

# Closing the Regenerative Agriculture Economy Loop on Small Farms: A Training program for Agricultural Professionals and Curriculum for Small Farmers

2022 Western Professional Development Grant

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**Link to share:** <https://projects.sare.org/proposals/show/815945/12042>

**Grant Type:** Professional Development Program

**Region:** Western

**Application Year:** 2022

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**Description for search results if funded:** Produce a training curriculum for agricultural professionals to teach small farms about circular economy, closed-loop and regenerative agriculture and techniques of soil, water and resource recycling and conservation that will allow them to farm sustainably, at lower cost and with greater safety.

## Project Basic Information

### Proposed Project Start Date

April 1, 2022

### Proposed Project End Date

March 31, 2023

### Project Primary State

California

## Project Subject Matter

- Education and Training
- Field/Vegetable Food Production
- Soil Management/Health/Quality

## "Other" Subject Matter

Regenerative agriculture through closing the loop via a circular economy

## How did you learn about this call for proposal?

- E-newsletter

## Proposal Resubmission

No

## Project Cooperators

### Major Cooperators

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## Summary

### Project Summary

This project, building on activities and results from our 2021 SARE grant (FW21-379), will develop a training program for agricultural professionals to teach closed-loop, sustainable agriculture to operators of small farms, based on the technologies, techniques, and best practices of Whiskey Hill Farm in Watsonville, California.

The project addresses a primary challenge to the sustainability of agriculture: heavy reliance on the extractive, open flow model of farming in the United States that treats land, water, minerals, microbiomes, and soil as free and unlimited goods, leading to their degradation and loss in the form of wastes disposed of as trash rather than treated as valuable resources. In the face of growing populations, climate change, transformation of peri-urban farmland to housing, demand for nutritious food, and low profitability of small farms, it is critical that farmers begin to “close the loop” of their agricultural economies through regenerative agriculture, recycling, and reuse of agricultural inputs and wastes.

This project will:

1. **Train-the-ag-professionals:** Working with a cohort of ag educators from local institutions, including CAFF and Watsonville High School, we will upskill ag professionals with the capacity to teach small farmers, employees and students about how to conduct closed-loop agriculture. We will
2. **Create a ‘close-loop’ curriculum** that agricultural professionals can use to teach small farmers and ag students about innovative, feasible technologies, techniques, and practices in regenerative, close-loop agriculture. The curriculum will be modular and include learning materials and freely available to all interested.
3. **Collaborate with Latinx farmers** to refine course materials and workshops developed for SARE grant FW21-379 and to ensure that curriculum and materials are available in both English and Spanish and accessible and acceptable to minoritized farmers.
4. **Create digital web-based educational resources**, including learning materials and video demonstrations of technology and technique application.
5. **Foster a community-of-practice in closed-loop agriculture** through tours, demonstrations and outreach.

## Narrative

## Introduction

One of the greatest challenges to sustainable agriculture is the depletion of the natural resource base on which food production depends. To sustain the natural resource base requires broad adoption of circular economy, closed loop agriculture. While the concepts and practices of closed loop farming are relatively well-known, they are not being taught and applied systematically on real, working farms. This project will develop a training program for agricultural professionals to teach closed-loop, sustainable agriculture to operators of small farms, based on the technologies, techniques, and best practices of Whiskey Hill Farm in Watsonville, California. Whiskey Hill specializes in regenerative agriculture and has become so efficient at close-loop agriculture and resource recycling that it is a net consumer of organic wastes.

Training agricultural professionals to teach small farmers how to implement closed loop agriculture could make significant contributions to fostering and facilitating the necessary transition. Small farms (less than 50 acres) are well-placed to implement closed-loop systems. Such operations, which comprise the majority of the Nation's farms (USDA, 2017), are critical to urban food supplies but are often marginal in terms of sales and profitability. Moreover, their numbers are in decline, and closed-loop agriculture could increase their productivity increase their revenues and profits and improve the well-being and livelihoods of farmers, their families and their communities.

Whiskey Hill Farm received a 2021-22 SARE grant (FW21-379) to deploy and quantify the efficacy of small-scale agriculture through new, scalable technologies and practices. This project builds on that work by translating learning and practices into a curriculum for the application of closed-loop agriculture. The project proposed here continues our aim of explicitly working with small farms, especially those with Latinx operators.

This project will target two related groups of learners: ag professionals and small farmers. We will undertake a professional development program that will prepare ag professionals to acquire the skills and knowledge to teach about close-loop agriculture. We will also carefully evaluate the target the needs of small farm operators themselves to produce a training curriculum. The agricultural professionals will be able to use this curriculum on an ongoing basis to teach operators of small farms the principles, techniques and practices that will allow them to recycle organic wastes, conserve valuable resources inputs, reduce operating costs and increase productivity and profits. The curriculum will include digital and hard-copy educational resources, including a handbook for farmers, training workshop modules, and short instructional video demonstrations. We will aim to foster a local community of practice around close-loop agriculture by offering experiential learning, educational tours and demonstrations at Whiskey Hill Farm that will be open to the broader community of small farms and ag professionals. Educational materials and workshops will be co-created with Spanish-speaking farmers and professionals to ensure accessibility in English and Spanish.

## Relevance to Western SARE Goals/Sustainable Agriculture

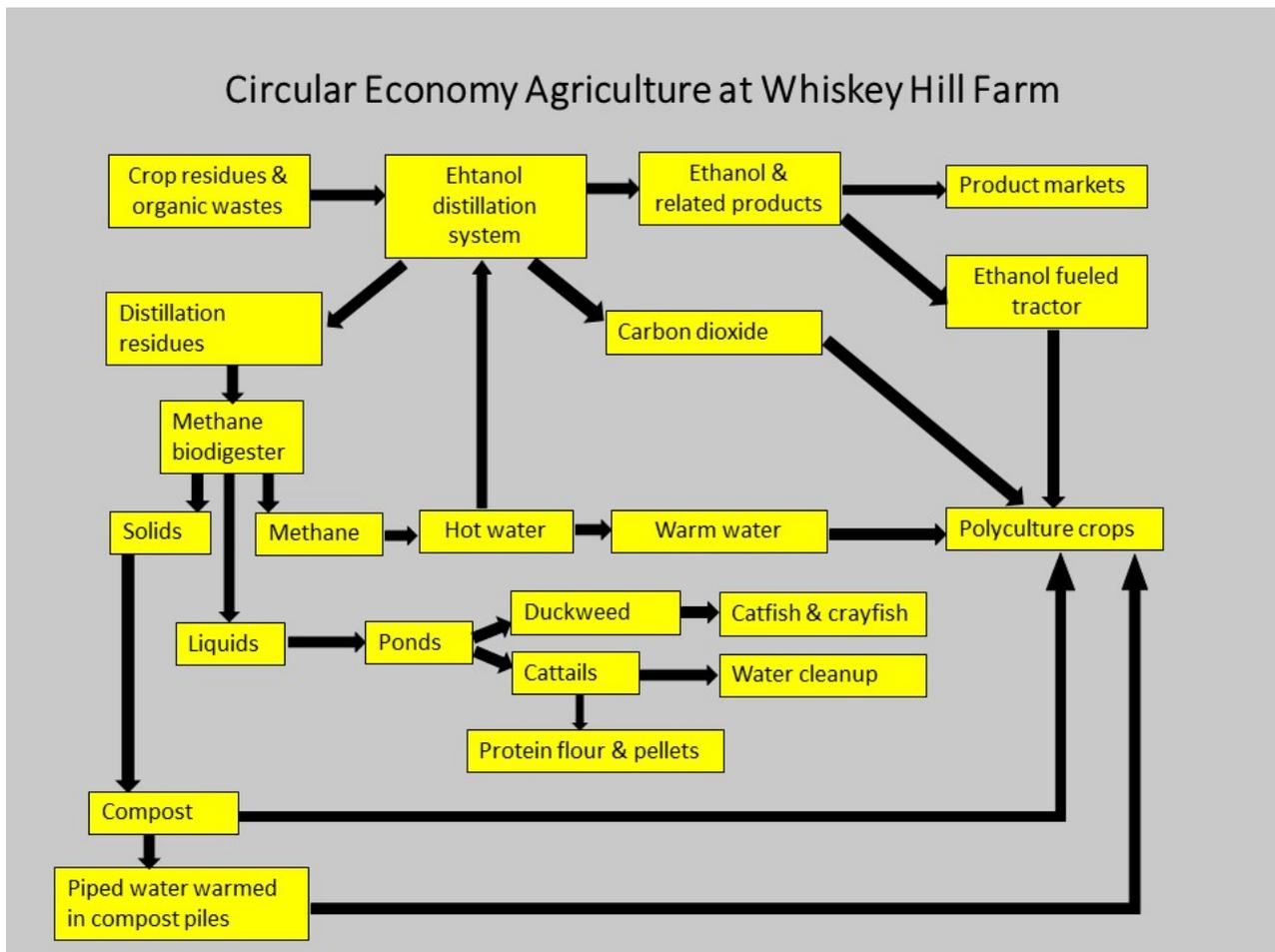
Closed loop agriculture is the very definition of “sustainable.” It is

an economic system focused on maximizing the reuse of resources and products and minimizing their depreciation. The circular system consists of two material cycles: (i) a technical cycle, and (ii) a biological cycle. The technical cycle relies on the use of mineral resources as production inputs, where products and their parts are designed and marketed in a way that they can be maintained and reused, maximizing their quality and their economic value. Within the biological cycle, resources used as production inputs have a biological origin, allowing for products to be safely discarded into the natural system once they reach their end of life. The system is meant to be both ecologically and economically restorative (Breure, 2018; see also Nogueira, et al, 2020).

In reviewing the literature on the subject, SARE projects and ongoing work across the country (see citations in additional documents), we found one similar one: ONC21-096, New and Beginning Farmer Regenerative Agriculture Fellowship Program (D’Ambrosio, Jessica, 2021), based in Ohio. That project does not include education, training and experiential learning on a working farm, and does not address new technologies and techniques. Nor does it propose to develop a training program for agricultural professionals. Other SARE projects (e.g., Borelli, 2020; Silveri, 2020; Singh-Knights, 2020) address portions of regenerative agriculture and training of farmers but are not broadly focused on closing the loop.

The research, education and training site for SARE FW21-379 is Whiskey Hill Farm (<http://whiskeyhillfarms.com/>), a 14-acre organic farm on California’s Central Coast, near Watsonville. WHF is a pioneer in developing a systems approach to agricultural technology by recycling and reusing various inputs and outputs in farming and demonstrating the technology and best practices of a circular, closed-loop food economy (see Figure 1).

Blume Distillation, adjacent to the farm, produces food- and medical-grade ethanol and hand sanitizer using organic wastes from its operations and from nearby farms. The organic by-products of the biorefinery are recycled into the farm’s greenhouses to enhance crop growth and grow duckweed fed to fish and crayfish. Solid and liquid organic wastes are deposited in a large methane digester whose liquid outputs are piped into ponds to grow cattails that are turned into feed pellets and other products. Digester solid residues are turned into rich compost which is then worked into the soil to restore it, increasing soil productivity. Crops are grown with polyculture techniques, at multiple levels, with tall plants providing shade for low ones. Hot water from the distillation system is piped through drip irrigation lines to warm the soil and encourage growth. Carbon dioxide from the distillation process is also piped into greenhouses, via the same drip irrigation lines, to maintain high CO<sub>2</sub> levels that feed plants and increase growth.



The circular, closed loop agriculture model that will be the focus of training, curriculum development, demonstrations and educational materials developed by the project proposed here promotes Western SARE goals and sustainable agriculture in the following ways:

1. **Stewardship and conservation:** Application of closed-loop approaches strengthens farm competitiveness by reducing the need for synthetic inputs to maintain soil fertility, composting organic wastes to regenerate soil, husbanding water resources through direct delivery to plant roots, utilizing pinpoint delivery of heat and carbon dioxide to enhance growth, satisfying human food needs, including culturally specific foods, and providing nutritious foods through organic farming. Closed economy agriculture also reduces the volume of organic wastes in landfill, thereby limiting land use and methane emissions from decomposition. And by recycling carbon dioxide from distillation and composting into plants and using on-farm produced ethanol for farm equipment, this closed economy system also limits greenhouse gas emissions from agriculture.
2. **Quality of life:** A closed-loop approach enhances the quality of life and viability of small farms by avoiding costs of synthetic (and costly) inputs, such as fertilizer and pesticides; ameliorates the economic and environmental effects of organic waste management and disposal off-site; increases farm income through more intensive polyculture production of high-value crops that can be sold to specific

cultural groups and give small farms access to higher-return, specialty markets and customers (e.g., restaurants). Closed-loop agriculture can increase the viability of small-scale agriculture, the majority of which generate \$10,000 or less in annual sales.

3. **Health & safety:** Closed-loop technologies, techniques and practices promote health and safety of both farmers and their employees by reducing exposure to toxic substances, such as pesticides; contamination of wells and surface water by nitrates from synthetic fertilizers; increasing and optimizing the use of farm resources through the implementation of biological cycles and controls; and limiting the potential for crop contamination by external sources through judicious planting of borders and plants avoided by invasive species.
4. **Diversification:** Cultivation of high-value, exotic, and culturally demanded foods allows the small farmer to sell into smaller markets with less competition from more conventional products and to contract directly with specialty customers, such as restaurants and organic supermarkets. “Hoop houses,” which are in wide use by berry growers, to small farms can allow operators to grow multiple crops per year and take advantage of higher prices during off-seasons. Extending the growing season will offer longer-term employment to farm employees and more stable incomes throughout the year.
5. **Regional implications and impacts:** Small farms producing conventional fruits, vegetables and other crops are subject to diseconomies of scale and, as a result, are often marginal in terms of “moving markets.” For example, if everyone is growing a crop that matures at a particular time (e.g., pumpkins), larger farms will produce pumpkins at lower cost, forcing smaller growers to find other outlets for their product. By turning to higher-value crops and markets, such competition will be reduced and will increase farm sales and viability.

Finally, although this is not a SARE goal, return of organic wastes to the soil will prepare small farms to comply with new California legislation requiring management and composting of organic wastes.

## Objectives

**Objective 1. Agricultural professionals will develop the knowledge and skills to teach operators of small farms about circular, closed-loop agriculture, in English and Spanish.** This will happen through a set of training workshops on the need for, principles of, benefits from and deployment of technologies, techniques and practices of a circular, closed-loop agricultural economy as demonstrated at Whiskey Hill Farm, and an instructional handbook. Ag professionals will be given a curriculum and educational materials that they can use to teach close-loop agriculture on an ongoing basis (objective 2).

**Objective 2. Ag Professionals and farm operators will use a modular curriculum and**

**digital learning materials to understand and apply technologies, techniques and practices of a circular, closed-loop agricultural economy as demonstrated at Whiskey Hill Farm.** This will be achieved through the development of a new curriculum based on materials developed and results from the current SARE grant, including brief online videos, a handbook of principles and applications, with “how-to” instructions and a specialized web site, in collaboration with CAFF.

**Objective 3: Minority/BIPOC farmers operating small farms will be able to implement closed-loop agriculture on their farms.** We will partner with Latinx and BIPOC farmers to understand their needs and ensure that the training curriculum and materials are accessible and acceptable.

These three objectives will be the outcomes of the training and educational curricula and materials created during this one-year project and evaluated on the basis of both agricultural professionals’ and farmers’ collaboration on, inputs to and reviews of these materials.

## Methods and Timeline

**Activity 1: Revise and refine curriculum materials on closed-loop agriculture for agricultural professionals to use in teaching small farmers (April 1-August 31, 2022)**

Tasks & Time frames	Methods
#1: Needs Assessment (April-May)	Engage with Latinx operators of small farms and agriculture professionals to assess curriculum development needs for each group.
#2: Curriculum development (July-Sept.)	Develop a new, modular curriculum, developed in collaboration with farmers & educators, drawing from materials from SARE FW21-397.
#3: Develop instructional videos (July-Sept.)	Create 10-15 minute videos to match six modules & “how to do it” instructions demonstrating practices and principles of close-loop systems
#4: Prepare handbook (August)	Curricular materials & how to instructions compiled into a pdf handbook that can be printed, in English and Spanish
#5: Put materials online (August)	All materials uploaded onto an open access website

#6: Beta-test (August)	Evaluate user experience of educational materials with farmers & extension agents, NRCS staff and high school and higher education instructors & have them complete evaluations
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**Activity 2: Develop a training program & workshops for agricultural professionals to teach and deliver closed loop curriculum to small farmers (August 2022-March 2023)**

Tasks & Time frames	Methods
1. Create team of ag professionals (August)	Solicit participation of 6-8 agricultural professionals from CAFF, ALBA, SSCRC, UC for beta testing of curricular materials
2. Review beta test & revise curriculum (September)	Based on results of beta test, identify materials to be added and deleted, revise curriculum, review by farmers & ag professionals
3. Develop training workshops with videos (October-December)	Work with ag professionals on training format, materials, hands-on exercises & create training workshop curriculum
4. Conduct beta test (January)	Conduct a beta test of training workshops, including time to review & critique
5. Revise program (February-March)	Revise the training curriculum as necessary
6. Print & upload program (March)	All materials printed and uploaded onto open access website

**Activity 3: Disseminate training, curricular & communication materials (August 2022 to March 2023 & beyond)**

<b>Tasks &amp; Time Frames</b>	<b>Methods</b>
1. Dissemination (August-March)	Connect project website with other agricultural sites, agencies and organizations; announce website going live
2. Public communications (September-March)	Interviews with journalists, conference papers, public talks, radio broadcasts and other similar activities
3. Academic & popular outreach (January-March)	Prepare academic articles for to ag education journals; write & submit informative articles to ag magazines

## Products

<b>Product &amp; Audience</b>	<b>Description</b>
Closed loop curriculum for small farmers	Six bilingual modules including: learning objectives, teaching strategies, and necessary materials.
Training workshops for ag professionals	Curriculum, educational materials, instructions for teach ag professional show to deliver closed-loop curriculum to small farmers
Closed loop handbook including design & construction instructions	Compilation of curricular and resource materials developed and disseminated to participants in SARE FW21-379.
Instructional videos	A set of 10-15 minute videos filmed during SARE FW21-379, and edited to appropriate length
Journal & popular communications	Two articles in ag education journals and a number of popular articles in general interest ag journals and on associated websites

Outreach & communication	Interviews on radio, newspaper articles, conference & public presentations, regular open houses, tours and demonstrations
Workshops & short courses	Continuing program of specialized workshops and short courses utilizing closed-loop and training materials.

<b>Closed Loop Curriculum Modules</b>	<b>Module topics &amp; content</b>	<b>Examples of Videos</b>
1. Closed-loop agriculture	Principles, need, objectives, practices, requirements	Applications at Whiskey Hill Farm
2. Agricultural science basics	Soil science & restoration, plant biology & growth, water & irrigation, species	Field experimental plots: inputs & outputs
3. Recycling waste & by-products	Composting, ethanol distillation, hot water, CO-2	Composting practices; simple still; ing hot water & CO-2 through irrigation tape
4 Ag tech for small farms	Application of Whiskey Hill techniques plus sensors, UAVs & hydroponics	Specific techniques; new ag tech applications; hydroponics operations
5. Distribution, marketing & high-value products	Identifying potential customers; working with distributors; growing high value crops	Who is interested in buying from you? What should you look for in distributors? Targeting ethnic group customers
6. Small farm management	Accounting, cash flows, labor requirements, logistics, et al	Economic practices; regulatory requirements; managing a farm

<b>Ag Professional Workshops</b>	<b>Training objectives: Ability to teach about</b>
1 The circular economy	The need for closed loop agriculture, with reference to resources, wastes & costs
2 Regenerative agriculture	The principles & practices of closed loop, regenerative agriculture, including field observation & application
3 Techniques for recycling	Techniques and practices of recycling “waste” outputs from farming
4 Technologies & crops for productivity	New ag tech that can increase productivity and high value crops that can increase margins
5 Distribution & marketing	Identifying and development channels for branded crop distribution and sale
6 Managing the closed loop farm	Managing a closed loop farm, including health, safety and regulation.

## Outcomes

1. **Agricultural professionals** will acquire the knowledge and hands-on experience to educate small farm operators about the principles and practices of a circular, closed-loop agricultural economy, with particular emphasis on new Latinx and minority farmers. The potential for closed-loop farming to protect the natural resource base and reduce operating costs will provide them with the motivation to reach out to farmers to inform and teach them and provide educational materials and applied implementation skills. Their experience will allow them to communicate to other ag professionals and engage in teaching activities at high schools and community colleges with agriculture programs.
2. **Small farmers** will learn about the principles and practices of a closed loop agricultural economy, which technologies and techniques can be deployed on their farms and how to deploy them successfully. On-going assessment of application results will provide feedback to farmers, what they can do to improve production and what fellow farmers are achieving. They will also be able to strengthen communication and collaboration across the agricultural community and inform

other farmers about these new strategies. Successful adoption will motivate other small farmers to learn about the closed loop agricultural economy and how to implement principles and practices on their farms.

3. **The public and students** will observe operations and Whiskey Hill Farms and “spread the word” to others who may be interested in closed loop economies. This could lead to invitations to public presentations, lectures and use of materials on the website.
4. **Educational materials** produced by the project will be available to a broad range of farmers, gardeners, activists, educators and researchers who will learn and disseminate knowledge and skills. These will also be introduced to agriculture programs in high schools and community colleges.
5. **Closed-loop regenerative agriculture** and associated technologies, techniques, practices and results will become more widely known, encouraging farmers to apply them to their operations and creating a community of practice.

## Evaluation

We are working with an experienced agricultural education evaluator who will help us to research various methods, offer pros and cons of different ideas and brainstorm method adaptations. She will help to create a data collection or evaluation strategy, provide feedback on data collection instruments/protocols, and offer feedback on a report draft. She will review instruments and provide feedback on interpretation of results. .

Planned evaluation activities include:

1. **Participant assessments:** A retrospective pre/post assessment will be conducted. The Western SARE survey will be incorporated into the Beta test survey tool. Farmers will be asked about their interest in pursuing closed loop agriculture on their farms and what assistance they will require. Ag professionals will be asked whether they will use any of the materials in future outreach and education. Individual interviews and focus groups will be conducted to facilitate revision and completion of materials prepared for the closed-loop curriculum and training workshops, prior to launch.
2. **Tracking of project progress:** Maintain a record of tasks completed on time or not and the impact on those activities. Record progress toward project objectives, revisions and completion.
3. **Products delivered:** Track interim and final distribution of educational products including farmer and training curricula, videos, reports and articles; tours and demonstrations.
4. **Project outreach:** Records of web statistics, social media contacts, phone and mail inquiries, public presentations and news reports; numbers of individuals (and their home organizations) attending events, requesting materials, participating in

training, watching webinars and lectures, numbers of project trainees and training sessions; numbers of presentations, visitors, volunteers;

5. **Project impacts:** Post project collection of data from farm participants including data on increased productivity, sales, income, inputs and outputs; labor; effect of technologies; distribution of food to communities in need. Follow-up interviews will be conducted in subsequent years.

## Budget and Budget Justification

### Total Budget

\$99,807

### Budget Worksheet for Awarded Institution

[Regenerative Ag.Whiskey Hill](#)

### Sub-awards to Other Institutions

Yes

### Budget Worksheet for Sub-awarded Institution(s)

[Regenerative Ag.Subaward](#)

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## Supporting Documents

### Signature Page

[SARE Signature-page\\_DB1](#)

### Vitae

[Blume biosketch](#)

[Lipschutz Biosketch](#)

[kmonsens\\_SARE](#)

[Harvey Biosketch](#)

[Bell biosketch](#)

[Josefina Lara Chavez](#)

[Correia Biosketch](#)

[Jakki C-D](#)

[Perez](#)

[Kathy D'Angelo](#)

[Jazzelle Lasiuk](#)

## Animal Welfare Assurance Statement

[WSARE\\_PDP\\_IACUC](#)

## Letters of Support and References

[LOS SARE project\\_Nov 2021](#)

[References](#)

[Regeneration\\_LOS\\_SARE\\_2021](#)

[CFF LOS](#)



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