

A SARE SAMPLER OF SUSTAINABLE PRACTICES

# What is SUSTAINABLE agriculture?





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A simple way to think about sustainable agriculture is that it involves producing enough food and fiber to satisfy today's needs without compromising the ability of future generations to do the same. Farmers and ranchers who value sustainability embrace **three common goals** while running productive operations:

**PROFIT** over the long term

**STEWARDSHIP** of our nation's land, air and water

**QUALITY OF LIFE** for farmers, ranchers, farm employees and our communities

To achieve these sustainability goals, a farmer typically views their operation as an **integrated system**, meaning they recognize how all of its parts are related to one another. For example, we may talk about “farming with nature” or promoting biodiversity in order to take advantage of ecological processes that improve crop and livestock production. Having a systems perspective can also mean thinking beyond the farm gate when making important management decisions. For instance, raising livestock in a pasture-based system has a positive impact on local water quality and can lead to sales opportunities among consumers who value grass-fed products.

Because farms and ranches everywhere are incredibly diverse, there's no “one-size-fits-all” approach to sustainability—what works on one operation can vary to the next one. However, in this publication we'll identify some of the most common practices that can enhance sustainability for all farms, and we'll share examples of how producers around the country are putting them to use.

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We include SARE grant project numbers for each of the stories included in this publication. To find complete project reports, visit [projects.sare.org](https://projects.sare.org) and search by the project number.



Photo by Preston Keres, USDA

## OTHER RELATED TERMS

There are many popular terms used to describe approaches to farming that are similar in both spirit and practice to the concept of “sustainable agriculture.” **Organic agriculture** is one of the most common, but it is distinctly different. Unlike sustainable agriculture, organic falls under a certification program of the USDA with clearly defined regulations that largely focus on both the elimination of synthetic inputs and the use of practices that promote soil health, biodiversity and animal health. Farmers who are certified organic will sometimes say they “go beyond organic” when they embrace sustainable practices that are outside the scope of the National Organic Program.

**Regenerative agriculture** is another term that has become popular in recent years, and it doesn’t have a standardized definition the way that organic does. The concept has arisen largely in response to the extreme effects of climate change and the degradation of natural resources that are vital to healthy farming systems. Proponents of regenerative agriculture tend to emphasize practices that increase biodiversity on farms, including the use of perennials and livestock integration, as well as ones that improve soil health, such as cover crops and reduced tillage. The focus tends to be on sequestering atmospheric carbon and improving the conservation of natural resources, such as soil, air, water and wildlife habitat.

## Sampler of Proven Practices

It’s impossible to list all the innovative and varied ways that farmers and ranchers improve sustainability, so consider our list below a sampling, not a prescription, of proven practice areas. We dedicate a page of this publication to illustrating each practice area in more detail.

### CLIMATE RESILIENCE

Conservation tillage systems, manure management, alternative energy and climate adaptation strategies, such as enterprise diversification

### SOIL HEALTH

Cover crops, reduced tillage, crop rotation, organic matter additions, management-intensive grazing

### LIVESTOCK HEALTH AND HUSBANDRY

Preventive health practices, stress reduction, reduced use of antibiotics/hormones, breed selection, animal welfare

### COMMUNITY VITALITY

Social justice and equity, food sovereignty, urban agriculture, peer networks, local and regional food systems

### HEALTH AND WELLBEING OF PEOPLE

Support for mental and physical health, workplace safety, fair compensation, social networking, interpersonal skills

### ECOLOGICAL PEST MANAGEMENT

Crop rotation, beneficial organisms, integrated pest management (IPM), pest identification and scouting, soil health practices

### BIOLOGICAL DIVERSITY

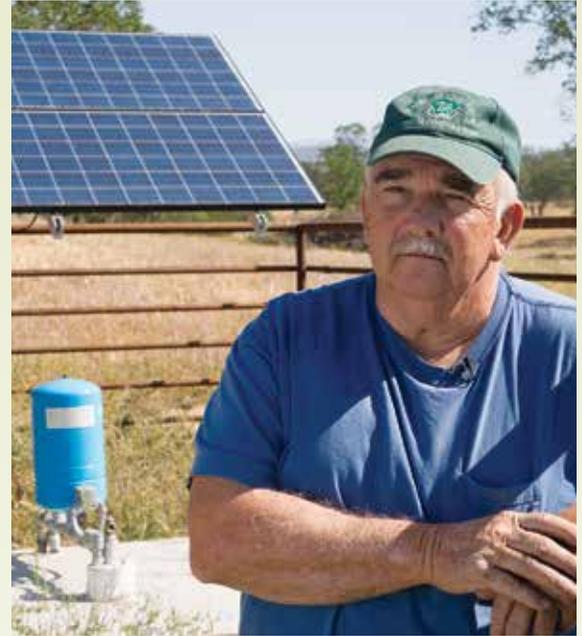
Wildlife and pollinator habitat, agroforestry, riparian buffers, crop/livestock integration, mixed species grazing, heirlooms and heritage breeds

### INNOVATIVE TECHNOLOGIES AND ENTERPRISES

Precision agriculture, alternative energy systems, interseeders, new marketing channels, niche products, value-added processing

# Climate Resilience

Many practices can lower a farm's greenhouse gas emissions, including alternative manure management techniques and the use of renewable energy. Other practices that build soil organic matter, such as cover crops, compost, perennials and conservation tillage, can sequester carbon in the soil. Focusing on soil health and diversifying farm enterprises are two prime examples of how farms can adapt to the extreme weather events associated with climate change.



Photos by Lance Cheung, USDA

## ADAPTING TO CLIMATE CHANGE THROUGH DATA-DRIVEN DECISIONS

### SARE PROJECT [FNC19-1182](#)

Like so many other farmers, Jeff Miller of Prairie Wind Family Farm in Grayslake, Ill., has found that increasingly extreme and unpredictable weather is making it harder to grow crops on a consistent basis and, ultimately, to run a viable business. For example, heavier and more frequent rains during the growing season cause increased weed and disease pressure on his 40-acre vegetable farm, as well as crop failure due to flooding. In an attempt to adapt to this new reality, Miller used a SARE Farmer/Rancher grant to introduce drone imagery and weather station data in order to better assess the impacts of extreme weather on his fields and crops, and to inform his responses. Miller is now using these tools to improve in-season management, such as the timing of tillage, cultivation and irrigation, as well as off-season planning, such as modifying crop rotations based on how individual fields are responding to extreme rain patterns.

## LOWERING METHANE EMISSIONS AND IMPROVING THE ECONOMICS OF FORAGE-BASED DAIRIES

### SARE PROJECT [LNE16-352](#)

Pasture-based dairy farmers are always on the lookout for ways to extend the grazing season and to reduce the amount of feed they need to buy. One promising approach to this for Northeastern dairy

farmers is to use annual brassicas, which can also lower methane emissions, a major greenhouse gas. Supported by a SARE Research and Education grant, a multi-state research team led by USDA Agricultural Research Service Animal Scientist Kathy Soder demonstrated that canola, turnips and forage rape produce nearly double the amount of fall forage than the more commonly used annual ryegrass. These brassicas also produce two to three times the protein and energy of ryegrass, which significantly extends the grazing season and improves animal productivity. At the same time, the methane output of cows grazing on these brassicas is about 50% less than when they graze on ryegrass.

## LONG-TERM RESEARCH ON RESILIENT CROPPING SYSTEMS

### SARE PROJECTS [LS18-303](#), [LS15-267](#) AND [LS12-247](#)

As climate patterns continue to change and extreme weather events happen with more frequency and intensity, farmers need reliable information on how to make their production systems more resilient. For Southeastern farmers, an invaluable resource is the Center for Environmental Farming Systems' Long-Term Farming System Research trial, a multi-disciplinary project comparing the performance of five agricultural systems from many perspectives. One key finding by the group, which has been supported by three SARE Research and Education grants in the past 10

years, is about the greater resilience of some systems over others. With their research spanning more than two decades, they're finding that cropping systems that rotate pastures with annual crops and use organic management have improved soil conditions that make them more productive and resilient in the face of climate-related threats compared to less diverse systems.

## EARLY WEANING AS A DROUGHT MANAGEMENT STRATEGY

### SARE PROJECT [OW18-013](#)

Climate change is bringing more intense droughts and heat waves to the annual rangelands of California, forcing ranchers to seek out a wide range of adaptive tools if they're going to survive. One drought management strategy that's familiar to ranchers in other parts of the country is early weaning, but it hasn't been studied as much in California, where calving happens in the fall instead of spring. Using a SARE Professional and Producer grant, a team of ranchers and University of California Extension specialists studied the effect of early weaning on pasture production and the performance of cows and calves. The team, led by Livestock and Natural Resources Advisor Dan Macon, looked at the economics of different weaning and feeding options, and created a decision-making tool that's now helping ranchers evaluate which drought management strategies might work best for their situation.

# Soil Health

It's difficult to overstate the importance of soil health to the sustainability of any farm or ranch. Healthy soil is the foundation of a healthy crop or forage, and it is critical to the effective management of nutrients and water. Cover crops, conservation tillage, crop rotation, compost and pasture management are some of the key ways farmers and ranchers improve the health of their soil.



Photos by (from left): Preston Keres, USDA and Carly Whitmore, Indiana NRCS

## RESTORING DEGRADED PASTURES WITH BALE GRAZING

**SARE PROJECTS [FNC22-1326](#), [FNC20-1218](#) AND [FNC18-1123](#)**

When siblings Erin and Drew Gaugler took over a ranch in New Leipzig, N.D., they found that years of mismanagement by previous tenants had left the land in poor shape. In particular, their soils had low fertility and were susceptible to wind and water erosion. The Gauglers have since committed to using and refining practices that will rejuvenate their land, such as the use of mixed species cover crops and management intensive grazing. With two SARE Farmer/Rancher grants, they explored the potential of multi-species bale grazing to further improve the health of their soils and pastures. The practice involves putting livestock on pastures in winter months to graze on hay bales. This puts more manure and feed residue directly onto the soil. They found it to be an effective way to increase nutrient capture and cycling, and to reduce both labor and input costs. The incorporation of sheep improves forage utilization.

## USING TESTS TO SEE AND APPRECIATE THE VALUE OF SOIL ORGANIC MATTER

**SARE PROJECT [ONE20-376](#)**

Practices that increase the amount of organic matter in the soil yield many benefits, and one that's being talked about more is the potential to sequester carbon. However, for farmers to fully appreciate the value of organic matter in general—and its potential role in sequestering carbon in particular—they need access to

soil tests that can connect organic matter to improved crop production and carbon capture. This is why Leah Penniman of Soul Fire Farm in Petersburg, N.Y., worked with a group of five other farms to evaluate a variety of soil tests and determine which ones were most accessible and reliable at measuring organic matter improvement. The effort, funded by a SARE Farmer/Rancher grant, focused on engaging farmers of color and Spanish-speaking farmers. The participants already used soil-building practices such as no-till, silvopasture and perennial polyculture, but for the most part they lacked methods for assessing their impact on soil carbon. Through their efforts, 61 area farmers reported improved knowledge and skills related to soil testing.

## BRINGING LEGUME COVER CROPS TO WEST TEXAS

**SARE PROJECTS [OS20-138](#) AND [OS19-131](#)**

Cover crops represent one of the best ways to improve and maintain soil health, but they aren't widely used in places such as west Texas because farmers don't know how to successfully add them to a rotation when the climate is very hot and dry. Texas A&M Agronomist Reagan Noland is trying to change this by evaluating the performance of different cover crop species under different kinds of management. Supported by two SARE On-Farm Research grants, Noland is collaborating with local farmers to study warm- and cool-season legumes in no-till cotton and grain systems, in particular to assess both their forage quality and impact on the following crop. With this research ongoing,

the team is learning that legumes can be added to cotton and small grain rotations, but there's no one-size-fits-all answer to which legume will work best for individual farmers. "With continued development and producer engagement, these concepts do have the potential to sustainably diversify and strengthen local economies and agricultural communities," Noland says.

## CREATING A FARMER-TO-FARMER SOIL HEALTH NETWORK

**SARE PROJECT [FW19-341](#)**

Many farmers in the Front Range region of Colorado appreciate the importance of soil health, yet they struggle to adopt soil health practices. A short growing season, poor soils, high weed pressure and a lack of late-season water all make it difficult to use reduced tillage and cover crops, even though these practices can in turn help with difficult growing conditions. Now, farmers are helping each other make soil health a priority through the Citizen Science Soil Health Project, a 10-year research and networking collaboration among 50 area farmers. Supported by two SARE Farmer/Rancher grants, the network provides its members with one Haney soil test annually and one phospholipid fatty acid (PLFA) test biennially. While their individual test data is kept confidential, the group uses annual questionnaires, meetings and classes to provide network members the opportunity to encourage one another and share information about their experiences with soil-building practices.

# Livestock Health and Husbandry

Promoting animal health and welfare can not only improve animal productivity and lower costs, but there's also increasing consumer demand for animal products raised in this manner. Some ways to do this include adequate access to both shelter and high-quality pasture, a low-stress environment, good sanitation practices, managed grazing, balanced nutrition that includes vitamins and supplements, appropriate vaccines, and selection of livestock breeds with characteristics that suit your climate and geography.

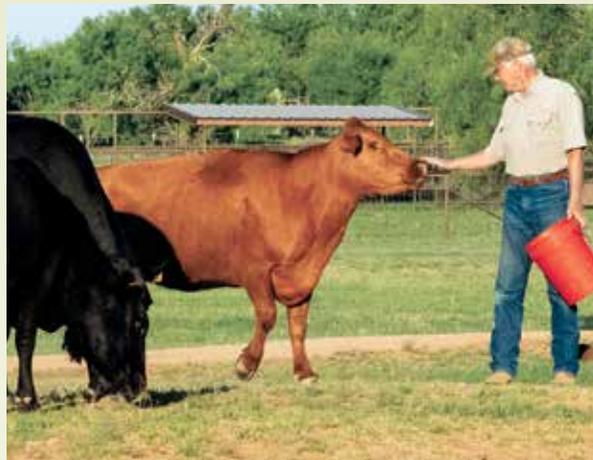


Photo by Lance Cheung, USDA

## USING LUNG SCANNING TECHNOLOGY TO IDENTIFY RESPIRATORY ILLNESSES

### SARE PROJECT [FNC20-1252](#)

Bovine respiratory disease (BRD) is the second leading cause of illness in dairy calves. Animals that suffer from it go on to experience many negative effects, such as lower milk production and higher mortality rates, that can cost a producer up to \$245 per heifer, according to one study. Farmers typically screen for BRD through a visual assessment, which can easily result in a misdiagnosis. Using a SARE Farmer/Rancher grant, Tabitha Steckler Hurst of Hunley Creek Heifer Farm in southern Indiana set out to see if the same ultrasound technology used to scan cows for pregnancy could be used in a practical setting to scan lungs for illness. Collaborating with two other farmers, she lung scanned dairy calves at different ages to determine the best time to implement lung scanning. Hurst found that rather than identifying exact ages at which farmers should scan animals, it's most efficient to scan once in order to treat ill animals and to scan another time in order to cull them.

## CONTROLLING BACTERIAL MASTITIS WITH HYGIENE AND SCREENING

### SARE PROJECTS [FNE19-946](#) AND [FNE20-965](#)

Katie Webb Clark and her husband Nate found themselves facing a potential disaster when they discovered an outbreak of mastitis caused by a highly contagious bacterial infection among their Windsor, Maine, dairy herd in 2018. The primary treatment tool, antibiotics, was unavailable

to them because their farm is organic, and with over a third of their small, 33-head herd affected, immediate culling would have ruined them financially. So, working with a technical advisor, the Clarks used a SARE Farmer grant to test if preventive and screening practices could limit the spread of the bacteria and protect milk quality. By adopting rigorous hygiene protocols at milking, they managed to prevent the further spread of mastitis and could cull infected animals at an economically feasible pace. At the same time, regular milk screening allowed them to isolate milk from cows experiencing health issues, thereby safeguarding their milk quality premiums.

## ASSESSING THE ANIMAL HEALTH BENEFITS OF SILVOPASTURE SYSTEMS

### SARE PROJECT [GS19-202](#)

Heat stress can have a major impact on the health and welfare of grazing animals, which in turn can result in significant economic losses for producers. Silvopasture systems reduce animals' exposure to heat and can improve both their stress levels and productivity because they allow livestock to graze among trees. While weight gain is typically used as a key measure of animals' health and wellbeing, Virginia Tech graduate student Sanjok Poudel wanted to take a different approach to comparing stress levels in different grazing systems. Using a SARE Graduate Student grant, Poudul compared open-field grazing and silvopasture systems for sheep by measuring cortisol levels, since prolonged periods of stress are linked to higher cortisol

levels. He also monitored body temperature and sheep behavior. In the end, he found that sheep in the open pasture system had higher cortisol levels and body temperatures. They also spent more time standing—considered a cooling-off strategy—than the sheep in the shade, which spent more time lying down (a sign of contentment).

## REDUCING GOAT PREDATION AND IMPROVING RANGELAND ECOSYSTEMS

### SARE PROJECT [FW19-357](#)

When Sydney Franz moved her goat ranch from Central Texas to Mora County, N.M., she quickly confronted the problem of increased animal losses to predation, to the extent that it was threatening the sustainability of her business. Central Texas had lower coyote and mountain lion populations, so the grazing management practices she had been using were suddenly inadequate to protect her herd. She and two other ranchers collaborated on a SARE Farmer/Rancher grant project to evaluate the effectiveness of improved herding techniques. Through the three-year project, the group was able to significantly reduce predation using a combination of herders, herd dogs and guard dogs. The presence of human herders deterred predators and allowed goats to be trained to stay together, especially kids. Even on days when no human herder was present, animal losses were minimal. Franz was able to reduce animal losses from 14% the year before the project, to a consistent 6–8% per year.

# Community Vitality

Whether it's through urban agriculture, food sovereignty work, local marketing or peer networks, farmers can enrich communities and at the same time be strengthened by the connections they maintain with both the general public and with their fellow farmers. For our farming communities to thrive to their fullest, social justice topics must be addressed in ways that promote equity for farmers of color and other marginalized populations.



Photo by Preston Keres, USDA

## BRINGING HEALTHY OPTIONS TO FOOD DESERTS

### SARE PROJECT [FNC19-1169](#)

Legacy Taste of the Garden is a Black-owned family farm in Princeton, Ind., that seeks to improve socioeconomic outcomes in communities that are considered food deserts. As a multi-generational farm, Legacy uses traditional farming practices and a network of like-minded farmers and partner organizations to teach community members about the value of healthy foods and how to grow them sustainably. Partnering with two other farms, Legacy Taste of the Garden Operations Director John Jamerson used a SARE Farmer/Rancher grant on a multi-faceted project aimed at increasing the availability of whole foods in food deserts in Princeton, Evansville and Indianapolis. At multiple locations, the group taught youth and adults about urban farming techniques and business opportunities, such as the community supported agriculture (CSA) marketing model, and connected communities to local food options. They also partnered with chefs to educate communities about healthy dietary choices and food preparation, and created a “28-day challenge,” a guided, plant-based diet lasting a month.

## DISMANTLING BARRIERS FOR YOUNG FARMERS OF COLOR

### SARE PROJECT [ONE19-328](#)

Young farmers face many challenges in gaining access to the land, capital, networks and other resources needed to grow a successful business, but they don't face these challenges equally. The number of Black, Latino, Asian American and Native

American primary producers all decreased between 2012 and 2017, according to the 2017 Census of Agriculture, which shows that centuries of marginalization and systemic racism are causing young people of color to struggle with a career in agriculture. As a result of this, the National Young Farmers Coalition (NYFC) partnered with Soul Fire Farm in Petersburg, N.Y., to equip young farmers around the country with tools they can use to confront and dismantle racism and inequity in food and farming systems. Supported by a SARE Partnership grant, NYFC offered anti-racism training to 25 of its chapter groups that were facilitated by Soul Fire Farm. Participants completed NYFC's Racial Equity Toolkit and were connected with Black- and Brown-led organizations engaged in anti-racism work in their regions.

## BRINGING FARMER-LED TRAINING NETWORKS TO THE DEEP SOUTH

### SARE PROJECT [LS20-331](#)

One of the most powerful ways that farmers can improve the sustainability of their operation is by seeking community with their peers. By networking and building relationships with one another, farmers can share ideas, experiences and resources, and offer support when times are difficult. Recognizing this, the Alabama Sustainable Agriculture Network (ASAN) decided to bring a model for farmer-led training and peer networking used in other parts of the country, known as a Collaborative Regional Alliance for Farmer Training (CRAFT) Network, to central Alabama. Using a SARE Research and Education grant, the team at ASAN worked with farmers to establish

a CRAFT Network, the first of its kind in the Deep South. Along with developing its structure and governance, the group conducted interviews and focus groups with 50 farmers to assess their learning needs and backgrounds. They also began holding monthly on-farm workshops on topics determined by a steering committee. The group places an emphasis on creating an inclusive environment for BIPOC farmers, women farmers and LGBTQ+ farmers.

## MUSHROOMS AS A SOVEREIGN FOOD FOR NORTHERN CALIFORNIA TRIBES

### SARE PROJECT [RGR20-010](#)

Native American tribes across the country view food sovereignty as an act of cultural resurgence that ties directly to the health, economic development and shared identity of tribal communities. In this spirit, members of the Potter Valley Tribe, who are descended from the Pomo people of northern California, are seeking to bring native mushrooms back into regular use by their tribal members. Supported by a SARE Research to Grassroots grant, members of the tribe built a community mushroom lab space and evaluated how well they could grow a variety of native mushroom species using readily available substrates from local businesses, including brewer's grain, walnut waste and spent coffee grounds. The mushrooms they selected had both culinary and medicinal purposes. Collaborating with eight neighboring tribes, they held educational workshops and began mapping the distribution and diversity of fungi in nearby natural areas, and took people, primarily tribal youth, to gather mushrooms using traditional methods.

# Health and Wellbeing of People

Our food system is only sustainable when the health and wellbeing of all those involved in agriculture are taken into account. This means ensuring safe and reasonable workplace conditions for farmworkers, as well as fair compensation and benefits. Many farmers need things like better access to mental and physical health support, childcare and networking opportunities to deal with the stress and isolation of farm life.



Photo by Preston Keres, USDA

## HELPING FARMING COMMUNITIES COPE WITH STRESS AND SUICIDE

### SARE PROJECT [ENC18-170](#)

Farming is very stressful. From the long hours and the difficult, solitary nature of the work to the many risk factors that are largely beyond one's control, farmers confront major mental health challenges that for many years were not talked about within agriculture. But today, farming communities are turning more attention to the issue of mental health and the high suicide rate in agriculture, one of the worst of any professions in the country. As one example, the Minnesota Department of Agriculture's Meg Moynihan is working with a wide range of partner organizations to deliver training and resources on mental health topics to people who work with farmers in their local communities, including government staff, Extension educators and community leaders. Using a SARE Professional Development Program grant, Moynihan and her collaborators expanded on previous work by delivering seminars and workshops on the topics of stress among farm youth, supporting farmers who are under stress, navigating conflict and difficult conversations, and suicide prevention and bereavement.

## EFFECTIVELY MANAGING THE HUMAN RELATIONSHIPS ON THE FARM

### SARE PROJECT [ENE16-142](#)

To be successful, farmers need a diverse set of skills in crop and livestock production, equipment operation and maintenance, marketing, and business management, among other areas. For

many, though, a weak spot can be in the cultivation of healthy relationships with the people who play a role in the success of the operation: business partners, employees, family members and others. This prompted Leslie Forstadt, a University of Maine Cooperative Extension human development specialist, to develop a training program for agricultural service providers (ASP) to make them better able to support their farmer clients in the area of interpersonal skills. The project, funded by a SARE Professional Development Program grant, focused on four key areas: communication, decision making, goal setting and time management. The aim was not to make ASPs "experts" on these topics but rather to help them recognize when their clients are facing interpersonal challenges and then to guide them toward the skills they need to find a resolution.

## TRAINING FOR BLACK FARMERS IN LOW-INCOME URBAN COMMUNITIES

### SARE PROJECTS [EDS20-15](#) AND [EDS18-07](#)

HABESHA is a nonprofit organization in Atlanta seeking to improve food access, business and employment opportunities and health outcomes for low-income communities in urban areas. Through their HABESHA Works program, the nonprofit's staff provides urban farm and garden training to Black adults with the goal of helping low-income communities produce their own fresh foods. HABESHA Executive Director Cashawn Myers used two SARE Research and Education grants to expand the capacity of HABESHA Works to train new farmers by incorporating an incubator

farm into the program and creating a more advanced curriculum on leadership and business skills. The incubator allows trainees to gain basic farming skills in a low-risk, supportive environment. The advanced curriculum, called HALO, covers such topics as branding and marketing, financing, interpersonal skills and running an organic operation.

## TOOLS AND TRAINING TO REDUCE FARMERS' PESTICIDE RISK

### SARE PROJECT [EW17-019](#)

On a day to day basis, pesticides represent one of the most immediate risks to the health and safety of farmers and farmworkers. At the same time, their regular use can have a negative impact on nearby communities and the environment. Integrated pest management (IPM) programs within state Extension systems play a critical role in helping farmers reduce their use of pesticides and handle them safely. Using a SARE Professional Development Program grant, Oregon State University's Paul Jepson and Katie Murray sought to improve the capacity of these IPM specialists to help farmers adopt safer pesticide protocols. Working with their peers in 11 other Western states, Jepson and Murray held workshops focused on pesticide risk assessment and education for agricultural professionals and organized monthly discussion topics. They also refined and shared a pesticide risk classification tool that will help farmers both in the United States and worldwide to begin moving away from highly hazardous pesticides and toward less harmful options.

# Ecological Pest Management

Many of the ecological strategies farmers use to manage pest insects, weeds and diseases not only result in fewer pesticide applications but also create a healthier and more sustainable farm overall. Some of the most effective approaches include promoting biodiversity on the farm, rotating crops, conserving habitat for beneficial insects and using practices that improve soil health. Learning about your problem pests through regular scouting, identification and monitoring, and following integrated pest management (IPM) practices are also key.



Photo (left) by Lance Cheung, USDA; photos (right) by Preston Keres, USDA

## ATTRACTING BENEFICIAL INSECTS TO URBAN FARMS

### SARE PROJECT [FNC17-1083](#)

EarthDance is a teaching farm located in Ferguson, Mo., that focuses on providing youth programs, volunteer opportunities and other activities to help connect the local community to the land. The team at EarthDance uses organic practices to grow almost 90 varieties of crops on 2.3 acres. Always seeking ways to improve the sustainability of their farm, they used a SARE Farmer/Rancher grant to incorporate both permaculture and IPM practices. Their main objective was to establish plots of 25 species of native perennial flowers around the farm. The group also tested the use of insect netting instead of row covers to exclude insects from tender crops. Over the course of the project, the group found the established wildflower plots began to attract a wider variety of beneficial pollinators and pest predators, to the point that they were able to achieve improved yields while lowering their use of organic sprays.

## COVER CROPS FOR WEED SUPPRESSION IN DRY WESTERN ORCHARDS

### SARE PROJECT [GW19-194](#)

While farmers and researchers are increasingly turning their attention to cover crops because of the many benefits they provide, the practice is slower to gain ground in some parts of the country. For example, there is little research available on how cover crops can fit into perennial cropping

systems in the arid West. University of California, Davis graduate student Steven Haring took this as his cue to explore their potential. Using a SARE Graduate Student grant, he and his faculty advisor looked specifically at whether winter cover crops can improve weed management in California's plentiful orchard farms. Haring evaluated different cover crop and management practices in a commercial walnut orchard to assess which approaches might result in improved non-chemical weed control. He found that the presence of a cover crop did provide weed control and that trying to increase cover crop biomass didn't result in decreasing weed biomass.

## PROVIDING GOOD QUALITY, DISEASE-RESISTANT SQUASHES FOR SOUTHERN GROWERS

### SARE PROJECTS [FS20-325](#), [FS16-291](#) AND [FS13-273](#)

For many years, downy mildew has been the primary limiting factor to cucurbit production at Twin Oaks Seed Farm in Louisa, Va., to the extent that some years the disease has caused entire crop failures. So, farmer Edmund Frost set out to develop crop varieties that combined strong disease resistance with desirable characteristics like size and taste. Supported by a SARE Producer grant, his initial efforts involved extensive variety trials of cucumbers, melons and winter squash, as well as selection work from a cross he made between a tropical pumpkin variety and a northern butternut squash. The resulting

butternut squash, called South Anna, takes advantage of the disease resistance of the pumpkin and the fruit quality characteristics of the squash. Frost has received two additional SARE grants to continue improving his disease-resistant squash varieties by crossing them with other varieties to create different sizes and flavor profiles, and to bring out other desirable characteristics like storage quality and uniformity.

## THE ROLE OF BARN OWLS IN PROVIDING RODENT CONTROL

### SARE PROJECTS [GW19-200](#) AND [SW18-063](#)

Barn owls and other raptors can play an important role in controlling the populations of rodent pests in farm fields, including across the western United States. Supported by two SARE grants, researchers at the University of California, Davis wanted to study the contributions these birds make to rodent control and, critically, to explore whether farmers' use of rodenticides had a negative effect on bird health. Professor Joshua Hull and graduate student Breanna Martinico monitored the activity of barn owls and hawks on four farms and analyzed them for signs of rodenticides in their blood and pellets. The team found that the birds do in fact consume a significant amount of mice, voles and other pests near their habitats, but the presence of rodenticides in their bodies was low. This could be because farmers' use of the chemicals didn't coincide with the timing and location of raptor activity, according to the team.

# Biological Diversity

Sustainable farms strive to maintain a high level of biological diversity across the landscape. This can take many forms, such as agroforestry, cover crop mixes, crop rotation, riparian buffers, pollinator plantings, wildlife habitat, mixed species grazing and integrated crop/livestock systems. There are many possible benefits too, including improvements to water quality and conservation, nutrient cycling and soil fertility, and pest management.



Photos by (clockwise from top): Mark Brannen, Breanna Martinico and Carly Whitmore, Indiana NRCS

## GENERATING INCOME FROM POLLINATOR HABITAT ON AN URBAN FARM

### SARE PROJECT [FNC19-1156](#)

Supporting beneficial insects such as pollinators and predators is important on all farms because of the services they provide. In urban areas, attracting beneficials can be particularly challenging because their natural habitat is highly fragmented. Also, urban farms typically operate on a very small land base and often need to extract as much production from their land as possible, perhaps making them hesitant to devote a significant amount of space to insect habitat. Mark Brannen of Benson Bounty in Omaha, Neb., used a SARE Farmer/Rancher grant to establish native plant habitat on his 0.75-acre urban farm and to assess what kind of revenue stream he could get by selling cut flowers. Brannen found that he could gross about \$2 per square foot, which was \$1 less than vegetable beds, but with considerably less labor involved.

## GIVING MAINE POTATO GROWERS MORE CROP ROTATION OPTIONS

### SARE PROJECT [LNE17-358](#)

The benefits of crop rotation are well known: They can break pest and disease cycles, help control weeds, reduce inputs and create new revenue streams. But many potato growers in Maine are pulling back from the practice because the typical rotation is with small grains such as oats and barley, and the regional market for

these crops is poor. Motivated by this, Jack Dyer, an agronomist with the Maine Potato Board, used a SARE Research and Education grant to evaluate the potential of rotating potatoes with oilseed and pulse crops. After evaluating many crop species over two years, Dyer found that field peas, sunflowers, canola and condiment mustard are all viable options for potato rotations and, depending on market demand and currency exchange rates with Canada, can increase revenue. They also require low fertility and chemical inputs, and fit well into a reduced tillage system.

## DIVERSIFIED AGROFORESTRY SYSTEMS FOR SMALL-SCALE GROWERS

### SARE PROJECT [FS18-311](#)

Many small-scale Kentucky farmers are seeking to move away from tobacco production, and one promising alternative is in diversified agroforestry. This is according to Matthew Wilson of Rindlewood Farm in Berea, Ky., who used a SARE Farmer/Rancher grant to explore a production system that incorporates fruit and nut trees, cover crops, sweet sorghum and pastured broilers while making use of old tobacco equipment. While perennial orchards come with many environmental benefits and income opportunities, growers need a source of revenue while trees are young, so Wilson experimented with alley cropping, or growing crops between tree rows. He took two approaches: one was cover crops and the other was sweet sorghum. Both of these crops served as a

feed source for his flock of broilers and as a mulch to help the young trees establish. Wilson produced value-added syrup from the sorghum. In the end, he found that his diversified agroforestry system did provide a promising alternative to small-scale tobacco production.

## CONNECTING THE DOTS BETWEEN SOIL HEALTH, CLIMATE RESILIENCE AND POLLINATORS

### SARE PROJECT [WRGR19-03](#)

The threat posed to agriculture by climate change is well known, as is the need to adopt practices that improve soil health, because healthy soil makes farms more resilient to extreme weather and has the potential to sequester carbon. What's focused on less is how pollination fits into this picture. Honeybees don't pollinate during rain, wind or extreme heat: all weather events that are becoming more frequent and intense. Native bees are better at pollinating in these kinds of weather, so their importance may increase in the near future. This prompted the nonprofit Our Family Farms to use a SARE Research to Grassroots grant to help Oregonian farmers learn how to promote climate resilience, soil health and native insects on their land. The group created a toolkit on some of the best practices, including reduced tillage, flowering cover crops, integrated pest management and establishment of permanent habitat for native beneficials.

# Innovative Technologies and Enterprises

Keeping an eye out for new technologies or business opportunities is one way farmers can make their operation more sustainable and adaptable to change. Precision agriculture is a prime example, and others include alternative energy systems, roller crimpers, interseeders and the countless low-cost tools small-scale farmers build to improve efficiency. On the business side, many farmers diversify into new marketing channels, niche products, heirloom or ethnic crops, value-added processing and unique or emerging production systems, such as agroforestry.



Photo by Lance Cheung, USDA

## IMPROVING NO-TILL COVER CROP SYSTEMS WITH A PRECISION PLANTER

**SARE PROJECT** [FNC15-1018](#)

Illinois farmer Ralph “Junior” Upton has decades of experience with cover crops and no-till under his belt, but like most farmers who prioritize sustainability, he’s still looking for ways to improve his system. Using a SARE Farmer/Rancher grant, he set out to tackle a problem that many no-till farmers face when adopting cover crops: how to maximize cover crop biomass in order to get the most benefit from the practice while also being able to plant effectively into the residue in the spring. His approach was to build a customized precision planter that could seed different species of cover crops in specific parts of his field rows. The idea was to seed species within the rows that are easier to manage during spring planting and to seed higher biomass, more difficult species, between the rows. While Upton and his collaborators saw some alignment issues, they felt the addition of an auto-steer system would improve efficiency.

## GROWING RICE IN UPSTATE NEW YORK USING TRADITIONAL AFRICAN PRACTICES

**SARE PROJECT** [FNE19-933](#)

One might think that trying to grow rice, a tropical grain, in Upstate New York is an impossible task, but Nfamara Badjie and Dawn Hoyte are making it happen at Ever-Growing Family Farm. They’ve found a way around the short growing season

by bringing practices used by farmers in Badjie’s native country of Gambia to their New York farm, located in Ulster Park. In particular, they used a SARE Farmer grant to compare two approaches to establishing seedlings: the established plug-tray method and the Diola-style field nursery. This is a centuries-old method used by the Diola (or Jola) people of West Africa, in which field nurseries are constructed as raised beds next to rice paddies. Badjie and Hoyte included in the study an heirloom rice from Africa known as Ceenowa. They found that the Diola method was successful; it resulted in more robust seedlings, reduced transplanting labor and allowed them to shorten the production cycle. It’s also simpler, lower cost and easy to adopt compared to the established approach.

## USING DRONES TO COLLECT DATA THAT LEADS TO REDUCED NITROGEN APPLICATIONS

**SARE PROJECT** [FS20-321](#)

New technology is constantly being developed and adopted in agriculture, and one area with huge growth potential is the use of drones. Unmanned aerial vehicles (UAVs) can serve many purposes on a farm, such as crop and field monitoring. Nolan Parker, a UAV flight technician, wanted to see if drones could be used to improve the sustainability of corn and cotton farms by helping farmers reduce their use of nitrogen without affecting yields. Using a SARE Farmer/Rancher grant, he set out to test the ability of different drone models to collect imagery data and to see if he

could use it to reduce nitrogen applications early in the season. Conducting his research at his family’s farm in Lake Providence, La., Parker assessed the efficiency of two styles of drone: quad-copter and fixed-wing. He found that fixed-wing drones fly faster and cover more acreage, and that the quality of data collected by each is comparable. Furthermore, the data he collected did allow for more precise nitrogen applications.

## GROWING A COOPERATIVE TO MEET STRONG LOCAL DEMAND FOR PORK

**SARE PROJECT** [FW19-339](#)

In Hawai‘i, pork is an important part of the cuisine and culture for Native Hawaiian, Filipino, Portuguese, Tongan and Samoan communities. At the same time, small-scale pig farmers in the state can have a difficult time meeting local demand and providing a consistent supply of pork products. This prompted farmer Atto Assi to use a SARE Farmer/Rancher grant to develop a cooperative that would help its members better serve local markets through economies of scale. Through the project, the Hawai‘i Swine Producers Cooperative held workshops on the inoculated deep litter system that its members use: a low-cost system for raising pigs that produces minimal odor and has a low environmental impact. The co-op also used the workshops to grow their membership. The co-op removes barriers to entry for small-scale pork producers by buying their piglets and raising them to market weight, then returning the sales revenue back to them minus feed and labor costs.

# SARE IS ...



## GRANT MAKING

SARE offers grants to farmers, ranchers, researchers and ag professionals for on-farm research, education, and professional and community development. SARE-supported projects address pest management, soil health, stewardship, marketing, social topics and much more.

## ENGAGEMENT

SARE shares research results by funding trainings for ag professionals and requiring project outreach such as field days and workshops.

## FARMER LEADERSHIP

Hundreds of producers from all corners of the nation advise SARE.

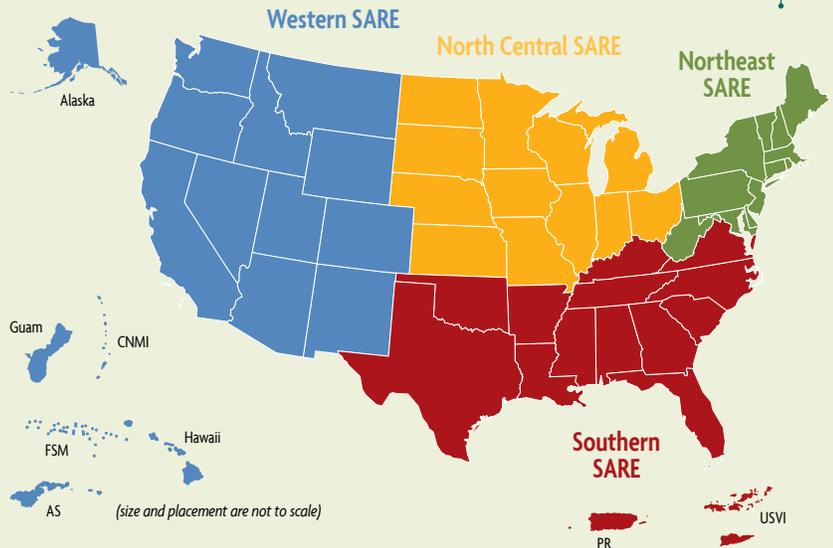
## LOCAL LEADERSHIP, NATIONAL IMPACT

Four regional councils—including farmers, educators, scientists, government, NGOs and other stakeholders—set priorities and make grants.



## RESOURCES

SARE Outreach and regional communications specialists translate SARE's more than 30 years of applied research results into newsletters and practical books, bulletins, multimedia and online resources for farmers, ranchers and ag professionals.



## YOU, EXPLORING YOUR SUSTAINABLE INNOVATIONS!

Contact your region to apply for a SARE grant. Contact SARE Outreach or visit [www.sare.org](http://www.sare.org) for publications.

### SARE OFFICES

#### NORTH CENTRAL SARE

(hosted by the University of Minnesota)  
[northcentral.sare.org](http://northcentral.sare.org)  
 (612) 626-3113  
[ncrsare@umn.edu](mailto:ncrsare@umn.edu)

#### Northeast SARE

(hosted by the University of Vermont)  
[northeast.sare.org](http://northeast.sare.org)  
 (802) 656-0471  
[northeastare@uvm.edu](mailto:northeastare@uvm.edu)

#### Southern SARE

(hosted by the University of Georgia and Fort Valley State University)  
[southern.sare.org](http://southern.sare.org)  
 (770) 412-4787  
[ssare@uga.edu](mailto:ssare@uga.edu)

#### Western SARE

(hosted by Montana State University)  
[western.sare.org](http://western.sare.org)  
 (435) 797-2257  
[wsare@montana.edu](mailto:wsare@montana.edu)

#### SARE Outreach

(hosted by the University of Maryland)  
[www.sare.org](http://www.sare.org)  
 (301) 453-5358  
[info@sare.org](mailto:info@sare.org)

Photos by (from left): Preston Keres, USDA; Preston Keres and Lance Cheung, USDA



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