, production and marketing to help equip them with the information and skills needed to plan, produce and market high-value alternative crops and livestock.

Beginning in 2015, the Small Farm Outreach Program initiated an Agribusiness Production and Financial Management Program. This program consisted of workshops designed to boost farm profitability and income for small and socially disadvantaged farmers, increased understanding of mandatory USDA Farm Service Agency (FSA) financial and production management borrower requirements, and offered hands-on-training to farmers to assist them in developing valuable skills in financial management and crop production. It also provided additional support through one-on-one farm visits, workshops, field days, hands-on demonstrations, conferences, farm and market tours, group meetings and more.

As a result of the various activities, 87 farmers transitioned to the production of alternative crops and livestock in 2015, and 58 percent of those farmers reported a 15 percent or more increase in farm incomes from previous years. In addition, 50 farmers reported a 15 percent increase in income in 2015 due to participating in the Small Farm Outreach program education and outreach activities.

Contact: *William Crutchfield, (wcrutchfield@vsu.edu, 804-524-3295), Small Farm Outreach Program, Virginia Cooperative Extension*

Collaborators: *USDA Farm Service Agency, USDA National Institute of Food and Agriculture, USDA Natural Resources Conservation Service, Colonial Farm Credit, Black Family Land Trust, VSU's Reginald F. Lewis College of Business, VSU College of Agriculture*

Source: *Land-Grant Impacts,* ***https://landgrantimpacts.org***

University of Connecticut

Building sustainable, diverse and resilient food systems. Lack of access to healthy and locally grown food affects nutrition and obesity rates. In the last few years, there has been a resurgence in food production questions and interest from the public, with Master Gardener programs and volunteers focused on building diverse and resilient food systems. Studies show that food deserts are common in lower-income neighborhoods and communities. In Connecticut, food deserts were found in Fairfield County in Bridgeport and Danbury — two of the poorest cities in Connecticut with large Hispanic populations.

In Fairfield County, Master Gardener volunteers worked through their local UConn Extension Center and the Bartlett Arboretum to provide horticulture-related information to the community. The educational focus of the program shifted away from landscape gardens and toward food-producing gardens and container gardens that can be grown in urban areas. Target audiences included younger residents with no prior gardening experience, sections were translated into Spanish for Hispanic students.

During the reporting period, 32 Garden Master classes were offered to volunteers and the general public. Of the participants, 196 self-identified as Hispanic, Asian, Pacific or African American. Food-related courses included Sustainable Farming Design, Gardening for the Ages, Plant Pruning Basics, Do-it-Yourself Plant Breeding, Get a Jump on Spring Vegetables and Raspberry Cultivation. In total, 3,164 hours of instruction were provided for 14 signature projects.

The People's Harvest Garden was a successful example of this effort — a one-acre garden devoted to harvesting and donating produce to local soup kitchens. Local youth groups visited People's Harvest and learned about raising vegetables, sustainable growing techniques, the natural environment and food security. More than 4,000 pounds of produce were donated to local soup kitchens during the reporting period.

Contact: *Sarah Bailey, (sarah.bailey@uconn.edu, 860-409-9053), state Extension Master Gardener program leader, Hartford County Extension Center*

Collaborator: *Bartlett Arboretum*

Source: *Land-Grant Impacts,* ***https://landgrantimpacts.org***

Virginia Polytechnic Institute and State University

Strengthening Virginia's Produce Food Safety Culture. According to the Centers for Disease Control, approximately 46 percent of all foodborne illness outbreaks originate with fresh produce. Increased incidences of foodborne illness outbreaks contributed to the implementation of the Food Safety Modernization Act (FSMA), which changed the regulatory environment for produce growers. Today growers selling to larger buyer channels and institutions are often required to obtain a Good Agricultural Practices (GAP) certification audit, and some must comply with FSMA's Produce Safety Rule (PSR). Regardless of regulatory requirements, expanded food safety education is crucial to providing a safer food system.

In response, Virginia Cooperative Extension provided a publication, *Enhancing the Safety of Locally Grown Produce*, to 357 produce growers and market managers. Additionally, 661 growers and 39 agents were trained in navigating food safety requirements and certifications, including market sector training and handling requirements as well as GAP preparedness. To date, 516 growers, 23 agents and six state officials completed the Produce Safety Alliance Grower Training curriculum, the only curriculum the Food and Drug Administration recognizes for PSR training requirements. Since 2018 a comprehensive website has received about 6,700 views.

As a result, direct market growers intended to implement food safety practices, including enhancing food safety training (72 percent), improving cleaning and sanitizing methods (77 percent), and monitoring of storage temperatures (66 percent). Furthermore, 100 growers were mentored in performing on-farm risk assessments, implementing best practices and developing food safety plans. Of those 100, 53 passed their third-party GAP audit, opening new markets for their products. Additionally, 100 percent of growers increased their knowledge of the FSMA PSR, with an average increase of 19 percent on pre- and post-tests. Thirty-five growers have completed an On-Farm Readiness Review with state regulatory officials and Extension. Ultimately, the adoption and implementation of best practices reduces risks, thereby strengthening the food safety culture among produce growers.

Contacts: *Laura K. Strawn, (lstrawn@vt.edu, 757-414-0724), assistant professor, Extension specialist, Eastern Shore Agricultural Research and Extension Center, Department of Food Science and Technology, Virginia Cooperative Extension; Renee Boyer, (rraiden@vt.edu), professor, Extension specialist, Department of Food Science and Technology, Virginia Cooperative Extension; Amber D. Vallotton, (avallott@vt.edu, 540-231-5655), fresh produce food safety coordinator, Extension specialist, School of Plant and Environmental Sciences, Virginia Cooperative Extension*

Collaborators: *Virginia Department of Agriculture and Consumer Services, Virginia Apple Board, Northern Neck Vegetable Growers Association, Association of Virginia Potato and Vegetable Growers*

Sources: *Truitt, L.N., K.M. Vazquez, R.C. Pfuntner, S.L. Rideout, A.H. Havelaar, L.K. Strawn. 2018. Microbial quality of agricultural water used in produce preharvest production on the Eastern Shore of Virginia. J. Food Prot. 81: 1661-1672.*

https://pubs.ext.vt.edu/author/s/strawn-laura.resource.html
https://pubs.ext.vt.edu/author/b/boyer-renee.resource.html
http://pubs.ext.vt.edu/author/v/vallotton_amber.resource.html
https://www.hort.vt.edu/producesafety

Public Outreach: Non-Land-Grant Colleges of Agriculture

Introduction

Outreach and engagement are also part of the mission of public non-land-grant colleges of agriculture (NLGCAs). The 58 NLGCAs that grant degrees in agriculture (Appendix B) are involved in educational outreach that often complements Cooperative Extension efforts. This includes helping farmers and ranchers produce the food and fiber utilized by the world as well as improving quality of life for residents through family and consumer science programs.

NLGCAs, which have a regional footprint, may be more involved in rural economic and community development activities than land-grant universities, which have a more statewide emphasis. Entrepreneurship and business development endeavors include development of farmers markets/local food systems, alternative specialty crops, agri- and eco-tourism, agricultural technology and other innovative agriculture-related enterprises. Rural lifestyle businesses are also assisted by public university outreach activities.

Advocacy is also an important function of all public colleges of agriculture. Public agricultural universities promote awareness of the needs of, and advocate for, the residents of their states and regions, improving health, education, economic development and general quality of life. Rural broadband, health access, mental health, drug addiction, farm safety, environmental issues, immigration and other farm worker issues are all examples of these advocacy efforts.

Because the NLGCAs grant about 25 percent of U.S. undergraduate degrees in agriculture, they can be particularly complementary in their training expertise. Four success stories that follow provide specific examples of contributions by NLGCAs.

Sources: ***http://www.aplu.org/members/commissions/food-environment-and-renewable-resources/board-on-agriculture-assembly/narru/***

Success Stories

Four success stories representing outreach accomplishments by NLGCAs were selected from different regions of the country— California, Wisconsin, Illinois/Tennessee, and Texas. Examples include agricultural food production, manufacturing and safety. Information was obtained from university officials, center websites and the USDA Current Research Information Systems (CRIS).

California State Polytechnic University at San Luis Obispo

Improving Strawberry Production. The Strawberry Center at California State Polytechnic University (Cal Poly), San Luis Obispo — through the College of Agriculture, Food, and Environmental Sciences — works closely with the California Strawberry Commission undertaking industry-priority research on strawberry diseases and pests, health benefits, automation of strawberry production and more. The center's goal is to increase the sustainability of the California strawberry industry through research and education that addresses industry needs.

The Strawberry Center is the only facility in the U. S. dedicated solely to strawberry research and education. It is uniquely positioned on California's Central Coast in the center of 90 percent of the nation's strawberry production. The facility is funded through a unique partnership between Cal Poly and the California Strawberry Commission. Through Cal Poly, the center has access to a broad range of faculty in all agricultural sciences as well as some of California's top undergraduate students. The strawberry industry is a resource for education and training of Cal Poly students and provides technical expertise on strawberry production and its issues.

The center hosts an annual field day with more than 200 attendees. The field day covers diverse topics, including bug vacuum optimization, host plant resistance to Macrophomina crown rot and Verticillium wilt, Botrytis gray mold management, transplant cold storage treatments, fungicide resistance development, harvest aids and more. The center also hosted a Strawberry Automation Summit with presenters and attendees from across the country. The summit showcased the latest advances in production automation, highlighting on-farm robotics and integration of digital technologies in strawberry production agriculture.

Contacts: *Jim Prince (JPPrince@calpoly.edu), associate dean of research; Gerald Holmes (gjholmes@calpoly.edu), director, Strawberry Center, College of Agriculture, Food, and Environmental Sciences, California State Polytechnic University at San Luis Obispo*

Collaborator: *California Strawberry Commission*

Source: ***https://strawberry.calpoly.edu***

University of Wisconsin–River Falls

Improving Food Processing. The College of Agriculture, Food and Environmental Sciences (CAFES) at the University of Wisconsin–River Falls (UWRF) has educated students and placed professionals across the agriculture industry for more than 100 years. CAFES is actively engaged in fundamental and applied research, including partnerships with private industry and government agencies. Outreach and engagement, both public and private, through workshops, training sessions and other activities is an important and increasing focus as well.

UWRF's food processing pilot plants are examples of these broad and integrated activities. UWRF has a reputation for educating and training students in dairy product manufacturing and meats processing. Many dairy processing plants in Wisconsin look to UWRF to provide knowledgeable and trained graduates who are plant-ready and capable of quickly assuming management roles in their businesses. The significant financial support of these industries, relative to renovation of the dairy plant speaks to the value evidenced in UWRF. Along with additional experiences for students, the renovation will expand cooperative pilot-scale research in addition to the current portfolio of workshops, certifications and training sessions on various components and issues in dairy processing.

Similarly, the meats processing pilot plant is a resource for the state, providing knowledgeable and trained graduates capable of working in small, medium or large facilities and assuming management roles. UWRF has been active in workshops and training sessions on meats processing and is visiting with industry entities to expand those opportunities.

The unique education and training experiences at UWRF allow the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) to consistently look to the campus for key hires in its meat plant inspection program. Several individuals in DATCP's dairy inspection program also have UWRF backgrounds.

Contacts: *Dale Galenberg (dale.gallenberg@uwrf.edu), dean; Michelle Farner (michelle.farner@uwrf.edu), dairy pilot plant manager; Steve Watters (steven.h.watters@uwrf.edu), meat pilot plant manager, College of Agriculture, Food, and Environmental Sciences, University of Wisconsin–River Falls*

Collaborators: *Wisconsin Department of Agriculture Trade and Consumer Protection (DATCP), Wisconsin Cheese Makers Association, Wisconsin Association of Meat Processors, Wisconsin Dairy Products Association*

Sources: https://www.uwrf.edu/ANFS/FalconFoods/Index.cfm; Dairy Processing Workshops
https://www.uwrf.edu/ANFS/DairyProcessingWorkshops.cfm

Texas Tech University

***Increasing Water Use Efficiency*.** Texas Tech University, recognizing the need for intervention to prevent continued unsustainable depletion of the Ogallala Aquifer, created the Texas Alliance for Water Conservation (TAWC) in 2004. TAWC was created as a producer-driven demonstration of different agricultural systems to find strategies to use less irrigation water while remaining profitable.

The TAWC project is a unique partnership of area producers, universities, government agencies and industries, and is strongly positioned to assemble the range of scientific skills and communication outlets to prolong water supplies. The give-and-take relationship among landowners, support industries, commodity groups and scientists is key to this momentum. This strategy can sustain a long-term effort in creating and transferring innovations needed to feed and clothe the public.

TAWC demonstration sites represent monoculture, multicrop and forage-livestock systems using conventional, limit-till and no-till practices. Irrigation systems used include furrow, center pivot and subsurface drip technologies. Crops include cotton, sorghum, corn, alfalfa, grass seed and various specialty crops. Each irrigated site is monitored for timing and amount of water applied, precipitation, and beginning and ending soil moisture. Total crop water use is determined from these measurements and used for comparing irrigation delivery systems and crop types for water-use efficiency. Producers keep records of all fertilizer, herbicides, tillage and other associated inputs along with production records. A detailed data analysis is conducted for each site showing profitability or loss, gross margin and net return per acre-inch of irrigation water applied, and pounds of nitrogen used and water saved.

The TAWC project has demonstrated and communicated methods of increasing water-use efficiency to thousands of water users through conferences, field walks, fact sheets and online media. The wide reach and high impact of this project has induced savings in water use and improved crop production practices.

Contacts: *Rick Kellison (rick.kellison@ttu.edu) and Samantha Borgstedt (Samantha.Borgstedt@ttu.edu), Department of Plant and Soil Science*

Collaborators*: Texas Water Development Board; High Plains Underground Water Conservation District, Texas A&M AgriLife Extension, USDA Agricultural Research Service, Natural Resources Conservation Service, Texas A&M Agrilife Research*

Source: ***www.depts.ttu.edu/tawc/***

Southern Illinois University and University of Tennessee at Martin

***Food Safety and Sanitation Training*.** In 2016 the College of Agricultural Sciences at Southern Illinois University, Carbondale implemented a food safety project funded by the USDA-NIFA Food Safety Outreach Program to educate and empower the small-scale produce growers and processors of the Southern Illinois region. The project delivered need-based food safety education and training to enable growers eventually to comply with Food Safety Modernization Act rules. Southern Illinois is composed of the 24 southernmost counties, with the far south being hilly and supporting small farms growing a variety of specialty crops.

This project identified existing food safety training programs for small-scale produce growers and processors in Southern Illinois, the gaps and their training needs; identified food safety course curricula and modified them to suit the small growers and processors as well as specific crop commodities of southern Illinois; and delivered food safety trainings to small growers and processors in Southern Illinois based on a finalized curriculum.

Standardized course curricula developed by Produce Safety Alliance (PSA) and Food Safety Preventive Control Alliance (FSPCA) for Human Food were adopted with suitable modifications based on the local audience needs. Face-to-face training workshops were conducted in three Southern Illinois locations. Additionally, growers were provided cost-sharing incentives for group Good Agricultural Practice (GAP) audits. This project affected approximately 150 small-scale produce growers and processors in Southern Illinois with about 50 growers being GAP-certified. The University of Tennessee at Martin, in collaboration with the Northwest Local Foods Network and the Tennessee Department of Agriculture, is currently implementing a similar project for northwest Tennessee. This project will include food safety training with both local specialty food crops as well as both large and small-scale producers in the meat and dairy industries.

Contacts: *Karen Jones (kljones@siu.edu), chair; Ruplal Choudhry (choudhry@siu.edu), professor of food and bioprocess engineering, Department of Plant, Soil, and Agricultural Systems, College of Agricultural Sciences, Southern Illinois University Carbondale; Todd Winters (winters@utm.edu), dean; Amy Richards (aricha54@utm.edu), assistant professor of dietetics, food and nutrition, College of Agriculture and Applied Sciences, University of Tennessee at Martin.*

Collaborators*: Northwest Tennessee Local Foods Network (a local NGO), Tennessee Department of Agriculture*

Sources: ***https://coas.siu.edu/people/faculty/plant-soil-agsystems/choudhary.html***
http://www.utm.edu/departments/caas/
https://nwtnlfn.org/

Public Outreach: Nongovernmental Organizations

Introduction

Farmer-based nongovernmental organizations (NGOs) (Appendix C) play an important role in disseminating on-farm research results, producing educational materials for farmers and food system entrepreneurs, and developing and implementing training programs. Various NIFA competitive grant programs help fund some of these NGO activities.

On-farm trials, demonstrations, and field days are a form of outreach at which farmer-based NGOs have a long and successful history. There is often no better way of spreading adoption of innovative research-based practices and farming systems than through peer-to-peer education. An example of a Sustainable Agriculture Research and Education farmer-led education and outreach project that is part of the Practical Farmers of Iowa field day series is highlighted below.

Training is also an important feature of NGO activities. NIFA's Food Safety Outreach Program is a good example. Congress created this competitive grant program to assist small and mid-sized farms, small processors, and small-scale wholesalers in complying with food safety requirements. Grants help NGOs, food hubs, farm cooperatives and Extension create innovative training programs for farmers and processors. An example of an NGO-led FSOP project carried out by the Carolina Farm Stewardship Association follows below.

Partnerships are an important model for NGO involvement in education and outreach. For example, USDA NIFA's Beginning Farmer and Rancher Development Program is targeted especially to collaborative state, tribal, local, or regionally based networks or partnerships of public and private groups, including nongovernmental organizations. The Land Stewardship Project's Farm Beginnings project highlighted below underscores the value of partnerships for outreach.

Sources: ***https://attra.ncat.org/other/#Nonprofit***
http://sustainableagriculture.net/about-us/members/
https://www.sare.org/About-SARE/SARE-Outreach

Success Stories

Four success stories representing outreach accomplishments by NGOs were selected to represent different regions, different topics and different NIFA programs. Other programs that have supported NGO outreach beyond those highlighted below include Risk Management Education, the Organic Agriculture Research and Extension Initiative, and Community Food Grants, as well as the National Sustainable Agriculture Information Service funded by USDA Rural Development and run by the National Center for Appropriate Technology.

Organic Farming Research Foundation

Educating Farmers on Soil Health. The Organic Farming Research Foundation (OFRF) is a champion of organic farmers. It works to foster widespread adoption of organic farming systems by cultivating organic research, education and federal policies that bring more farmers and acreage into organic production.

Soil health is a challenge for organic farmers, according to an OFRF national survey. OFRF is responding by developing a series of educational guidebooks and webinars that teach organic farmers how to enhance soil health and the overall resilience of their operations. The huge response to this educational series indicates a need for credible, science-backed information. Seven guidebooks were introduced in 2017, covering topics from weed management and cover cropping to plant breeding and water management. Thousands of guidebooks have been downloaded and hundreds of people registered for the webinars. Topics include conservation tillage, ecological approaches to weed management and organic practices for climate mitigation, to name a few.

The eighth guidebook, released in December 2018, focuses on organic practices for climate mitigation, adaptation and carbon sequestration. The final book in the series will cover soil biology for health and crop production. In addition to producers, this project informs researchers, Extension agents, policymakers and others on the importance of soil health to organic farming.

To provide scientifically validated information on organic farming practices for beginning or transitioning farmers in specific geographic regions, OFRF is partnering with the University of California Sustainable Agriculture Research and Education Program and the Cal Poly San Luis Obispo Center for Sustainability to create free, online courses on organic production in California specialty crops. The courses will include on-farm demonstration videos illustrating the implementation of a variety of organic practices, like growing cover crops for weed management and soil fertility, and methods for composting using a variety of feedstocks.

Contact: *Vicki Lowell (vicki@ofrf.org, 831-426-6606), Organic Farming Research Foundation*

Collaborators: *University of California Sustainable Agriculture Research and Education Program, Cal Poly San Luis Obispo Center for Sustainability*

Source: *Clarence E. Heller Charitable Foundation*

Practical Farmers of Iowa

***Cover Cropping Systems for Corn and Soybeans*.** NIFA's Sustainable Agriculture Research and Education (SARE) program is a competitive grant program that responds to the applied research needs of farmers, and includes a component for participatory farmer-led research, demonstration and outreach. By utilizing farmer leadership combined with NGO outreach, results are more readily adopted by other farmers.

Two transitioning organic corn and soybean farmers in north-central Iowa led one such project in partnership with Practical Farmers of Iowa (PFI). Seeking to optimize no-till cover cropping, the project investigated hairy vetch as a cover crop to provide nitrogen, increase biomass and suppress weeds when roller crimped into the field. Cover cropping is especially important in organic systems where it can build organic matter while reducing weed pressure.

The farmers experienced adequate weed suppression and determined the best times to terminate the vetch to optimize nutrient availability, crimping and planting of soybean crop to obtain the best yield. Several beneficial findings emerged from this SARE research. For organic farmers, the crimping method assists in reducing secondary tillage and increases carbon sequestration. For conventional farmers, crimping cover crops can reduce the need for chemical treatment while providing adequate weed control and increasing biomass.

PFI held a field day about this on-farm research with more than 120 people attending and featured the farmers in its newsletter, in addition to a "farminar" webinar. *Wallaces Farmer* published an article on the project, and the research was presented at the Iowa Organic Conference at Iowa State. NRCS staff and other farmers have visited the farms to review the research results. Several farmers in the area have subsequently adopted this technology and reported the purchase of a roller-crimper a reasonable investment in controlling weeds in an organic operation.

Contact: *Stefan Gailans (stefan@practicalfarmers.org, 515- 232-5661), Practical Farmers of Iowa*

Collaborators: *Hunter Organic Farm, Iowa State University Department of Horticulture, USDA National Resources Conservation Service, College of Agricultural and Life Sciences at University of Wisconsin, Madison.*

Sources: *Project: FNC16-1055. Developing Sustainable Roller Crimped Cover Cropping Systems for Corn and Soybean Production: Effects on Cover Crop Winter Hardiness, Biomass, N Mobilization, Weed Suppression and Yields.*

https://projects.sare.org/project-reports/fnc16-1055/

Carolina Farm Stewardship Association

Small Farmers and Food Safety. Carolina Farm Stewardship Association (CFSA) is at the forefront of delivering research-based food safety training, education and outreach through its Local Produce Safety Initiative (LPSI). This program benefits small and financially constrained beginning growers, serving markets in North and South Carolina.

With a grant from NIFA's Food Safety Outreach Program (FSOP) program, CFSA has expanded LPSI to provide technical assistance on good agricultural practices (GAP) training for produce farms, create curriculum for on-farm, value-added food manufacturing, and develop technology helping small farms be competitive.

Since 2012, CFSA has trained more than 600 farmers on water management and soil conservation, assisted more than 140 farms in writing food safety plans and mentored more than 100 farms to pass GAP audits. These trainings also go hand-in-hand with workshops on FSOP principles and the creation of the Good Agricultural Practices for Small Diversified Farms: Tips and Strategies to Reduce Risk and Pass an Audit manual. Additionally, CFSA is working with a private firm, FoodLogiQ, to provide its cloud-based platform to farmers, allowing buyers to access centralized food safety certifications, audits and other farm-specific documentation. FoodLogiQ also will include a robust traceability component that will provide farmers a real-time solution to track movement of their product from the farm to the supply chain.

Through the years, CFSA has identified strong demand from farmers for food safety training and technical assistance that LPSI provides. New GAP requirements have emerged due to increasing liability insurance concerns and the implementation of new food safety protocols and regulations. These new requirements necessitate an education program like LPSI, which gives producers and buyers confidence in a small or beginning farm's ability to manage food safety risk, thus expanding a farmer's access to local, regional and national markets.

Contact: *Roland McReynolds (roland@carolinafarmstewards.org, 919-542-2402), Carolina Farm Stewardship Association*

Collaborator: *Department of Horticulture and Food, Bioprocessing and Nutrition Sciences, North Carolina State University*

Sources: *Project: NC.W-2017-04935. Local Produce Safety Initiative.*
https://www.carolinafarmstewards.org/local-produce-safety/

Land Stewardship Project

***Training Successful Beginning Farmers*.** In the early 1990s, the Land Stewardship Project (LSP) recognized that while farmers in sustainable agriculture were finding success accessing emerging organic and local markets, a structured training program for beginning farmers was nonexistent. LSP created Farm Beginnings, a farmer-led, community-based model for beginning farmers with a goal of training farmers and ranchers, supported in part through the National Institute of Food and Agriculture Beginning Farmer Rancher Development Program.

Farm Beginnings is currently in its 22nd year, with more than 1,000 farmers trained in how to overcome barriers and be successful in agriculture. The course is targeted to those with two or less years of farming experience in ways to build on basic skills and foster greater community connection. Each farmer implements an individual learning plan with the ultimate goal of being equipped to start a farm that is part of a support network. On average, 70 percent of farmers continue to farm five years after taking the course, with 98 percent of graduates following sustainable practices, 75 percent owning or managing their own farms, and 69 percent exceeding their farm income goals. The program's success is attributed to many factors, including strategies that address different stages of farmer development — a farmer-to-farmer focus where farmers act as instructors, guiding the development of curriculum and provide mentoring.

Sustainable agriculture not only provides an entryway into emerging markets, but it also reduces farmers' risks through diversifying farm products and increasing soil-building practices that reduce costs. Strengthening farmer networks and establishing sustainable practices allow communities to grow their local food economies, giving small farms a better chance of success. LSP's model has been disseminated with 11 organizations across the country through the Farm Beginnings Collaborative.

Contact: *Amy Bacigalupo (amyb@landstewardshipproject.org, 320-269-2105), Land Stewardship Project*

Collaborators: *Angelics Organic Learning Center, Dakota Rural Action, FARRMS, Food Works, GrowNYC, Hawthorne Valley Learning Center, Maine Organic Farmers and Gardeners Association, Nebraska Sustainable Agriculture Society, Ohio Ecological Food and Farm Association, Organic Growers School, The Land Connection, University of Nebraska Extension*

Sources: *Project: MINW-2010-03107. Farmers Growing Farmers: Next Generation Learning In Four Stages*
www.landstewardshipproject.org

Cooperative Extension and Public Outreach Integration with Research

Cooperative Extension has a historical and powerful integration with research. The underlying principles behind the USDA investments in Smith-Lever-authorized programs and 1890 land-grant universities focused on bringing science to the agricultural community and later to communities, families and youth. As Extension has evolved, this relationship has also evolved and strengthened. Likewise, NLGCA public outreach is strongly integrated with research. Often this NLGCA outreach/research is specific to the agricultural, natural resources and human sciences issues of that region of the state. NGOs often conduct research as an integral part of their public outreach efforts. In fact, NGOs often partner with Extension on these integrated research efforts.

The integration of Extension with research was present at its inception and has grown exponentially. Extension's education programs depend on science and evidence-based research. Campus faculty often have joint Extension-research appointments, and most applied research is conducted by these co-funded faculty. This integration is also present in the field, with many states having co-funded faculty at their outlying research stations. Extension's integration with the Experiment Station's research agenda is far more than shared funding positions on campus. The historical connection between the campus-based faculty and academic staff with their county/regional Extension colleagues remains a key component of the Extension network. Campus and county-based faculty and staff are strongly engaged with stakeholders, resulting in a two-way street of engagement, issue identification and knowledge sharing.

The issues facing rural and urban America are complex. Across the nation, land-grant universities and NLGCA faculty and staff from many academic disciplines engage and partner with NGOs and practitioners to develop alternative solutions that can be customized to address these issues at the local/personal level. Extension personnel also are highly engaged with the research communities' grand challenges in food and agricultural research, *Grand Challenges In Food & Agricultural Research: Addressing Issues Through Our Land-grant Universities & Agricultural Experiment Stations* (bit.ly/30eCow7), and the recently released study *Science Breakthroughs to Advance Food and Agricultural Research by 2030* (bit.ly/30c7ynt).

The 21st century Cooperative Extension and public outreach institutions are engaged across the research continuum. Many Extension, NLGCA and NGO faculty and staff conduct applied research that takes bench science to farms, families, firms and communities. Without research, extension and public outreach is just another Google search. Without extension and public outreach, research has no impact on our communities, our nation and our world. This objective public research is relevant and impactful because of Extension's connections to our communities and understanding of the challenges they face and the opportunities they strive to achieve. NLGCA and nonprofit engagement with research from their institutions and in partnership with land-grant universities has high value because Extension is embedded in our communities.

Cooperative Extension, Public Outreach and the Unifying Message

This current report, *Cooperative Extension and Public Outreach: Advancing Agriculture and Improving Lives*, is an integral part of RMF's effort to develop a unified message to increase support for agricultural, food and natural resources research, education, extension and outreach. Twelve previous, related reports are available at ***https://rileymemorial.org***. However, two reports — *A Unifying Message: Pulling Together, Increasing Support for Food, Agricultural and Natural Resources Research* and *Pursuing a Unifying Message: Elevating Food, Agricultural and Natural Resources Research as a National Priority: A Commodities Research Perspective* — may be particularly relevant to future planning.

In addition, reflecting on the importance of extension and outreach in the unifying message process and using the collective knowledge of the authors of the current report to provide a next step for consideration can be a valuable outcome. However, since that is a secondary outcome from preparing the current report, those reflections with some projections are being provided in a separate working paper, *Increasing Support for Food, Agricultural and Natural Resources Research, Education, Extension and Outreach: Building on the Unifying Message Effort*, which has been prepared by three members of the RMF Board of Directors for consideration by the entire RMF board and its collaborators.

Opportunities for the 21st Century

Cooperative Extension

The Extension system continually demonstrates its ability to engage people, businesses and communities across the country to listen and respond to their concerns and issues. Likewise, partnership with the land-grant university research community enables Extension to develop — with the help of stakeholders and partners — customized solutions to critical societal issues. Among key opportunities for the 21st century that Extension has already begun making strides to engage are:

- ***Securing the economic, environmental and social sustainability of agriculture***, with regard to helping farmers make production decisions in evolving environmental and social contexts.

- ***Developing an approach to address the natural resource consequences of a variable climate,*** implementing adaptive management processes that focus on maintaining health and resiliency to mitigate negative outcomes amid future uncertainty.

- ***Respecting the differing needs and capacity of U.S. agriculture*** by tailoring programs to benefit large-scale operations, small-scale operations, urban and rural, and socioeconomically disadvantaged and underserved farmers, ranchers and communities.

- ***Improving water quality and quantity*** by addressing conservation efforts relative to the issues regarding ground and surface water, including irrigation efficiency, aquifer management, residential conservation, nutrient management**,** agricultural pesticides and erosion control — vital to the health and welfare of every state in the nation.

- ***Addressing the emergence of digital agriculture and the evolution of big data*** with regard to the agricultural industry, necessitating the education of farmers about proper use and integration of these new technologies. Because agriculture is the ultimate STEM playground — where youth first learn about science — the integration of 4-H into this effort will help prepare the next generation of STEM workers.

- ***Motivating the next generation of the food and agriculture workforce*** relative to agriculture and food literacy, urban agriculture, and health and nutrition, along with the many 4-H programs that educate consumers about how food, fiber and fuel are produced.

- ***Advancing infrastructure, with a robust focus on broadband***, in an effort to help a vast population of rural (and some urban) areas that must get connected and prepared to use this connectivity— key in the creation of learning and workforce opportunities, comparable to the advent of electricity in the 20th century.

- ***Emphasizing health and wellness*** to enable productive learning and job performance, which includes education about nutrition in addition to positive mental health strategies to assist in the prevention of substance abuse.

- ***Fostering community resilience*** in the face of changing demographics, catastrophic weather events, and limited access to broadband and other technologies, meanwhile creating opportunities for engagement and partnership in the solutions relevant to the people and businesses of these impacted communities.

- ***Initiating a comprehensive urban agriculture effort*** that educates Americans about where, how and by whom their food was produced in conjunction with support of new local and regional food production systems in rural and urban communities in an effort to expand the workforce beyond the traditional farms in rural communities.

Extension's 21st century opportunities to address these issues will focus on engaging people, businesses and communities in partnership with the land-grant research community and is based on the following principles:

- ***Science in action*** that leverages the research and engagement initiatives of land-grant universities.

- ***Proactive, flexible and collaborative action*** on disasters, threats and emerging opportunities.

- ***Extension's national reach*** with the opportunity for meaningful local impact.

- ***Opportunities to expand high-impact programs*** such as 4-H youth development and Extension's agriculture, community and family-focused educational programs.

- ***Providing value for local, state and federal partners***, as the outreach and engagement arm of the local, state and federal governments.

Non-Land-Grant Colleges of Agriculture and Nongovernmental Organizations

How might outreach activities of NLGCAs and NGOs conducted in close collaboration with Cooperative Extension and other partners be fostered and encouraged as more a mainstay of the public agricultural research, education and Extension system? There are many important opportunities moving forward, including:

- ***Outcome-based reporting***. Given the dearth of indicators and lack of data to adequately understand whether and how funded research projects are reaching farmers and other stakeholders, how the research is being communicated, and whether outcomes help create

a more economically, ecologically and socially sustainable food and farming system, seizing this opportunity would be a big step forward.

- ***Public communication strategies*.** Such strategies could be part of most projects and might include requirements to:

  - Work with farmers or other end users to demonstrate research results and to educate and communicate research results with their peers.
  - Explore partnerships with organizations that work closely with intended end users.
  - Include web-based and print publications that translate research results into implementable practices and user and publicly accessible information.
  - Be connected to an easy-to-use, publicly available and easy-to-search database of research results.
  - Explore opportunities to translate results into smartphone apps and other newer information-sharing mechanisms.

- ***Fully competitive programs.*** While some NIFA programs allow producers and nonprofits to apply for funding, others explicitly prohibit a diversity of applicants. For example, despite clear statutory language to support wide-open eligibility and a "diversity of applicants," USDA has implemented the Agriculture and Food Research Initiative in such a way that prohibits nonprofit organizations, private labs and public agencies from applying for integrated projects.

  USDA could encourage greater diversity of applicants for integrated project grants by developing partnerships among academic institutions and ARS, nonprofit organizations, private labs, producer groups or individual farmers, and by allowing these other participants to be principal investigators where appropriate. In other words, competitive grants could actually be fully competitive, not limited to competition only between academic institutions, and partnerships and collaborations should be given priority.

- ***Streamlined applications and administrative requirements for all applicants*.** Grant application procedures for some USDA competitive grants are generally targeted to large-scale, multi-institutional grants, with many pages needed to complete a grant proposal. This process discourages smaller eligible institutions and organizations from submitting grant proposals for smaller projects that request less funding but could pay off with big results. Many of these organizations do not have access to the same high indirect cost from the agency enjoyed by many academic institutions, putting them at a further disadvantage that could be rectified in part by streamlining the process.

- ***Priority on partnerships.*** The Beginning Farmer and Rancher Development Program is an example of a NIFA program that prioritizes partnerships. It requires grant recipients to be a collaborative state, tribal, local or regionally based network or partnership of public and private entities. In this particular case, priority is also given to partnerships and collaborations that are led by or include NGOs or other community-based organizations with expertise in new agricultural producer training and outreach. Each program will be

different in focus and emphasis, but more programs could benefit from an emphasis on partnerships, especially those that can help deliver strong outreach components.

- ***Current Research Information System (CRIS) improvements.*** CRIS displays grant abstracts, objectives, approaches and progress reports for existing or finished grants. These filings often do not include indicators for extension, education, outreach or communications. Improvements to CRIS reporting to clearly incorporate extension and outreach could both make the system more relevant and also point to new opportunities.

Appendix A

1862 and 1890 Land-Grant Institutions

The list below includes educational institutions that receive funding for Cooperative Extension, associated with the Morrill Act of 1862 and 1890. More information on land-grant universities with Cooperative Extension Services is available at ***http://www.aplu.org/members/commissions/food-environment-and-renewable-resources/board-on-agriculture-assembly/cooperative-extension-section/index.html***.

AK University of Alaska Fairbanks
AL Alabama A&M University
AL Auburn University
AL Tuskegee University
AR University of Arkansas at Fayetteville
AR University of Arkansas at Pine Bluff
AS American Samoa Community College
AZ University of Arizona
CA University of California
CO Colorado State University
CT University of Connecticut
DC University of the District of Columbia
DE Delaware State University
DE University of Delaware
FL Florida A&M University
FL University of Florida
FM College of Micronesia
GA Fort Valley State University
GA University of Georgia
GU University of Guam
HI University of Hawaii at Manoa
IA Iowa State University
ID University of Idaho
IL University of Illinois
IN Purdue University
KS Kansas State University
KY Kentucky State University
KY University of Kentucky
LA Louisiana State University System
LA Southern University
MA University of Massachusetts, Amherst
MD University of Maryland
MD University of Maryland Eastern Shore
ME University of Maine
MI Michigan State University
MN University of Minnesota
MO Lincoln University
MO University of Missouri
MP Northern Marianas College
MS Alcorn State University
MS Mississippi State University
MT Montana State University
NC North Carolina A&T State University
NC North Carolina State University
ND North Dakota State University
NE University of Nebraska-Lincoln
NH University of New Hampshire
NJ Rutgers, The State University of New Jersey
NM New Mexico State University
NV University of Nevada, Reno
NY Cornell University
OH Central State University
OH Ohio State University
OK Langston University
OK Oklahoma State University
OR Oregon State University
PA Pennsylvania State University
PR University of Puerto Rico
RI University of Rhode Island
SC Clemson University
SC South Carolina State University
SD South Dakota State University
TN Tennessee State University
TN University of Tennessee
TX Prairie View A&M University
TX Texas A&M University
UT Utah State University
VA Virginia Polytechnic Institute & State University
VA Virginia State University
VI University of the Virgin Islands
VT University of Vermont
WA Washington State University
WI University of Wisconsin
WV West Virginia State University
WV West Virginia University
WY University of Wyoming

Appendix B

Non-Land Grant Public Colleges of Agriculture that Grant Degrees in Agriculture

Abraham Baldwin Agricultural College (GA)
Angelo State University (TX)
Arizona State University Polytechnic Campus
Arkansas State University
Arkansas Tech University
Austin Peay State University (TN)
Cal Poly, Pomona
Cal Poly, San Luis Obispo
California State University
California State University, Chico
California State University, Fresno
Stanislaus Cameron University (OK)
Dickinson State University (ND)
Eastern Kentucky University
Eastern New Mexico University
Fort Hays State University (KS)
Illinois State University
Louisiana Tech University
McNeese State University (LA)
Middle Tennessee State University
Missouri State University
Montana State University–Northern
Morehead State University (KY)
Morrisville State College (NY)
Murray State University (KY)
Nicholls State University (LA)
Northwest Missouri State University
Northwestern Oklahoma State University
Western Illinois University
Oklahoma Panhandle State University
Sam Houston State University (TX)
Southeast Missouri State University
Southern Illinois University Carbondale
Southern Utah University
Southern Arkansas University
Southeastern Louisiana University
Southwest Minnesota State University
State University of New York, Cobleskill
Sul Ross State University (TX)
Tarleton State University (TX)
Tennessee Technological University
Texas A&M University, Commerce
Texas A&M University, Kingsville
Texas State University, San Marcos
Texas Tech University
Truman State University (MO)
University of Minnesota, Crookston
University of Nebraska, Kearney
University of Tennessee, Martin
University of Wisconsin, Platteville
University of Wisconsin, River Falls
University of Wisconsin, Stevens Point
West Texas A&M University
University of Arkansas, Monticello
University of Louisiana, Lafayette
University of Louisiana, Monroe
University of Hawaii, Hilo
University of Central Missouri

Appendix C

Examples of Nongovernmental Organizations with Food and Agriculture Interests*

Agriculture and Land-Based Training Association, Salinas, CA
CCOF, Santa Cruz, CA
California FarmLink, Santa Cruz, CA
C.A.S.A. del Llano (Communities Assuring a Sustainable Agriculture), Hereford, TX
Catholic Rural Life, St. Paul, MN
Center for Rural Affairs, Lyons, NE
Clagett Farm/Chesapeake Bay Foundation, Upper Marlboro, MD
Community Alliance with Family Farmers, Davis, CA
CISA: Community Involved in Sustaining Agriculture, South Deerfield, MA
Dakota Rural Action, Brookings, SD
Delta Land and Community, Inc., Almyra, AR
Ecological Farming Association, Soquel, CA
Farmer-Veteran Coalition, Davis, CA
Florida Organic Growers, Gainesville, FL
FoodCorps, Portland, OR
GrassWorks, New Holstein, WI
Hmong National Development, Inc., St. Paul, MN and Washington, DC
Illinois Stewardship Alliance, Springfield, IL
Institute for Agriculture and Trade Policy, Minneapolis, MN
Interfaith Sustainable Food Collaborative, Sebastopol, CA
Iowa Natural Heritage Foundation, Des Moines, IA
Izaak Walton League of America, St. Paul, MN/Gaithersburg, MD
Kansas Rural Center, Topeka, KS
The Kerr Center for Sustainable Agriculture, Poteau, OK
Land Stewardship Project, Minneapolis, MN
MAFO, St. Cloud, MN
Michael Fields Agricultural Institute, East Troy, WI
Michigan Food & Farming Systems (MIFFS), East Lansing, MI
Michigan Organic Food and Farm Alliance, Lansing, MI
Midwest Organic and Sustainable Education Service, Spring Valley, WI
Montana Organic Association, Eureka, MT
The National Center for Appropriate Technology, Butte, MT
National Center for Frontier Communities, Silver City, NM
National Hmong American Farmers, Fresno, CA
Nebraska Sustainable Agriculture Society, Ceresco, NE
Northeast Organic Dairy Producers Alliance, Deerfield, MA
Northern Plains Sustainable Agriculture Society, LaMoure, ND
Northwest Center for Alternatives to Pesticides, Eugene, OR
Ohio Ecological Food & Farm Association, Columbus, OH
Oregon Tilth, Corvallis, OR
Organic Farming Research Foundation, Santa Cruz, CA
Organic Seed Alliance, Port Townsend, WA
Rural Advancement Foundation International, USA, Pittsboro, NC
Union of Concerned Scientists Food and Environment Program, Cambridge, MA
Virginia Association for Biological Farming, Lexington, VA
Wild Farm Alliance, Watsonville, CA
Women, Food, and Agriculture Network, Ames, IA

*These examples are organizations that have a special interest in sustainable agriculture and may not be representative of all nongovernmental organizations interested in agriculture, food and natural resources.

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