



The Center for  
**REGENERATIVE AGRICULTURE  
AND RESILIENT SYSTEMS**  
CALIFORNIA STATE UNIVERSITY, CHICO

# Center for Regenerative Agriculture & Resilient Systems

## Annual Report 2020

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**California State University, Chico**



Climate change and soil loss threatens food production around the globe. Regenerative agriculture (RA), with its robust, straightforward, and cost-effective practices, is uniquely poised to address these momentous threats to civilization. It has the ability to sequester significant carbon levels in the soil, leading to a healthier, more abundant, and water efficient food supply.

## The Future of Agriculture is Regenerative

The CSU, Chico Center for Regenerative Agriculture and Resilient Systems (CRARS) is the only comprehensive University based program devoted to regenerative agriculture in the United States. Our mission is to investigate, develop, demonstrate, and educate about comprehensive, regenerative practices that both restore and enhance the resiliency of living systems and communities. Our reach is local, regional, national, and global.

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# Meet Our Team

## CRARS Co-Founders & Faculty Affiliates



Cynthia Daley, PhD—co-founder and director; Organic Dairy Program supervisor; College of Agriculture professor



Tim LaSalle, PhD—co-founder; director of research and development; adjunct professor



Garrett Liles, PhD—co-founder; faculty affiliate; soil scientist; College of Agriculture professor; director of RAD Lab



Lee Altier, PhD—co-founder; faculty affiliate; organic vegetable cropping systems; College of Agriculture professor



David Johnson, PhD—program specialist in research and development; adjunct professor



Betsy Boyd, PhD—faculty affiliate; College of Agriculture professor



Maria Giovanni, PhD—faculty affiliate; College of Natural Sciences professor



Hossein Zakeri, PhD—faculty affiliate; College of Agriculture assistant professor



Jamal Javanmardi, PhD—faculty affiliate, Organic Vegetable Project director; College of Agriculture assistant professor



Jake Brimlow, PhD—faculty affiliate; College of Agriculture professor



Logan Smith, PhD—faculty affiliate; College of Agriculture assistant professor



James Pushkin, PhD—faculty affiliate; College of Agriculture professor emeritus

## Personnel



Priya Tuvell, MAgr—program coordinator and manager; nutrient density lab and online certificate program lead



Carmy Miller—office manager



Aundrea Asbell—soil lab technician



Scott Grist—Organic Vegetable Project manager; Community Supported Agriculture management & student training support



Breanna Owens—project development specialist



A. Michele Auzenne, MS—grant writer



Sheryl Karas, MA—communications and outreach support



Seth Myrick—staff research associate



Devin Pike—staff research associate



Constantin Raether—staff research associate



Marco Fernandez—staff research technician



Kyle Brasier, PhD—postdoctoral researcher

## Leadership Council



Rose and Ward Burroughs—  
CRARS co-founders, regenerative  
agriculture producers



Randy Record—past director,  
Metropolitan Water District



Rebecca Burgess—director,  
Fibershed



Joe Morris—regenerative  
rancher



Scott Park—regenerative farmer



Shannon Douglass—vice  
president, California Farm  
Bureau



Tom Newmark—regenerative  
farmer



Natasha Lilly—regenerative  
rancher; founder, Full Circle  
Veterinary Center

The Leadership Council’s purpose is to collaboratively think, plan, strategize, communicate, support, and help create productive alliances that can significantly contribute to addressing these global needs. As leaders from the industry and aligned fields, the Council’s potential to advocate for the Center for Regenerative Agriculture and Resilient Systems as a significant and primary contributor to help create a more resilient and ecologically healthy food production system is without limits.

## CRARS Structure

The Center for Regenerative Agriculture and Resilient Systems was established at CSU, Chico in 2019 as a research and education center. The University provides physical space, IT support, administrative support, University Farm access, and other resources, including consultation and collaboration to advance CSU, Chico’s goals to achieve climate neutrality by 2030; 80 percent waste reduction by 2020; remain responsive to additional sustainability needs; accelerate research and educational efforts to equip students, faculty, staff, and community members for a sustainable and resilient future.

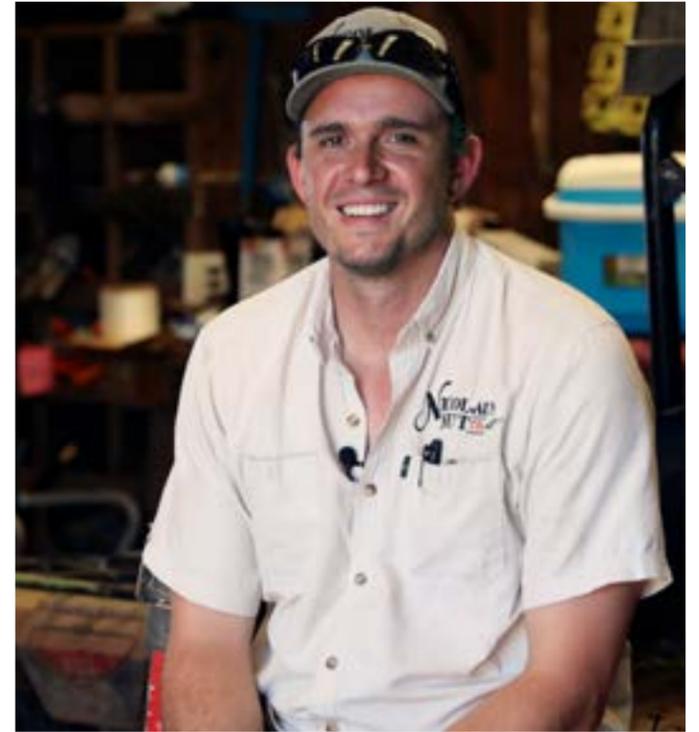
Guided by the talents and experiences of the CRARS Leadership Council, Executive Director Cindy Daley oversees all aspects of the Center. Driven by an ethic of servant leadership and collaboration, Director Daley works with a diverse team of faculty, researchers, and staff to support and collaborate with farmers, ranchers, and community members through research, education, and networking.

## Mentor Farmers

The following farmers have now joined our list of mentors willing to help others in transitioning to regenerative methods:

- Rory Crowley, Nicolaus Nut Company: conventional nuts, field research on cover crops, other innovations
- Greg Massa and Raquel Krach, Massa Organics: organic regenerative rice, almonds, wheat, cover crops, vegetables, animal integration
- Joe Morris, Morris Grassfed: holistic grazing management of 100 percent pasture-raised beef cattle
- The Burroughs family, Burroughs Family Farms: organic regenerative almonds, beef, chickens, cheese, dairy cattle, eggs, meat birds, olives, sheep.

At right: Rory Crowley  
Top photo below: Greg Massa and Raquel Krach and lamb  
Bottom photo below: Ward Burroughs and son-in-law Brian



## Graduate Students & Student Research Assistants

Graduate students in the interdisciplinary masters degree program are involved in research related to regenerative agriculture. Master's thesis projects vary depending on the student, which can be of their own design or follow the design of a funded research project already underway.



Matthew Housley: RA cotton systems (till vs. no-till), biologically enhanced agricultural management (BEAM vs. no BEAM)



Raquel Krach: RA in almond orchard systems, cover crops and compost



Irfan Ainuddin: RA in soils systems (soil survey of various production models in California)



Clayton Handy: RA walnut systems, cover crops, termination systems, costs of production

Student research assistants work on a variety of research projects initiated by CRARS.



Angelita Cisneros-Aguilar, student research assistant



Maura Rasmussen, student research assistant



Cooper Davis, undergraduate research assistant



Jordan Atmore, undergraduate research intern

## Regenerative Agriculture Events 2020



Eve Turow-Paul

### This Way to Sustainability Conference XV, March 26-27, 2020, "Resiliency in a Changing World"

Taking the conference online last year resulted in our lowest carbon footprint in TWTS history, while recording our highest number of pre-registrations in the last five years. Over 60 University campuses, Junior Colleges and School Districts were among the participants. The breakdown includes 17 CSU's; 9 UC's; 10 Junior Colleges; 3 Elementary Schools and/or School District; 15 Non-California based Universities; and 6 International University campuses.

Presenters:

- Nikki Silvestri, CEO of Soil and Shadow, a consulting firm for social and environmental entrepreneurs, guiding thousands of leaders and organizations into a conversation at the intersection of ecology, economy, and social equity.
- Kelsey Juliana, originator of a Constitutional Climate Change lawsuit against the US Government alongside 20 other youth plaintiffs and the nonprofit Our Children's Trust.
- Erin Meezan, vice president and chief sustainability officer at Interface, a sustainable global business with a mission called "Climate Take Back".

### Virtual Seminars Hosted by CRARS and the Regenerative Agriculture Network

- "Building Public/Private Partnerships for a Carbon Neutral Water Efficient Almond" with multiple guest speakers—December 2, 2020
- "Millennials and Gen Zers: Their Decisions Affecting Climate Change and Food Choices" with Eve Turow-Paul, author and executive director of the Food for Climate League—September 3, 2020
- "A Moment in Time: Black Lives Matter & Regenerative Agriculture" with Leonard Diggs, director of operations and farming education, Pie Ranch—August 20, 2020
- "The COVID Pandemic and Market Disruptions for Farmers and Ranchers - What Role Can Regenerative Agriculture Play?" with Rebecca Burgess, executive director of Fibershed—August 13, 2020
- "Remote Sensing for RA: Past Barriers, Present Status and Future Potential," one-hour group discussion, led by Rob Trice of The Mixing Bowl—June 15, 2020



Nikki Silvestri

# CRARS Programs

The Center is leveraging our applied research, hands-on educational programs, industry partnerships, and the newly formed Regenerative Ag Network to investigate, develop, and rapidly disseminate important and progressive forms of agricultural production.

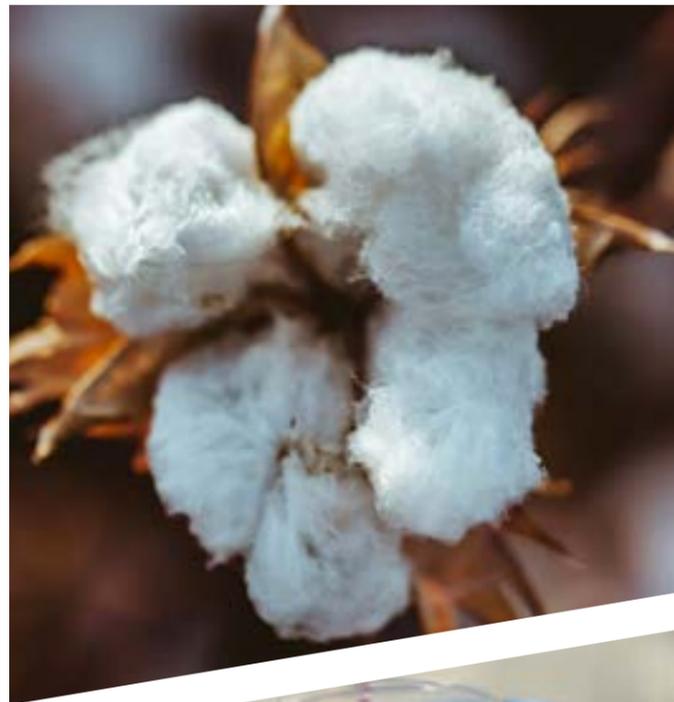
## Innovative Applied Research

The CRARS is a global research center, demonstration and training site, and policy think tank working to usher in a brighter future. We develop, demonstrate, and disseminate techniques and practices that rebuild and enhance the resiliency of our living systems. Through on-farm research at sites around the world, we discover and test regenerative methods and share the outcomes via our website, workshops, and online journal.

With funding from multiple sources, we are validating Johnson-Su Biologically-Enhanced Agricultural Management (BEAM) research in corn, cotton, alfalfa, vegetables, and rangeland systems. BEAM combines a fungal-dominant soil inoculant with cover crops to enhance biodiversity. Each multi-year study is designed for peer-reviewed publication.

The CRARS, University of California Cooperative Extension (UCCE) and five organic vegetable farmers, are studying the impact of RA practices in organic vegetable production. With farmers leading their own experiments, we provide soil testing, nutrient density analysis, and farmer-to-farmer networking tools. A companion study, funded by the Agriculture Research Institute (ARI), is to study changes in the nutrient density of regenerative production systems vs. conventional practices in vegetables.

A series of research proposals support the study of regenerative cotton production. In collaboration with Guess Jeans, Bowles Farming, and Fibershed, we aim to reduce soil disturbance, improve water use efficiency, and eliminate synthetic inputs through regenerative practices. Five cotton producers participate in this work along with brands interested in developing regenerative cotton textile lines.



## Engaged Outreach & Education

We seek to provide education and training to all who are involved in producing our food and managing our landscapes and to support the next generation of regenerative farmers, ranchers, and agricultural leaders.

### Graduate and Undergraduate Education:

- Phase I: Interdisciplinary Master's Degree in Regenerative Agriculture: We currently offer an interdisciplinary master's degree program with an emphasis in RA.
- Phase II: On-Line Master's Degree in Regenerative Agriculture (in planning stages): This will be a 30-unit degree program suitable for students and farmer/ranchers. Enrollment as a Chico State student will be required. Tuition will be applied.
- Phase III: Undergraduate Degree Program in Regenerative Agriculture (in planning stages): This will begin as an advising option within the plant and soil sciences degree program. As enrollment grows, regenerative agriculture will be elevated to a major within the College of Agriculture.



Undergraduate research opportunities are currently available in the Regenerative Agriculture Demonstration Laboratory (RAD Lab), with additional proposals in development.

### Farmer-to-Farmer Network & Educational Program:

Planning is underway for a professional course series in RA that will be available on our website, free of charge.

The next evolution (Phase II) will be a certificate program in RA, developed in collaboration with our mentor farmers, for producers or practitioners interested in receiving documentation of completed coursework. We continue to provide conferences and field days to promote RA within the industry.

The RAD Lab supports farmers and ranchers with relevant soil analysis and nutrient density testing. ([www.csuchico.edu/regenerativeagriculture/soil-lab](http://www.csuchico.edu/regenerativeagriculture/soil-lab))

Our website includes an extensive Learning Center, RA Mentor-Farmer information, and media resources. ([www.csuchico.edu/regenerativeagriculture](http://www.csuchico.edu/regenerativeagriculture))

“We used to just graze to the ground until we learned about high intensity rotational grazing through these soil health workshops. We now understand the importance of time and intensity. We used to think in terms of weed control, and not in terms of what’s happening underground (in the soil).”

—Raquel Krach, Massa Organics



Top photo: Seth Myrick in the Soil Processing Area  
Photo at left: lambs at Massa Organics

## Farmer-to-Farmer Transition

We have developed a strategy for on-farm transition that builds upon proven techniques for achieving greater than normal rates of farmer adoption using a Communities of Practice (CoP) model that includes farmer-to-farmer mentorship/networking and collaborative on-farm research trials and demonstrations. We began the process with organic vegetables and the USDA Conservation Innovation Grant (CIG) (funded); and are expanding this approach to rangeland, almonds, walnuts, and cotton (currently unfunded).

Our latest grant submission to CIG is “Conservation Innovation in Soil Health for California’s Sacramento Valley Almond Industry,” in cooperation with North State Hulling Cooperative (125 farmers) and Glenn County Resource Conservation District, with the support of Karen Ross, Secretary of the California Department of Food and Agriculture. The project will facilitate the adoption of Soil Health Management Systems in almond orchards using almond processing waste products (compost and biochar) together with cover crops and biological inoculations. We use the CoP approach to facilitate transition to RA practices throughout the cooperative, using the producers’ own waste materials. We plan to track water use efficiency, soil health, GHG emissions, and energy use through economic and Life Cycle Assessments. This approach targets the successful transition of 28,000 acres of almonds in the next five years within North State Hulling, with the potential to impact over 1.5 million acres of almonds industry wide.



“Dirt is really where our primary asset is. It’s not in our tractor, it’s not in our trucks. . . Our motto is that if you put life into the ground, you’ll get life out.”

—Rory Crowley, Nicolaus Nut Company



## The Regenerative Agriculture Network (RAN)

The Regenerative Agriculture Network (RAN) is our newest program, which evolved from a science convening held in collaboration with TomKat Ranch. The RAN is an international virtual collaborative space where the RA community can gather to think big thoughts and have focused/targeted conversations to address gaps in our knowledge of RA and address barriers to transition. The Network is composed of farmers/ranchers, scientists, consultants, agency personnel, foundations, brands, and community activists: diversity is key to a rich dialog and innovative thought. Currently, RAN is operating within a Google group web forum and is organized into categories or topics of interest. Each topic has its own forum. Regular Zoom conference calls are organized around each topic area by industry leaders. Participants/members of RAN can join in the conversation and network together to create SMART goals and actionable outcomes that will support the cause.

At present, all reports and access information can be found on the CRARS website: <https://www.csuchico.edu/regenerativeagriculture/reg-ag-network/reg-ag-network-landing.shtml>. Membership information, video recorded sessions, and current transcripts for each topic area can be found at: <https://groups.google.com/forum/#!forum/regenerative-agriculture-network>.

We anticipate that RAN will grow to accommodate demand for this collaborative space. Currently there are 140 members, organized around 10 topic areas that either address gaps in our scientific understanding or work to overcome a barrier to RA transition. There is also space to share events, plan events, and share curriculum. RAN has sponsored multiple webinar events for the public this year with guest speakers and group discussion. Recordings of those events are also being made available on our website in the coming year.

## Regenerative Agriculture Practices That Improve Soil Health

Regenerative practices include cover cropping and biomass; crop rotation; soil inoculants, compost and manures; conservation tillage (no till, strip till, ridge till, mulch till, vertical/shallow till); managed grazing and livestock incorporation; rangeland seeding and biomass; hedgerows and pollinator habitat; riparian plantings, buffer and filter strips; silvopasture; alley cropping. All of these choices support soil health but specific ones are better for certain situations than others. Click the links below to learn more.



**Cover Cropping and Biomass**  
Crops that are used specifically for the purpose of improving soil health.



**Crop Rotation**  
Growing a series of different crops with different nutrient usage and nutrient fixing qualities in succession.



**Soil Inoculants, Compost and Manures**  
Soil amendments that address fertility and soil biodiversity.



**Conservation Tillage**  
No till, strip till, ridge till, mulch till, and vertical/shallow till.



**Adaptive Grazing and Regenerative Ranching**  
Adaptive multi-paddock grazing, animal impact, and riparian restoration.



**Livestock & Crop Integration**  
Combining raising animals and crops on the same farmland.



**Rangeland Seeding and Biomass**  
Adding diversity to the rangeland that exists.



**Hedgerows and Pollinator Habitat**  
Windbreaks that add biodiversity.



**Riparian Plantings, Buffer and Filter Strips**  
Strips that separate natural waterways from farmland.

## Website Expansion

We've made significant additions to the website this past year (see page at left). Most importantly, we've greatly expanded the RA101 section to serve as an educational hub that farmers, students and the general public can use for free to learn the basics of regenerative agriculture. In addition to the resources about the principles of soil health that were there before we've added eleven new sections with extensive links for deeper exploration on the following regenerative agriculture practices:

- Cover Cropping and Biomass
- Crop Rotation
- Soil Inoculants, Compost and Manures
- Conservation Tillage
- Adaptive Grazing and Regenerative Ranching
- Livestock and Crop Integration
- Rangeland Seeding and Biomass
- Hedgerows and Pollinator Habitat
- Riparian Plantings, Buffer and Filter Strips
- Silvopasture
- Alley cropping

Each section includes an introductory description and numerous links to mentor farmers who describe how they work with the practices plus articles, videos, free downloadable publications, useful websites and web-based tools, and scientific research.



Mentor Farmer Phil Foster of Pinnacle Organically Grown Produce

We've also added four more mentor farmer case studies and updated several other mentor-farmer pages with news of their CIG project progress and initial results. The Regenerative Agriculture Network Web Forum has its own section with links to reports and events and there are new pages for farmer and student grant opportunities, RA jobs and internships, books; and expansion of all other sections. To view our updated and expanded website, visit: [www.csuchico.edu/regenerativeagriculture](http://www.csuchico.edu/regenerativeagriculture).

## The Journal of Regenerative Agriculture

As our new understanding of soil health emerges, conventional paradigms will need solid peer-reviewed proof as to the efficacy of these resilient systems. The Journal for Regenerative Agriculture (JORA) is an online, peer-reviewed research journal, published by members of the regenerative agriculture community including academics, the scientific community, extension agents, governmental agencies, non-governmental organizations, farmers and allied industries. The journal provides a platform for the dissemination of systems-based applied research and related works that will extend our knowledge and understanding of regenerative agricultural practices.

JORA is an open access journal intended to provide the public with unrestricted, free access to scholarly research specific to regenerative agriculture. We are actively recruiting systems-based scientists as peer reviewers and comprehensive, whole-system, regenerative field research manuscripts for submission.

## Johnson-Su BEAM Research and Bioreactor Registry

The research to expand and verify the work of CRARS adjunct faculty affiliate David Johnson, PhD has grown continuously over the past year. He has developed a biologically correct, fungal-dominated compost for carbon sequestration, improved soil health and crop yields. The method is called BEAM (Biologically Enhanced Agricultural Management) and centers around the products created using the compost creation system he devised with his wife Hui-Chun Su (called the Johnson-Su Bioreactor).

At least three research projects involving BEAM are now funded in addition to the work Johnson has been doing at New Mexico State University. In addition, the number of individuals and organizations who have joined our Bioreactor Registry to participate and share results of their BEAM experiments has grown to 95 projects in 22 countries and 17 U.S. states. Results are already coming in that contribute to the data of how well this method works in a variety of climates and soil conditions, with different crop types, and other variations.

Photo clockwise: David Johnson teaching people how to build a bioreactor; finished compost from a project in Berlin, Germany; group photo in front of a bioreactor in the process of being built in Kenya.



## Partners and Collaborators Spotlight

### Finca Luna Nueva

Finca Luna Nueva, located in Costa Rica, was founded in 1994 as a 74-acre organic farm by Steven Farrell, who was growing ginger and, later, turmeric for the natural supplement industry. He is devoted to farming holistically with a conscious perspective that views every aspect of the farm including the animals, human beings, and surrounding environment as a living system. In 1999 he was joined by Tom Newmark (member of the CRARS Leadership Council) and his wife Terry who added 53 acres and an organic dairy operation. About ten years ago, Newmark met CRARS co-founder Tim LaSalle, then CEO at the Rodale Institute, a meeting Newmark says “rocked his world.” It was about how carbon sequestration and regenerative agriculture could be an answer to the existential threat of climate change. When he came home, he and his wife decided to devote their lives to regenerative agriculture.



Terry and Tom Newmark

Today, Finca Luna Nueva operates as a 127 acre regenerative farm and ecolodge dedicated to providing education in regenerative farming and topics related to their location in the tropical rainforest. They neighbor the Children’s Eternal Rainforest and approximately 250,000 acres of protected land. Finca Luna Nueva is also home to the Sacred Seeds Sanctuary with more than 300 tropical medicinal plants, a conference center, guest accommodations, a restaurant, fields, and numerous walking trails.

### Burroughs Family Farms

The properites that make up Burroughs Family Farms have been certified organic for almost 20 years, with regenerative practices being implemented for 45 years. The transition from conventional farming to regenerative, organic farming was the result of a combination of family beliefs surrounding health, nutrition, the environment, and their interconnected relationships. With regenerative, organic farming, the health and nutrition of people and the health of the environment are given the highest priority.



The Burroughs Family

The Burroughs’ commitment to regenerative, organic farming can be seen in their continuous work to promote the restoration of soils and whole landscape. As part of their desire to further regenerative agriculture, the Burroughs provided the first seed funding to start the Regenerative Agriculture Initiative — now known as the Center for Regenerative Agriculture and Resilient Systems—and are founding members of the organization. As advocates of regenerative agriculture, the Burroughs family utilizes a wide array of practices developed to care for the entirety of the land in which they farm. They were recognized for their efforts this year by receiving the 2020 California Leopold Conservation Award for inspiring others with their dedication to water quality, soil health and wildlife habitat.

## 2020 Regenerative Agriculture Research Funding

Two million dollars has been secured to support research over the next five years. This funding came from successful bids for competitive grants and do not provide Center operational funds.



Student Kaeli McCarther at the Organic Vegetable Project

### **CIG Conservation Innovation Grant: Impact of No-Till Farming Practices in Vegetable Production: (sub-award)—\$58,000**

In collaboration with UC Davis, Jeff Mitchell, and five collaborating farms, we are investigating low soil disturbance methods for vegetable cropping systems. We will be working to refine relevant reduced disturbance practices that work in real-world settings. The CSU, Chico Organic Vegetable Project will serve as one of three research sites for the study, with the goal of transitioning to a no-till system that will support improvements in soil structure, water use efficiency, and fertility.

Partner producers on this CIG project include Sallie Calhoun, Paicines Ranch; Paul Muller, Full Belly Farm; Phil Foster, Pinnacle Organically Grown Produce; Scott Park, Park Farming; and Tom Willey, T&D Willey Farms.

### **NRCS Healthy Soils - Regional Soil Health Assessment—\$200,000**

As interest in regenerative management and soil health increases, the need for consistent, replicable, scientifically sound indicators and data are critical both to establish baseline conditions and track change over time. Starting in 2017, a cooperative agreement between NRCS and CSU, Chico, through the Regenerative Agriculture Demonstration Lab (Rad Lab) led by Garrett Liles, has worked to assess the accuracy, repeatability, and usefulness of a standard set of proposed soil health metrics. This agreement was part of a national scale program that allowed us to investigate annual and perennial management in CSU, Chico's service area and will help inform broadly about these practices related to soil health. Although this specific project has reached completion, it was instrumental in supporting the development of the RAD Lab which now offers soil health and carbon assessment services to support research and stakeholders trying to better understand their soils and production practices.

### **Improving Soil Carbon Capture and Water Use Efficiency in the Palo Verde Valley—\$ 527,000,**

Funded through the Metropolitan Water District (MWD). To address the impacts of MWD's current fallowing practices on soil health, the CRARS will study the comparison of regenerative management practices to the current MWD fallowing strategies, which involves multiple passes of full tillage. The regenerative approach includes summer and winter cover crops, BEAM inoculum and no-till practices. The study will replicate each treatment three times over the course of five years. An overall economic assessment will be performed, as well as a full soil health profile to be conducted every other year, and an annual assessment of water use efficiency through soil moisture probes and water metering technologies.



Soil Research Technician, Marco Fernandez, taking a sample in the field.



### **Agriculture Research Institute: Impact of RA on Vegetable Nutrient Density—\$238,000**

California State University Agriculture Research Institute (ARI) has funded a three-year study to investigate the impact of no-till farming practices on soil health, weed suppression, nutrient density, and profitability in California-based organic vegetable production systems. Research has shown that the nutritional quality of fruit and vegetables has significantly declined in the last 50 years. This research will determine if nutrient density is correlated with soil health.

California's organic vegetable production accounts for 64 percent of the United States total and is valued at \$1.5 billion annually. Increasing both soil health and nutritional density can increase market share and demand, provide healthier food to consumers, and contribute to

community sustainability and resilience. At Chico State, our Organic Vegetable Project provides food to the community through a local community-supported agriculture (CSA) and to Chico State students in need through the Hungry Wildcat Food Pantry.

### **Agriculture Research Institute: Effects of BEAM on Rangeland Ecosystems —\$250,000**

California rangeland makes up 40 percent of the land mass, land that can't be farmed, suitable primarily for grazing. Decades of set-stock grazing has left our rangelands depleted of nutrients and topsoil. The goal of this research is to determine if multispecies seeding methods with and without inoculation with BEAM will have a positive effect on forage productivity, soil microbiology, and soil fertility. Recently expanded to five rangeland sites.

# 2020 Regenerative Agriculture Research Funding



Students at Nueta Hidatsa Sahnish College

## **Nueta Hidatsa Sahnish College (NHSC ) New Discovery: NHSC Regenerative Agriculture: Researching if Diverse Year-Round Cover Crops and Intensive Grazing Build Soil Health for Local Food Production—\$220,000**

The CRARS will serve as a project collaborator to Nueta Hidatsa Sahnish College (NHSC) to implement and compare cropping systems in the NHSC Four Sisters Community Garden, located in New Town, North Dakota. Through this collaboration with NHSC project director Lori Nelson, the primary project objective is to determine the impact of cover crop termination methods (tillage, mulch, livestock) on soil quality, crop yield, weed pressure, and crop quality in a vegetable cropping system.

NHSC's Agriculture Department has a commitment to produce local food in their community gardens in a safe and sustainable way that honors their traditional culture, values and customs. The college strives to integrate traditional gardening techniques alongside modern organic methods that complement their holistic ways of living while honoring the land, animals and the cycles of life.

## **NIFA Grant: Creating a Soil Savvy Work Force—\$150,000**

The long-term goals of the project are two-fold: 1) develop confident, creative, critical thinkers to meet the increasing demand for agriculture and natural resources professionals trained with field, lab, and data science skills to assess soil health and environmental quality; and 2) support the development of the Regenerative Agriculture Demonstration Lab (RAD Lab) in its goal to provide innovative cost-effective soil health analytical services to California farmers and ranchers; and 3) to support and encourage adaptive management that promotes soil conservation-regenerative practices.

The project provides student with experiential learning opportunities through the one-year Soils Outstanding Interdisciplinary Leaders (SOIL) cohort experience. This experience will provide broad training and diverse experiences, including field sampling and assessment, safe and effective laboratory and instrument operation, data handling and documentation, leadership training, science communication, and peer-to-peer teaching experiences.

## **Utilization of BEAM in Conventional Corn/Bean Production Systems, Willcox, Arizona—\$304,411**

Funded by the Howard G. Buffet Foundation and in a collaboration between the CRARS and New Mexico State University's Institute for Sustainable Agricultural Research (ISAR), a new system of crop production coined Biologically Enhanced Agriculture Management (BEAM), will be tested in a corn/bean rotation under conventional production. This approach restores the population, structure and functionality of soil microbiota to effectively regenerate soil health and fertility, reducing the need for exogenous nitrogen fertilization.



## **Seeding Regenerative Agriculture Practice and Approach in California Cotton Systems—\$248,400**

A collaboration between Fibershed, Bowles Farming, and CRARS, this three-year study will track the impacts of multi-species winter cover crops and compost application in the setting of a leading large-scale commercial cotton farming operation. Baseline soil samples and initial treatment scenarios were completed in November 2020.

As the project progresses, data and outcomes will be shared with peer farmers through field days and educational outreach coordinated by Fibershed and CRARS, while also forming the basis for critically needed data collection on these farming practices and their impacts. We will gather production data (cotton yield and quality), soil carbon, water availability, and soil health monitoring in addition to data for an economic impact analysis of the practices.

**We also have nine active research grants, two on-farm master's projects, and four submitted grants that we are hopeful about for the 2021 funding cycle.**



Top photo: Dr. David Johnson holding BEAM compost extract at the research site in Wilcox AZ

Bottom photo: sheep grazing cover crops at one of the cotton field sites.

“As a farmer and former biologist, I find the new discoveries in soil biology fascinating. We're already implementing several practices on our farm that we learned about from the workshops offered through the Center, including better grazing management, soil tests, and brix measurements of our crops and forages.”

—Greg Massa, Massa Organics

## CRARS Funding Needs



### Immediate Projects for Funding Support

**Cotton:** Cotton is one of the four major crops in the United States and one of the most chemical- and tillage-involved agronomic systems, with synthetic fertilizer, herbicide, pesticide, and chemical defoliation applications. Our ability to provide a regenerative model for production of a natural fiber-based crop would help show the world a better method for carbon capture, restoration of biological diversity, and healthy soil building on 32.5 million hectares globally. For our health, as well as the future of our apparel industries, we need a profitable and ecologically sound farming approach to produce natural fibers. These can replace the growing ecological disaster of microplastics from synthetic fabrics contaminating our air and waterways. Five-year study, 20 acres: \$450,000

### Biologically Enhanced Regenerative Research

**Farm-scale field trial:** The farming community's rapid transition to regenerative agricultural techniques is critical. To make that happen, we need rigorous, scientifically designed replications of biologically enhanced regenerative practices. These must be compared to conventional high-input, fossil fuel-based farming practices demonstrated at farm scale with economic (cost/profit) analyses. The collaboration between the CSU, Chico University Farm and neighboring farmers provides the Center for Regenerative Agriculture and Resilient Systems with a unique opportunity to develop this proof of concept.

**Almonds:** Eighty-two percent of the world's almonds are grown in California with consumption rising as the world population grows and people look for plant-based protein alternatives. That means approximately 1 million acres are now contributing to extra water use, climate change, and diminished air quality. In preliminary research, regenerative systems indicate they can reverse ecological pressures in these critical areas. A well-designed and economically based research effort should be immediately implemented to help shift our current almond and orchard management practices. This could positively affect global orchard productivity models, introducing a much more regenerative approach that eliminates chemicals, builds soil fertility and biodiversity, and improves water utilization. Five-year study, 30 acres: \$450,000



## CRARS Funding Needs

### Priority: Stabilizing Staff

A critical need of the Center for Regenerative Agriculture and Resilient Systems to accomplish our paradigm-changing goals is the ability to stabilize staffing. We need to employ and retain talented individuals to manage and administer the research projects, plan and facilitate training events and seminars, handle inquiries and communications amidst global interest in regeneration, and manage the Center's broader public outreach. With the continual disinvestment in higher education by state and federal funding streams, essential programs like this must reach to the philanthropic sector for appropriate partnerships to create and develop this future-oriented mission.

### Staffing Needs

**Director:** This position, which has immediately become more than full-time, is held by Center co-founder Cindy Daley, PhD, who is also a full-time professor at Chico State. Her vision, passion, and leadership, as well as her farming and scientific competency, uniquely equip her for this role. In this position, she will be mentoring other faculty for succession within a decade. Part-time funding for the directorship has been created by cobbling together funds from grants and donations. An endowed chair (\$2.5 million) would allow for full focus and stability to the position; annual funding of \$150,000 would cover the position full time and benefits.



**Assistant to the director:** The assistant to the director would manage the Center's calendar; coordinate events; oversee global communications; develop materials; arrange meetings of the executive committee, leadership council, and visitors; post journal articles and distribute them to peers for review; coordinate the online journal; and act on behalf of the director as liaison to the University administration and colleges involved in this interdisciplinary commitment. \$65,000 annually or \$1.1 million endowment.

**Office manager:** The office manager would provide bookkeeping and budget management for the Center's operation, funded research grants, and contract maintenance between consultants, researchers, students, and field technicians. This is critical to provide projections on reaching budgetary goals and research objectives. \$65,000 annually or \$1.1 million endowment.

**Research technician:** With the growing array of regenerative agriculture projects occurring on the University Farm (vegetable no-till/BEAM, no-till forage crop, bioreactor development and maintenance, pasture grazing, cotton and almonds—tentative) a full-time research technician is needed to oversee and manage these agricultural research efforts and ready them for farmer and student visitors. \$65,000 annually or \$1.1 million endowment.



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