



ANNUAL REPORT

2017

Western Sustainable Agriculture Research and Education



SARE's mission is to advance – to the whole of American agriculture – innovations that improve profitability, stewardship and quality of life by investing in groundbreaking research and education.

SARE's vision is an enduring American agriculture of the highest quality. This agriculture is profitable, protects the nation's land and water and is a force for a rewarding way of life for farmers and ranchers whose quality products and operations sustain their communities and society.

Western SARE serves the 13 Western states and four Pacific island territories. We are supported by the USDA's National Institute of Food and Agriculture.

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Beginning September 1, 2018, the Western SARE program will be hosted at Montana State University.

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All Across the West

Western SARE Stays Focused on Serving Farmers and Ranchers

Friends of Western SARE,

Western SARE's commitment to supporting innovative and diverse solutions to our region's agricultural problems has never been stronger. That is why we are proud to release our second annual report, in which we highlight some of the great work being done in the West.

Through five competitive grant programs, Western SARE funded a variety of projects covering a wide range of topic areas. The projects led by researchers, ag professionals, farmers, ranchers, and graduate students address a full array of important issues for Western sustainable agriculture. The exciting work featured in this report includes research and education about pollinators, rangeland restoration, youth engagement, organics and conservation practices, livestock genetics, native and local foods, agroforestry, renewable energy, and crop production.

Geographical diversity is essential to meeting Western SARE's mission. Our program strives to address the full range of Western producers' needs found within our 13 states and four Pacific island territories. During the funding period of this report, 12 states received competitive grants totaling \$3,195,561. In addition, each state and territory was provided funding to help promote sustainable agriculture and conduct outreach and education. In this brief report alone, you will read about projects in Alaska, California, Colorado, Hawaii, Montana, New Mexico, Oregon, Utah, and Washington – again, only a partial glimpse of the work being conducted by Western SARE grantees.

While the topics and locations are diverse, these projects all share important traits.

- Every project must demonstrate that the challenge being addressed is relevant to farmers and ranchers.
- All projects must be conducted in full partnership with producers – even though the projects may be led by land grant institution researchers and graduate students, extension and other ag professionals, and nonprofit leaders.
- Innovation and creativity are key – Western SARE seeks out-of-the-box thinking.
- Research alone isn't enough. The results must get out to the ag community quickly and be easily accessible through public reports, field days, workshops, and educational materials.

Western SARE supports project leaders with their dissemination activities by making research results easily accessible to the public through an easy-to-use searchable database, numerous publications, a comprehensive Learning Center, and a coordinator in each state to help with outreach and dissemination. During this past year, Western SARE published two 16-page reports, two newsletters, a monthly e-newsletter, and dozens of project stories. We have also promoted the publications, websites, blogs, and videos of multiple projects, expanding the number of recipients of new knowledge.

After you read this snapshot of Western SARE's work, we encourage you to visit our website and take a deeper look at the important projects we did not have room to showcase and the variety of resources available.



A handwritten signature in blue ink that reads "Rhonda Miller". The signature is written in a cursive, flowing style.

Western SARE's Research and Education Grants create important new knowledge about sustainable systems. These projects are often multi-year efforts, and, like all SARE-funded research, require producers to be involved. These grants must also plan for and produce educational material for producers and ag professionals. It's not enough to publish in an academic journal – the knowledge has to get to farmers and ranchers.

Breeding for Behavior: Hill-Climbing Cows

Conventional wisdom says cows don't go up steep slopes. They don't climb hills and don't travel very far from water.

Some cows never got that memo.

"I've been watching cattle for years, and there are always some cows that just take off for the hills, like they didn't know they weren't elk," said Derek Bailey, a professor of range science at New Mexico State University. "They could be belly-deep in green grass and just bolt for the hills."

That got Bailey thinking.

"We can breed for other traits," he said. "Why not select for hill climbing?"

If ranchers could select for the hill-climbing trait the same way they select for any number of other genetic traits, it could have huge implications throughout the rugged West. They could graze more cows on mountainous ranches. Rangeland would be more productive and more evenly utilized, providing environmental benefits and better defense against invasive weeds. Riparian areas could be protected.

"We think this could make a big difference on the ground," Bailey said. "In agriculture, if you can get a 3 to 5 percent improvement, it's huge. We think if ranchers can get more use and grazing on slopes, they could increase stocking rates by as much as a third – and do it sustainably."

Bailey is working with a team of scientists located across the West to investigate this opportunity, including Milt Thomas, Scott Speidel and Mark Enns at Colorado State University, Juan Medrano at UC Davis, and Larry Howery at University of Arizona. They turned to Western SARE to fund the research that could soon turn into a cheap breeding test that would allow ranchers to select for hill-climbing traits.

"It's very exciting research," said Juan Medrano, a UC Davis animal geneticist. "DNA technology makes it relatively easy to test and breed for production traits like milk yield



Derek Bailey, New Mexico State University

Collecting a blood sample from a collared cow.

and growth rate. But it's brand new to identify genetic markers linked to animal behavior. This could have a huge impact on food security and rangeland management."

To identify hill-climbing cattle, Bailey and his crew put Global Positioning System collars on cows on ranches in several Western states and took measurements every 10 minutes for months at a time. They tracked each cow's movements and habits – their slope use, elevation gain and distance traveled from water.

They take blood samples from all the collared cows that Medrano and his team analyzed for chromosomal commonalities. Medrano has already found overlap in genes linked to locomotion, motivation and spatial learning.

"The secret to this is more data," Bailey said.

That data analysis is continuing.

Learn more: projects.sare.org/sare_project/sw15-015/

Improving Pollination: Flower Strips for Bees

A diverse food source is good for bees – European honeybees and the hundreds of different species of native bees – but can it also be good for farmers?

To answer that question, Laura Burkle, an assistant professor at Montana State University, and research scientist Casey Delphia used Western SARE funding to plant and monitor flower strips at four different Montana farms over a three-year period.

They looked at the species of bees that visited the flower strips and measured pollination services those bees provided on the farm. They calculated costs and the potential income from harvesting and selling seed from the flowers, which varied by plant and location.

The big takeaway was simply the variety of bee species that visit farms in Montana – more than 130 different native bee species.

“There are bees that visit our flower strips that look like flies and bees that look like little teeny tiny wasps,” Delphia said. “People just don’t realize that they’re bees.”

Burkle said just documenting that diversity was important.

“I get asked a lot about how the bees are doing and usually when people say that, they’re asking about honeybees,” she said. “So I sort of made it my own personal mission to try to emphasize that there are other bees besides honeybees that are also encountering difficulties.”

The team learned as much about the nine species of na-



Inspecting a flower strip planted on a Montana farm.

Steve Elliott, Western IPM Center

tive plants they tested as the bees that flocked to them.

“For every one of these species there were some really interesting things that happened as far as how easy it was to get these plants established, how much they filled out and how much seed they produced,” Delphia said. “A big thing was how difficult it was to collect and clean the seed.”

Answers to many of those questions are in plant fact sheets the team created for each of the nine species.

Learn more, and download the fact sheets: projects.sare.org/sare_project/sw13-043/

New Research & Education Awards

SW17-016, **Soil Acidity Management of Long-Term No-till Fields in Montana to Prevent Crop Failure.** Principal Investigator: Richard Engel, MT; \$264,016.

SW17-046, **Grass-birdsfoot Trefoil Mixtures to Improve the Economic and Environmental Sustainability of Pasture-based Organic Dairies in the Western U.S.** Principal Investigator: Blair Waldron, UT; \$214,123.

SW17-050, **Assessing and Sharing Breadfruit Management Practices.** Principal Investigator: Noa Lincoln, HI; \$220,811.

SW17-060, **UAS (Unmanned Aerial System)-guided Releases of Predatory Mites for Management of Spider Mites in Strawberry.** Principal Investigator: Elvira de Lange, CA; \$249,878.

SW17-077, **Best Management Practices for Regionally-Distinct Populations of the Blue Orchard Bee.** Principal Investigator: Theresa Pitts-Singer, UT; \$246,910.

SW17-080, **The Impacts of Integrating Livestock into Cropping Systems on Soil Health and Crop Production.** Principal Investigator: Devon Ragen, MT; \$249,502.

Professional + Producer Grants combine the skills of agriculture professionals – university researchers, extension specialists, county agents and others – with the on-the-ground knowledge and experience of Western farmers and ranchers. These projects are based on working farms, ranches or other operations and require a research and education component.

Restoring Rangeland to Benefit Livestock

Research Animal Scientist Kip Panter is passionate about helping ranchers through the collaborative work he and his team have done to restore degraded grasslands in the Chelan Scablands of eastern Washington.

The team, studying at three ranches, found a “really good economical way to reduce medusahead and prepare the land for restoration,” Panter said.

Livestock producers in the region confront degraded grazing lands from previous overgrazing, which has been worsened by frequent wildfires and the subsequent invasion of annual grasses and undesirable forbs, such as medusahead and cheatgrass, which have pushed out native grasses.

Without the native plants, cattle turn to eating lupine which in turn causes crooked calf syndrome (CCS). In one

county alone, 4,000 calves were affected with CCS in 1997, and many had to be destroyed, with some ranchers losing their entire calf crop. One rancher has data that showed his stocking rate throughout his ranch had dropped by more than 50 percent since 1990, which he attributes totally to the invasion of medusahead.

Ranchers and researchers partnered in looking at ways to beat back the invasive species and grow new forage. Range technician Clint Stonecipher explained that it is not enough to get rid of medusahead and other invasives, but to find ways to look at full restoration.

“There is not one silver bullet,” he said. “There will be different tools used. Natural systems are complex.”

The project demonstrated the success of introducing improved perennial grass species and forage kochia that compete with medusahead. The team also studied using targeted grazing techniques that provide a sustainable seed-bed preparation requiring only minimal disturbance to allow the planting of the improved grasses and kochia. Using this method, the rancher can fully utilize the rangeland the year of the seeding and, following one year of rest for seedling establishment, utilize the newly seeded pasture the fall of the second year.

The outcomes from their project led to the establishment of a larger scale project that will create an innovative grazing strategy to increase rangeland health and reduce the likelihood of crooked calf syndrome from over-eating of lupine.

In addition to leading to the larger R&E project, the promising outcomes resulted in an enthusiastic response from stakeholders and an increase in acreage being used for research and demonstration.

Learn more: projects.sare.org/project-reports/ow13-005/



Clint Stonecipher, USDA NRCIS

Reseeding to restore degraded rangeland.

Creating Opportunities in Reindeer Herding

Alaska is too cold, too remote, and too dark for too much of the year to produce all the food its population needs.

“We are just about totally dependent on outside food production systems and some of us are concerned about that,” explained Greg Finstad, a University of Alaska associate professor and director of its Reindeer Research Program in Fairbanks. “We’ll never be fully self-sufficient, but we need to enhance our self-sufficiency and develop our strengths.”

One of Alaska’s strengths: 20 million acres of undeveloped rangeland that can be productively grazed.

“Cows don’t work on this range,” Finstad explained. “Reindeer do.”

So with the long-term goal of expanding reindeer herding to create a home-grown meat supply, Finstad and Erin Carr, a research professional in the reindeer program, have been using Western SARE grants to build that system from the bottom up – beginning with 4-H.

“The idea was to bring in native Alaskan kids from different villages and teach them reindeer husbandry 101,” Carr explained. But Alaska doesn’t make that easy.

“We video conference and use social media, but it’s hard when you can’t sit down together,” Carr said.

Here’s how hard: Four of the kids involved in the program all come from the same town of Ruby, on the Yukon River in west-central Alaska, but they all go to different schools hundreds of miles apart. And there are no roads in that part of the state – travel is by air or boat.

“The traditional year-round 4-H club model just may not work here,” Carr said. “We’re going to have to develop something that’s virtual and seasonal.”



Erin Carr, University of Alaska Fairbanks

Learning reindeer husbandry basics at a 4-H camp.

The program first brought kids to the Reindeer Research Program, located on 17 acres near to the University of Alaska Fairbanks campus, in 2014. They had a camp in Nome in 2015, and last summer held two camps, one in the village of St. Paul in the Pribilof Islands, and one in Delta Junction.

Now Finstad and Carr are trying to develop adult leaders in the villages to keep the momentum going.

“We need a reindeer revolution,” Finstad said. “We need young people to develop and run with it. In rural Alaska, there are no jobs, no opportunity. There’s nothing in these villages. Reindeer are an opportunity to develop jobs and businesses and provide greater food security.”

Learn more: projects.sare.org/sare_project/ow16-031/

New Professional + Producer Awards

OW17-008, **Training Seed Producers and Increasing Local Markets for Seed Production.** Principal Investigator: Dana Kristal, OR; \$49,750.

OW17-009, **Soil Moisture Network and Tools - Montana and Wyoming Collaborative.** Principal Investigator: Brad Brauer, MT; \$49,995.

OW17-021, **Evaluating Nitrates and Forage Quality in Fall Re-growth of Annual Cereal Forages.** Principal Investigator: Tracy Mosley, MT; \$19,972.

OW17-024, **Resistant, Resilient and Long Storing Garlic Varieties for Organic Farming Systems and Markets.** Principal Investigator: Alexandra Stone, OR; \$49,971.

OW17-026, **Montana Food Economy Initiative.** Principal Investigator: Kaleena Miller, MT; \$50,000.

OW17-037, **Successful Cacao Establishment through Improved Soil Management.** Principal Investigator: Jean Brokish, HI; \$49,789.

OW17-043, **Beginning-Farmer Research and Instruction on Growing in High Tunnels.** Principal Investigator: Nathaniel Harkleroad, CA; \$49,999.

OW17-051, **Sustainable Crop-Livestock Integration for the System Health in the Dryland Inland Pacific Northwest.** Principal Investigator: Leslie Michel, WA; \$49,724.

OW17-054, **Advancing Sustainable Nitrogen Management in Strawberries through Participatory Research and Education.** Principal Investigator: Gerry Spinelli, CA; \$49,937.

Western SARE's Professional Development Program Grants help the Cooperative Extension Service, Natural Resources Conservation Service and other agricultural professionals in the West increase their understanding and proficiency in sustainable agriculture so they can better assist the region's producers.

Creating a Toolkit for Organic Certification

As producers work to meet regulations under the National Organic Program (NOP) and become certified organic, they often apply conservation practices that align well with the Natural Resources Conservation Service's (NRCS) conservation activities, such as green manures, buffer strips, and rotational grazing. NRCS assistance is being sought by both new and established organic farmers to help meet resource stewardship goals.

Yet NRCS staff, as well as other ag professionals like organic certifiers, need an improved understanding of natural resource conservation on organic and transitioning farms in Oregon and California, according to Oregon Tilth and the Wild Farm Alliance. In answer to a survey administered by the two organizations, the majority of organic certifiers stated that they did not work with NRCS.

Oregon Tilth and Wild Farm Alliance, through a Western SARE project, expanded NRCS' knowledge of soil health and conservation on organic and transitioning farms with the goal of reducing the barriers to organic certification and increasing organic and transitioning farmers' participation in conservation programs.

As the project leaders developed a toolkit to advance knowledge of organic conservation practices and how certification and conservation programs work together, a 30-page booklet was developed to support NRCS conservation planners and other agricultural professionals as they work with organic producers. **The National Organic Farming Handbook** describes organic systems and identifies key resources to guide conservation planning and implementation on organic farms. The handbook was developed with a team comprised of NRCS staff and partner organizations from across the country and from a range of disciplines. Producers and other audiences may also find the handbook useful, particularly the resources listed in various sections.

Sarah Brown, Oregon Tilth, was pleased with the results.

"This document provides the first comprehensive re-



Ron Nichols, USDA NRCS

NRCS staff and a grower walking by organic soybeans.

source focused on the intersect of conservation and organic agriculture," she said. "It serves as a guide for conservation professionals, farmers, and others interested in supporting conservation on organic lands."

In addition to the handbook, resources for organic certifiers were also developed. **The Biodiversity Conservation: An Organic Farmer's and Certifier's Guide** was created to clarify the National Organic Program's new Natural Resources and Biodiversity Conservation Guidance.

According to Jo Ann Baumgartner, Wild Farm Alliance, "the biodiversity guide has been well received by organic certifiers and is stimulating many to update their Organic System Plans."

One clear outcome of the project, according to Al Kurki, Western SARE PDP Associate Coordinator, was catalyzed institutional change.

"Not only did the project reach a lot of ag professionals and farmers, it also helped spur more frequent, regular dialogue and interaction between the National Organic Program and NRCS," Kurki said.

Learn more: projects.sare.org/sare_project/ew15-020/

Promoting Traditional Island Agroforestry

When Craig Elevitch began developing educational resources about food-producing agroforestry systems in the Pacific Islands 25 years ago, agriculture professionals and farmers needed convincing about the benefits.

No longer. The workshops and manuals have been so widely received that, with Western SARE funding, Elevitch is currently working on a highly anticipated “how-to manual” and workshops in Hawaii, Guam, and Pohnpei.

“Food producing agroforestry systems are time-tested models for sustainable agriculture, especially in tropical agriculture,” said Elevitch, director of Permanent Agriculture Resources in Hawaii. “Expanding knowledge about modern agroforestry practices will address food security, local economic development, and resource conservation needs.”

Traditional, sustainable agroforestry systems in Hawaii and other Pacific Islands supplied native communities excellent nutrition, building and crafts materials, and medicine. The diversity of trees provided ecological services as well. However, these systems and practices were gradually lost after European contact and the introduction of monoculture plantations.

Given the recognized risks in intensive monocultures, farmers and agriculture professionals are now seeking specific information on certain agroforestry practices for their benefits in responding to climate change, diversifying yields, managing risks, and conserving water and soil.

Elevitch and his team of seven writers are providing practical information on design methods, soil restoration, native and cultural plants in agroforestry, fire risk mitigation, managing tree/crop competition, and commercial enterprise development. The manual will synthesize published infor-



Craig Elevitch, Agroforestry Net

A 2015 workshop at Mohala Lehua Farm in Hawi, Hawaii.

mation on traditional Pacific agroforestry systems combined with modern science and methods. The topics were chosen based on identified needs of ag professionals who participated in previous Western SARE-funded workshops.

The manual will be free to all who wish to use it and will be distributed at workshops in Hawaii, Guam, and Pohnpei.

“Based on previous chapter downloads, I believe tens of thousands of the chapters will be read in the first year,” Elevitch said. He estimates there will be at least 180 people participating in the workshops as well.

Learn more: projects.sare.org/sare_project/ew16-008/?ar=2016

New Professional Development Awards

EW17-004, Breadfruit Agroforestry for Pacific Island Revitalization. Principal Investigator: Craig Elevitch, HI; \$73,689.

EW17-006, Collaborative Training for Southwest Grassland Restoration under Environmental Uncertainty. Principal Investigator: Barbara Hutchinson, AZ; \$71,503.

EW17-011, Integrated Parasite Management: Train the Trainer. Principal Investigator: Dave Scott, MT; \$74,189.

EW17-012, Growing California Agritourism Communities. Principal Investigator: Shermain Hardesty, CA; \$73,010.

EW17-014, Building Knowledge of Cover Cropping Techniques for Increased Adoption Rates. Principal Investigator: Jamie Meek, CA; \$52,172.

EW17-019, Western Region Pesticide Risk Reduction through Professional Development for Western State IPM Programs. Principal Investigator: Paul Jepson, OR; \$63,299.

EW17-021, Westside Pasture Calendar for Agricultural Professionals in the Pacific Northwest. Principal Investigator: Steve Fransen, WA; \$74,555.

EW17-025, Grazing Strategy Indices for Range Quality Assurance. Principal Investigator: Sherman Swanson, NV; \$42,369.

EW17-028, Sustainable Agriculture Outreach Training for Hawaii’s Immigrant Farming Communities. Principal Investigator: Marisol Quintanilla, HI; \$66,570.

SARE's commitment to involving producers in all of our research projects is seen in its most pure form in the Farmer/Rancher Grants. These awards go directly to producers in the West to conduct research on their own land and solve problems they and other producers face.

Shading Methods to Keep Leafhoppers Away

In 2015, Peter Sinanian's Albuquerque-area farm, TomatoCulture LLC, couldn't keep up with demand when beet curly top virus caused significant losses in his crop.

"It was a horrendous curly top season," he said. "We lost 30 percent of our plants to the disease, which reduced our cash flow by about \$10,000."

TomatoCulture specializes in heirloom tomatoes, a popular crop for many small-scale organic growers. Selling flavorful and interesting varieties directly at farmers' markets and to a dozen area restaurants and caterers, Sinanian went into the 2016 season hoping to reduce those losses.

"The beet leafhopper is the only known vector of the disease," he explained. "And leafhoppers prefer to feed in bright sunlight."

So, working with New Mexico State University extension agents, Sinanian developed an interesting farm-based research project. Would shading his various varieties of tomatoes reduce leafhopper feeding and disease losses? And could intercropping the tomatoes with sunflowers be as effective at warding off leafhoppers as installing shade cloth over them?

With funding from a Western SARE Farmer/Rancher grant, TomatoCulture began a two-year experiment. Sinanian covered some rows of tomatoes with shade cloth, interplanted other rows with sunflowers, and left some untreated as control sections. He repeated the treatments through three different blocks on his farm.

"The original plan was to use wild sunflowers," he explained. "But they didn't grow big enough ahead of the tomatoes."

A late-season visit with several extension agents and master gardeners did provide ideas for year two – mixed plantings of sunflowers and other flowers to provide multiple benefits. Those plantings could provide a refuge for pollinators and natural insect enemies, shade and additional revenue potential from selling cut flowers.

It wasn't a cheap experiment.



Heirloom tomatoes from TomatoCulture.

"The cloth itself is not cheap, and there are expenses in the cloth, labor and infrastructure," Sinanian said.

The biggest lesson learned in year one was that in the sun-baked New Mexico climate, soil matters as much as shade. The section of his land that had received the most soil amendments the previous year was the section where his tomatoes produced best.

After year two, Sinanian still didn't see a connection between shading and leafhopper activity, but did make two other important discoveries from shading tomato plants with 30 percent shade cloth:

- The shade cloth sections in all three zones had the lowest overall plant losses and;
- These sections had the highest yields per plant by significant margins.

That's a win, even if it didn't deter the leafhoppers.

Learn more: projects.sare.org/sare_project/fw16-035/

Testing Compost Heating for High Tunnels

Amy Yackel Adams and Rod Adams, of Sunspot Urban Farm, were aware of the work by Jean Pain in France where he transported heat in water from large mounds of finely ground wood chips to heat a home and shed.

Could such a system work in Colorado on a farm whose guiding principle is having a very small carbon footprint while having a very large idea footprint?

“We thought this would be really cool if we could get it to work in our cold region,” Amy said.

For their Farmer/Rancher project, the Adams built high tunnels with a compost heater and hydronic delivery system. The Adams tested using decomposing woody materials in compost piles as a heat source for their high tunnels. But what seemed straightforward turned out to be pretty problematic.

The Adams built successful, hot compost piles and heated water. However, they hit roadblock after roadblock in transferring the heat from that water into their high-tunnel soil, which was their goal. The Adams learned that data on how the heat transfer works is limited, with a lack of specifics on effective pumps and rate of flow.

“It’s probably a useful system for heating water for livestock, but transferring the heat to soil we found to be very complicated,” Amy said.

They didn’t give up though. When talking with local farmers, they determined there was an interest in using floating row covers to capture the transferred heat. At first, Amy and Rod proposed burying the tubes carrying the heated water, but no farmer wanted to take on that extra labor.



Sunspot Urban Farm

Preparing the compost by wetting and mixing.

Amy believes that there is potential if the tubes are placed on the ground under row covers.

“The work has been challenging,” she said. “There is still considerable interest and potential if pile maintenance can be minimized and heat delivery obtained.”

The Adams are dedicated to documenting their work. Their extensive reporting, instructions, and photographs are all posted on the farm’s website for others to learn from.

Learn more: projects.sare.org/project-reports/fw15-057/

Sunspot Urban Farm’s website: sunspoturbanfarm.square-space.com/research/

New Farmer/Rancher Awards

FW17-014, **My Boars Are in Iowa.** Principal Investigator: Eddie Saure, Guam; \$13,597.

FW17-015, **Development of a Locally-Adapted Apple Rootstock for the Maritime Northwest.** Principal Investigator: Eric Lee-Mader, WA; \$13,988.

FW17-017, **Honey Bee Mating Control and Production Cost Analysis in Africanized Regions Using Instrumental Insemination.** Principal Investigator: Jaime de Zubeldia, AZ; \$20,000.

FW17-026, **Grafted Watermelon Production in South-central Alaska.** Principal Investigator: Robert Brown, AK; \$19,999.

FW17-048, **Sustainable Alternative Livestock Feed System for Small-Scale Ranchers.** Principal Investigator: Chelise Largent, AZ; \$20,000.

FW17-034, **The Mango Loa Project.** Principal Investigator: Umi Martin, HI; \$19,878.

FW17-039, **Saving Water and Improving Soil Health Through LESA, Cover Crops, No-Till, and Management-Intensive Grazing.** Principal Investigator: Pat Purdy, ID; \$20,000.

FW17-050, **Ducks in a Row: Raising Ducks on Guam for Production and Pest Control.** Principal Investigator: Maegan Paloma, Guam; \$19,206.

FW17-054, **Honeybee Regeneration Project.** Principal Investigator: Aidan Wing, CA; \$19,851.

FW17-055; **No-till Potatoes into Cover Crop, Using Modified Conventional Planter.** Principal Investigator: Jeff Parkinson, ID; \$20,000.

*To encourage the next generation of sustainable agriculture researchers and professionals, Western SARE provides **Graduate Student Grants** that provide master's and doctoral students with funding to conduct new research important to farmers and ranchers in the West.*

New Graduate Student Awards

GW17-019, **Biodegradable Plastic Mulches: Performance, Degradation, and Impacts on Agroecosystems.** Graduate Student: Henry Sintim, WA; \$23,063.

GW17-021, **Introducing Organic Quinoa and Grain Cropping Systems in the Palouse.** Graduate Student: Rachel Wieme, WA; \$24,954.

GW17-025, **Evaluating the Exclusion and Non-target Effects of Shade Netting on Apple Orchards.** Graduate Student: Adrian Marshall, WA; \$23,678.

GW17-032, **Management of Fusarium Wilt of Strawberry through Crop Rotation.** Graduate Student: Peter Henry, CA; \$24,999.

GW17-040, **Sustainability of Dormant Season Grazing: Does Protein Supplementation Impact Beef Cattle Performance, Soil Organic Matter, Vegetation, and Residual Cover for Wildlife?** Graduate Student: Samuel Wyffels, MT; \$24,970.

GW17-058, **Effects of Subsurface Micro-irrigation on Water-Use Efficiency and Grapevine Growth.** Graduate Student: Xiaochi Ma, WA; \$25,000.

GW17-059, **Cattle Diets and Performance: Enhancing What We Know with Advanced Plant DNA Technology.** Graduate Student: Tamarah Plechaty, WY; \$24,970.

GW17-060, **Navajo Spinach: Improving Seed Germination from Wild Populations Gathered across Native Lands of the Four Corners.** Graduate Student: Reagan Wytalucy, UT; \$24,969.

GW18-014, **Conditioning Sheep to Avoid Koa Foliage: An Opportunity for Productive Silvopastures in Hawaii.** Graduate Student: Nicholas Krueger, WA; \$24,920.

GW18-020, **New Ranchers, New Needs: Why Are First-Generational Ranchers Deciding against Traditional**

Climate Adaptation Strategies? Graduate Student: Katherine Munden-Dixon, CA; \$24,982.

GW18-024, **Ecosystem Services on Shrub-Encroached Rangelands: Balancing Supply and Demand.** Graduate Student: Scott Jones, AZ; \$25,000.

GW18-025, **The Critical Role of Soil Microbiota to Sustainable Agriculture: Quantifying Short-term Microbial and Vegetation Feedback to Intensive Grazing.** Graduate Student: Emily Bean, WY; \$24,184.

GW18-026, **Cover Crop 5-in-1 Approach for Nematode Management Using Mustard and Oil Radish.** Graduate Student: Philip Waisen, HI; \$24,998.

GW18-027, **Determining the Impacts of Dormant Pruning Methods and Nitrogen Fertilization on Pinot Noir Bud Fruitfulness and Yield.** Graduate Student: Miranda Ulmer, OR; \$22,786.

GW18-034, **Understanding the Molecular Basis of Plant Response to Organic versus Conventional Fertilizer Using a Metatranscriptomic Approach.** Graduate Student: Danielle Guzman, WA; \$25,000.

GW18-039, **Assessment of the Positive and Negative Effects of Earwigs in Apple Orchards.** Graduate Student: Robert Orpet, WA; \$17,875.

GW18-041, **Insect Discovery and Breeding as Tools for Sustainable Solutions to Organic Waste Management.** Graduate Student: Trevor Fowles, CA; \$24,942.

GW18-050, **Montana Hardy Fruit Nutraceutical Quality.** Graduate Student: Durc Setzer, MT; \$17,765.

GW18-062, **Development of New Selection Tools and Crop Varieties for Sustainable Agriculture.** Graduate Student: Travis Parker, CA; \$24,443.

Taking Steps to Restore Traditional Foods

Navajo, Zuni, and Hopi communities historically produced sufficient food through traditional forms of agriculture. However, some of these traditional practices have been abandoned as the cultures become more integrated into western societies, according to graduate student Reagan Wytsalucy.

Although the Navajo Nation is one of the largest reservations in the U.S., there are only 13 grocery stores in the region. Wytsalucy notes that for those not living in urban areas, many travel 50 to 100 miles to their nearest store. In the Four Corners, obesity is three times the national average and one in three residents have diabetes, making poverty and malnutrition among Native Americans a high-priority focus of the USDA Food and Nutrition Service.

To address these problems, Native American communities want to reestablish their historic sustainable agricultural practices. The Rocky Mountain Bee Plant, also called Navajo Spinach, is a native plant that was commonly gathered and used by the tribes of the Four Corners.

To explore the potential of increasing interest in this traditional practice, Wytsalucy designed her project “Navajo Spinach: Improving Seed Germination from Wild Populations Gathered across Native Lands of the Four Corners.” The project will compile a record of its historic uses and strive to better understand its germination and early growth from distinct populations found across the Four Corners region.

Wytsalucy searched for wild populations to collect seeds for the germination studies. She also grew seedlings from

seed collected earlier.

Although there were challenges finding native populations due to drought and a very large land area, several new locations of plants were identified. Wytsalucy anticipates that Navajo spinach is a plant that could eventually increase the desire to have a native authentic cuisine for tourists or as a local food source. Growing the spinach locally could provide jobs within the Tribal lands.

“Researching the historic uses of Navajo Spinach has sparked my interest to investigate other native plants of the Four Corners area that have been historically useful to the people living within the area,” she said. “There is knowledge residing with the elders in the communities, and I would like to document that knowledge for future generations as they desire to learn the old ways again.”

Learn more: projects.sare.org/sare_project/gw17-060/



Fighting Fusarium Wilt with Rotational Crops

Which rotation crops are best suited to help strawberry farmers fight Fusarium wilt?

Researchers at UC Davis are studying that urgent question, thanks in part to a grant from Western SARE. Plant pathologist Tom Gordon and graduate student Peter Henry are testing how well spinach, lettuce, broccoli, cabbage, cauliflower, cilantro, raspberry, blackberry, and wheat can prevent the growth of Fusarium wilt, the pathogen so destructive to strawberry quality and yield.

Strawberries are especially vulnerable to soil-borne pathogens. Since the 1960s, strawberry growers have depended on fumigants like methyl bromide — a colorless, odorless gas — to control disease. But methyl bromide has been linked to lung disease and ozone-layer depletion and will no longer be available after 2017.

Some strawberry cultivars are resistant to Fusarium wilt, but most commonly grown cultivars are susceptible. Furthermore, the Fusarium wilt pathogen can colonize resistant strawberry plants and produce structures that survive in soil.

“We need to find rotation crops that are not good hosts for the pathogen and will not support its growth,” Gordon

said.

Gordon and his team are testing potential rotation crops by exposing crops to the pathogen in growth chambers where they can verify uniform exposure, and by growing crops in the field.

“It’s more challenging to get uniform exposure in the field, but that also allows us to see how the pathogen can colonize depending on plant physiology, the environment, water stress, and other factors,” Gordon said.

Researchers are also surveying strawberry growers, pest control advisors and others to identify barriers to using crop rotation as a disease-management tool.

“Land ownership can limit how growers manage disease,” Gordon said. “Many farmers lease the land where they grow strawberries, so what matters most is return on the crop that year rather than long-term benefit to the soil.”

Gordon and others are studying ways to incentivize collective action as farmers navigate producing high-quality fruit year-round while protecting the environment.

Learn more: projects.sare.org/sare_project/gw17-032/

In 2017, Western SARE awarded more than \$3.8 million in funding to researchers, Extension specialists, graduate students, agriculture professionals, and farmers and ranchers in the Western region. We are one of the largest and most-responsive sources of sustainable agriculture funding that exists, and are unique in requiring that all of our funded projects involve producers.

2017 Funding by State and Territory

Includes competitive grants and state implementation and enhancement grants

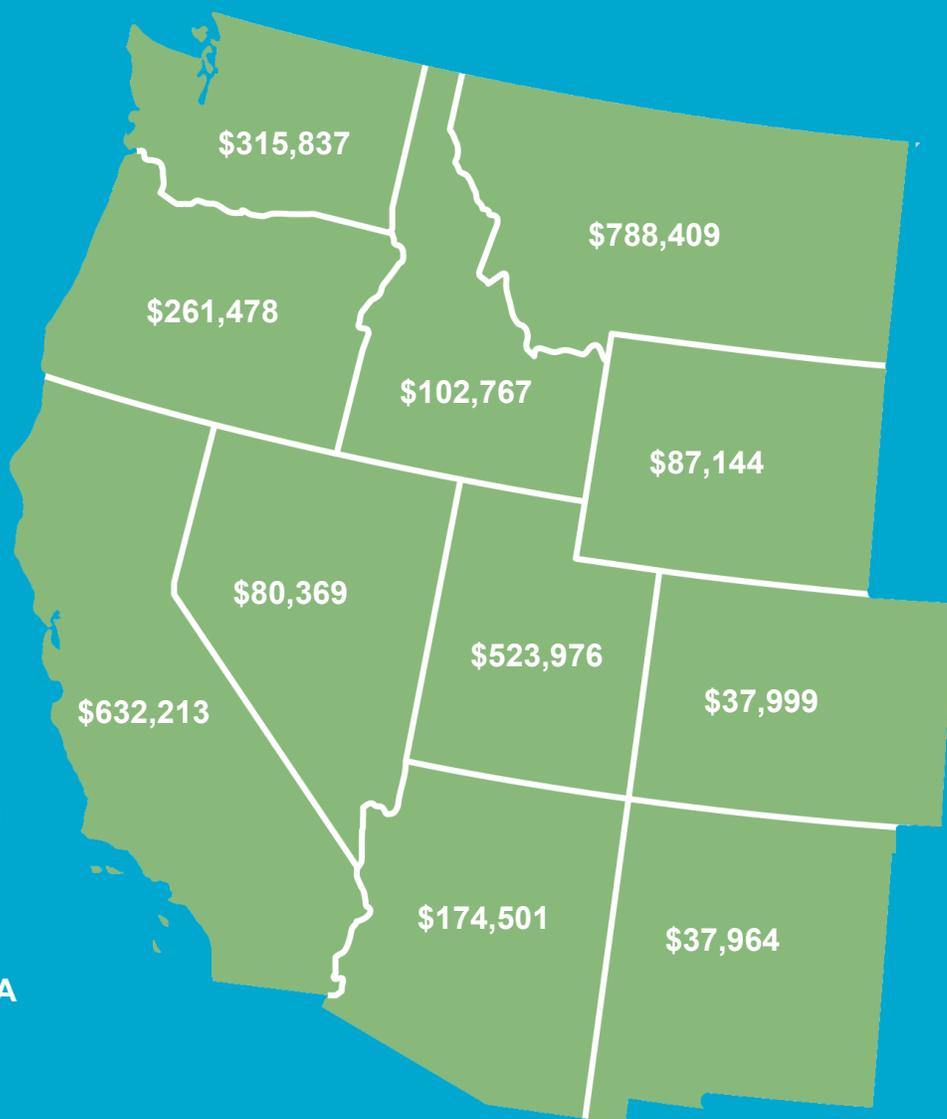
ALASKA
\$58,999

HAWAII
\$544,550

GUAM
\$122,721

AMERICAN SAMOA
\$33,375

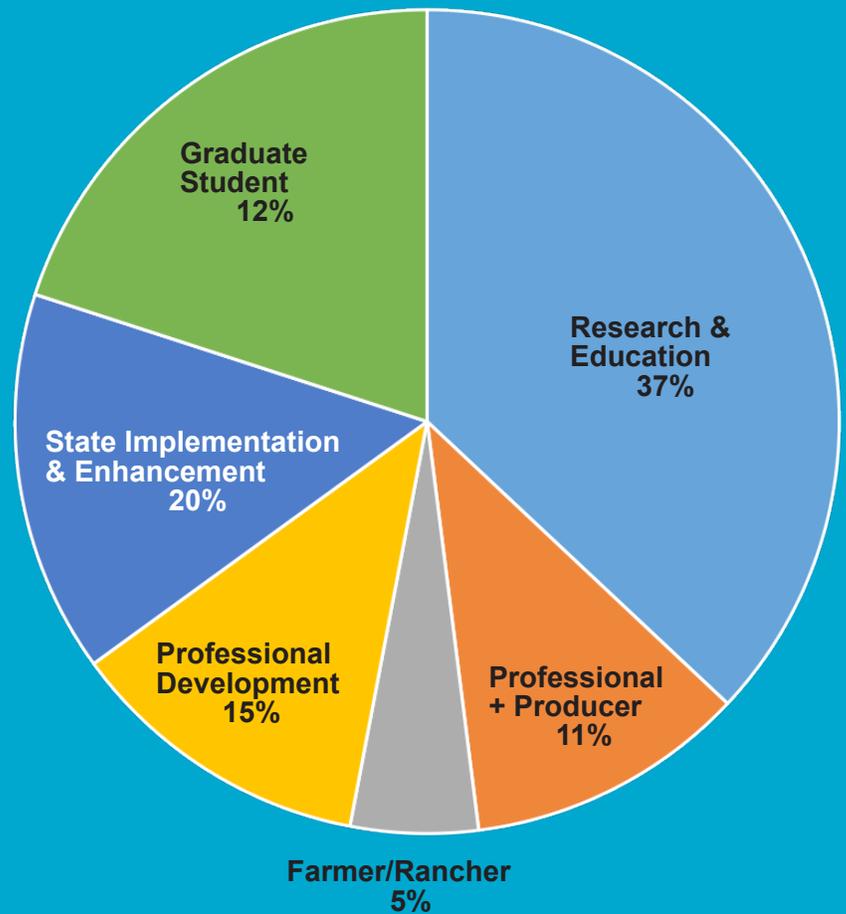
MICRONESIA
\$39,000



FUNDING UPDATE

2017 Funding by Project Type

Funding listed on these pages includes 2018 Graduate Student Grants awarded in 2017



2017 Funding by Subject Area

| | |
|-------------------------------------|-----------|
| Soil Management, Health and Quality | \$660,433 |
| Animal Production | \$588,617 |
| Education & Training | \$499,125 |
| Integrated Pest Management | \$473,904 |
| Natural Resource Management | \$417,163 |
| Field and Vegetable Crops | \$162,192 |
| Community Development | \$148,008 |
| Other | \$246,119 |

Over the past 29 years, Western SARE has provided more than \$60 million in funding for more than 1,000 projects.



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