Q2 — 2024-2025

ARP Quarterly Performance Reports

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QUARTERLY REPORTS

ARP PERFORMANCE PROGRESS REPORT

Title Project:	Yolo Carbon Farming Partnership
Name of the organization:	Center for Land-Based Learning

Reporting Period: Ju;y 1, 2024 - September 30, 2024

Purpose/Goal: The Yolo Carbon Farming Partnership seeks to increase the pace and scale of carbon farming and carbon farm planning in Yolo County through model carbon farm plans and trainings tailored to Yolo County growers.

Progress Report:

- Key Project Updates:

  The Center for Land-Based Learning and the Yolo County Resource Conservation District continue work on the third Carbon Farm Plan for Matchbook Wines which will cover approximately 2500 acres of owned and leased vineyards and olive orchards.

  Following the webinar and field day events, Center for Land-Based Learning staff have followed up with participants and other like-minded organizations in order to continue forward progress in Yolo County.

  The Center for Land-Based Learning, in collaboration with Carbon Cycle Institute, finalized and translated into Spanish the Carbon Farm Planning worksheet-based curriculum designed to be part self assessment and part guided by a technical assistant.

- ARP Performance Measures (from contract):

Total number of farmers, number of new farmers, and number of BIPOC farmers engaged through outreach.	We are expanding our outreach as an outreach partner through the Yolo CAAP process. CLBL continues to reach out about CFP to its 6500 subscribers.

Total number of farmers, number of new farmers, and number of BIPOC farmers attending training sessions/ field days.	50 total farmers, approximately half of which were BIPOC. We had a confirmed 25 farmers attend the Field Day event and approximately another 25 participate in the Webinar, based on the total numbers and the post-event evaluation.
Total number of farmers, number of new farmers, and number of BIPOC farmers interested in pursuing carbon farm planning.	The working lands survey received 83 responses and between the two outreach events we have a list of 18 farmers who are interested in developing a carbon farm plan for their farms.

- Challenges (if applicable):

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
CLBL staff salaries	$8,414.08	$6,492.20
Sub contracts:		
Yolo RCD	$3,822.00	$9,478.76
Carbon Cycle Institute	$1,800.00	$9,900.00
Yolo Land Trust	$0	$0
Indirect costs (10%)	$1,403.61	$2,587.09
Total Expenditures	$15,439.69	$28,458.05

ARP PERFORMANCE PROGRESS REPORT

Title Project:	Yolo Carbon Farming Partnership
Name of the organization:	Center for Land-Based Learning

Reporting Period: Oct 1, 2024 - January 18, 2025

Purpose/Goal: The Yolo Carbon Farming Partnership seeks to increase the pace and scale of carbon farming and carbon farm planning in Yolo County through model carbon farm plans and trainings tailored to Yolo County growers.

Progress Report:

- Key Project Updates:

  The Center for Land-Based Learning and the Yolo County Resource Conservation District worked on the third Carbon Farm Plan for Matchbook Wines, which will cover approximately 2500 acres of owned and leased vineyards and olive orchards. With this, we have fully developed three Carbon Farm Plans for three farms in Yolo County (see attached).

  Center for Land-Based Learning staff, in collaboration with the partners, followed up with participants and other like-minded organizations to continue forward progress in Yolo County. We conducted a webinar that was attended by 21 farmers, workshops for beginning and BIPOC farmers (24 participating farmers), carbon farming and beginning farmer field days (38 participating farmers), and conducted farm tours throughout the grant period. The carbon sequestration work was part of the presentation by UC (Davis) professor Dr. Amanda Hodson at the Olive Sustainability Conference (21 participating farmers).

  This project has helped put in place a number of efforts to create awareness of carbon farming in Yolo County and beyond. These included the workshops we conducted for existing farmers and beginning farmers. The many farm tours at the Maples we conducted across a wide variety of audiences - farmers, policymakers, government agencies, and even delegates from outside the US helped to expose the people (farmers and general public) on how farm land can contribute to carbon sequestration and reduce

global warming. The experience of working with local farmers has been valuable in informing us how we will do future carbon farm plans.

A Carbon Farm Practice Workbook was created to help producers take the first steps toward carbon farm planning. The document was translated into Spanish (see attached) to make it more accessible to Spanish speaking farmers who are interested in implementing carbon farm practices that enhance ecosystem function on the land they manage.

- ARP Performance Measures (from contract):

Total number of farmers, number of new farmers, and number of BIPOC farmers engaged through outreach.	CLBL continues to reach out about CFP to its 6500 subscribers.
Total number of farmers, number of new farmers, and number of BIPOC farmers attending training sessions/ field days.	104 total farmers, approximately 30 percent of which were BIPOC. Additionally, we had a monthly speaker series that was attended by both farmers and non-farmers who learned about the Maples Farm carbon farm plan and growing practices.
Total number of farmers, number of new farmers, and number of BIPOC farmers interested in pursuing carbon farm planning.	The working lands survey received 83 responses and between the two outreach events we have a list of 18 farmers who are interested in developing a carbon farm plan for their farms.

- Challenges (if applicable):

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
CLBL staff salaries	$33,520.18	$8,414.08
Sub contracts:		
Yolo RCD	$7,625.00	$3,822.00
Carbon Cycle Institute	$825.00	$1,800.00
Yolo Land Trust	$0	$0
Indirect costs (10%)	$4,197.02	$1,403.61
Total Expenditures	$46,167.20	$15,439.69

ARP PERFORMANCE PROGRESS REPORT

Title Project:	Downtown Streets Team Project
Name of the organization:	City of Davis

Reporting Period: October 1, 2024 – December 31, 2024

Purpose/Goal:

Downtown Streets Team (DST) launched a Davis Chapter of the flagship DST model per request from the City of Davis and Yolo County HHSA. The program provides city beautification, outreach, employment services and case management to people experiencing homelessness in Davis and Yolo County while offering a low-barrier work experience program. The program also helps to rebuild community while connecting people to the services they need to exit homelessness and/or gain employment.

Progress Report:

- Key Project Updates:
  For the months of October through December the beautification program Team Members removed 8,085 gallons of trash and recycling over the last quarter. Along with the trash and recycling, 61 needles were found and removed off the streets.

  Downtown Streets Team (DST) continued to provide case management and employment services for Team Members. During this quarter, the employment services portion included DST staff holding a series of employment-based workshops called "Job Squad" for Team Members. Workshops included activities such as resume assistance and preparation for job fairs. In the month of December DST staff hosted local career trainers including recruiters from a local truck driving school and bus driving school.

- ARP Performance Measures (from contract):

Performance Measure	Outome Measure	Outcome				
		Q1	Q2	Q3	Q4	TOTAL
How much did we do?	Number of Individuals Served	106	160	191	149	606
	Amount of Enviromental Debris Removed (gallons)	10,435	12,582	8,374	8,085	39,476
How well did we do it?	Number of Barriers to Service Removed*	84	84	119	109	396
Is anyone better off?	Number of Housing Placements	2	1	5	1	9
	Number of Job Placements	7	1	6	2	16
	Number of New Jobs Held Over 90 Days	4	0	2	3	9

- Challenges (if applicable):
  N/A – No challenges to report.

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Expenditures
Personnel/Salaries	$65,260.63	$231,927.72
Operating Expenses	$9,653.01	$27,034.94
Indirect Cost (10% of MTDC)	$14,223.59	$49,202.90
Total Expenditures	$89,147.23	$308,165.56

The Friday Report

Date: January 24, 2025

Project: Esparto High School New CTE Buildings

Client: Esparto Unified School District

	Esparto HS – New CTE Buildings	PBK #: 20404	DSA #: 02-118972

1. PBK addressing RFIs and submittals.
2. Final roof framing for building J is in progress. Building K is getting wrapped and prepared for plaster.
3. Rough electrical, fire sprinkler lines and plumbing continues in both buildings

Photos

Image 01 – Building J – Culinary classroom

Image 02 – Building J Digital Media Classroom

Image 3 – Building K – Welding Classroom

Welcome Baby (WB) Pathway in CHILD Project: Road to Resilience (R2R)

Reporting Period: October 1, 2024 – December 31, 2024

First 5 Yolo is grateful for the partnership with Yolo County and its dedication to serving the County's youngest children and families through the pandemic, at this most critical time. Since the last Q1 progress report, Welcome Baby has served more families and increased coordination among multiple health systems. Specifically, First 5 Yolo partnered with 10 different medical systems serving families in Yolo County which include CommuniCare+OLE Health Centers, Sutter Davis, Elica Health Centers, Winters HealthCare, Northern Valley Indian Health, Dignity Healthcare, Kaiser Permanente, UC Davis Medical Center, Capital OBGYN, and Partnership Health Plan. All partners are actively referring eligible patients into the Welcome Baby program, greatly increasing the reach of the program across the county. Welcome Baby nurses and the Medical Outreach Liaison are rounding at Sutter Labor & Delivery and Woodland Memorial Hospital. Rounding has been an effective strategy for engagement by facilitating warm handoffs into the Welcome Baby program. In addition, a new process was implemented for CC+OLE patients where all eligible perinatal clients are auto enrolled in Welcome Baby which has resulted in significantly greater families enrolled into the program. Critically, First 5 Yolo has been able to incorporate key components of Welcome Baby into a large, multi-year grant from CDSS Office of Child Abuse Prevention, thus preserving the leading edge infrastructure made possible by this ARP grant. Following this report, First 5 Yolo in partnership with UC Davis, will submit a final report highlighting the overall impact thus far of Welcome Baby in June.

During the reporting period, First 5 Yolo accomplished the following activities:

1. During Quarter 4 FY24-25, 166 families were enrolled in Welcome Baby and received evidence-based health literacy materials. Of those families, 99 gave birth during the reporting period and received WB nurse home visits. Importantly, almost all WB enrollments occurred prenatally which is a critical factor in early engagement and retention through the early postpartum period. Hospital staff are supporting the connection to Welcome Baby at Labor and Delivery for these families as well as those not yet enrolled at time of delivery.
2. Starting in Quarter 4 FY24-25, Welcome Baby implemented a new process for enrolling CC+OLE perinatal families into Welcome Baby. This process involves auto enrolling all eligible families in Welcome Baby. Providers still discuss Welcome Baby services throughout the pregnancy and families can opt-out if not interested. However, the auto-enrollment will allow the Welcome Baby team to better track pregnancies, decrease documentation errors, and ensure all CC+OLE patients are offered WB if eligible.
3. In collaboration with partners, all WB positions are filled including WB registered nurses (2.0 FTE), Medical Outreach Liaison (1.0 FTE), WB Data Analyst (.75 FTE), WB Community Health Worker (1.0 FTE), and an WB Behavioral Health Home Visitor (1.0 FTE). The WB Community Health Worker is trained as both a resource specialist and Healthy Families America home visitor, so they are able to meet the needs of the community through both short- and long-term supports. In addition, First 5 Yolo's Welcome Baby Community Outreach Specialist is promoting Welcome Baby awareness in the community to increase program referrals (see below for more details).

4. In Quarter 4 FY23-24, First 5 Yolo hired a Welcome Baby Community Outreach Specialist to support with building community referrals and create greater community awareness of Welcome Baby. The Community Outreach Specialist is strengthening partnerships with many different community organizations in Yolo County for referrals into WB. In addition, the Community Outreach Specialist has attended many different community events this quarter throughout Yolo County including the Yolo Food Bank Holiday Drive, Tree Lighting Event, Human Milk Drive, Kwanzaa celebration and more.
5. First 5 Yolo has worked with partners to ensure all WB staff are trained in trauma-informed care and their respective specialties. WB registered nurses have been trained in Primary Care in CC+OLE and have completed lactation courses to enhance their lactation training. Community Health Workers are trained using the Healthy Family America evidence-based curriculum. First 5 Yolo's Community Outreach Specialist has enrolled in Community Health Worker training and has begun a lactation training program.
6. First 5 Yolo is partnering with renowned health literacy and equity expert, Health Communications Partners (HCP), to deliver health literacy trainings to Welcome Baby staff. The health literacy training complements the Baby Basics health literacy materials provided to every WB family. Health Communications Partners developed a health literacy course based on WB program needs which all WB staff have completed. In addition, HCP leads live learning sessions to consolidate information, answered questions, and provided additional tools to facilitate stronger health communication.
7. Welcome Baby has accomplished ground-breaking coordination among multiple health systems serving birthing persons and infants. Specifically, Welcome Baby is now partnered with 10 different health systems serving Yolo County patients. Welcome Baby is coordinating care for families through developing care plans and sharing information between health providers thereby ensuring families receive timely medical care. In addition, F5Y is working with Partnership Health Plan to coordinate serving families and evaluate data for program impact.
8. First 5 Yolo has continued to build a partnership with the local Managed Care Plan, Partnership Health Plan, in order to sustain services. First 5 Yolo is set to start billing for Community Health Worker visits made by the WB nurses and is developing processes to start Enhanced Care Management billing in the next few months.
9. First 5 Yolo staff have convened regular meetings to coordinate Welcome Baby partners and engage in continuous quality improvement of Welcome Baby services. During these meetings, partners have refined workflows, discussed ongoing strengths and challenges of program implementation, and have monitored data collection for quality improvement.
10. First 5 Yolo has partnered with the evaluation team from University of California, Davis to develop and implement a WB evaluation plan. First 5 Yolo meets regularly with the evaluation team to monitor and evaluate programmatic data. This quarter, the UCD Evaluation team conducted interviews with important stakeholders and health providers to receive feedback about Welcome Baby. This information will be used for continuous quality improvement and to inform engagement strategies.
11. First 5 Yolo continues to host the Home Visiting Collaborative in Yolo County. This is a crucial meeting where home visiting programs and partners can collaborate on increasing efficiency in referral processes, discuss barriers, and highlight community needs. Currently, there are 11 home visiting programs represented with 20 staff attending the meetings. The Home Visiting Collaborative has finalized a mission statement to help guide the work of the collaborative and will

continue to form both short- and long-term goals that align with the mission. In addition, the Collaborative is maintaining an online excel form to track capacity and changing eligibility of participating home visiting programs.

Quarterly Performance Measures	Count
Number of families enrolled in Welcome Baby	166
Davis	19
West Sacramento	57
Woodland	72
Rural/Other	18
Number of completed nurse home visits	99
Davis	12
West Sacramento	26
Woodland	47
Rural/Other	14
Number of staff trained on Baby Basics (or similar); trauma-informed care/other	8
Number of mothers screened for social and medical risk over time	99
Number of mothers receiving lactation support over time	90
Number of direct connections to Covid-19 vaccines resources	0

As seen in the table, Welcome Baby served families in all areas of Yolo County with the highest numbers in West Sacramento and Woodland. This is not unexpected given Woodland and West Sacramento have the highest birth rates in the County. All hired Welcome Baby staff (n = 8) have been trained in trauma-informed care and will continue training into the next quarter. All mothers seen during the reporting period received social and medical screenings. As for lactation support, 90 mothers were provided lactation support while the other 9 mothers were either exclusively formula feeding or did not have the infant in their care,

Breastfeeding has significant health benefits both for the birthing person and infant (e.g., reduced risk of SIDS, child death, infection) as well as supports parent-child bonding. Unfortunately, many families do not receive needed lactation support early in the postpartum period leading to low rates of exclusive breastfeeding at 3 months and racial/ethnic disparities in these rates.

Importantly, many providers and families have expressed their gratefulness for Welcome Baby (see quotes from Welcome Baby parents below). Providers have been able to rely on Welcome Baby nurses to check on high-need families including families with medically vulnerable mothers and/or infants, families that missed postpartum medical appointments, and low-resourced families unable to afford basic needs. Moreover, during visits, WB nurses have caught life threatening conditions, connected families to medical homes, and provided needed concrete supports.

“It was helpful you coming out to weigh the baby and being available for question and concerns that I had. I really appreciate the education you provided.”

-Welcome Baby Parent

For questions regarding this report, please contact Gina Daleiden, Executive Director at gdaleiden@first5yolo.org.

Title Project:	East Beamer Shelter Phase II
Name of the organization:	Friends Of The Mission

Reporting Period: October 1, 2024 - 1 December 31, 2024

Purpose/Goal:

The focus during this reporting period was the new buildings surrounding site programming, and building design and development documentation. The City Planning application submission was prepared

The new building will expand existing services as well as implement new programming to support vulnerable populations. The facility will be owned and developed by Friends of the Mission, Inc. (FOM) and Yolo Wayfarer Center dba Fourth and Hope, Inc. will continue to operate the existing Shelter and the new facility. The expansion of the existing shelter will accommodate 60 men and 40 women. Additionally, four converted offices in the existing Shelter will provide non-congregate behavioral health respite beds for individuals with mental health and/or substance use disorders. Finally, 10 rooms will be for a residential perinatal substance use treatment program serving approximately 10 pregnant and/or parenting women.

Salazar Architects (SAI) began working on the architectural design. The floor plan was revised at the request of the City Fire Marshal and they are proceeding with the construction documents that are necessary for permitting. Concurrently, Laugenour and Meikle (LCME), the civil engineers and Sacramento Engineering, the site electrical engineers, in coordination with SAI, continue to develop plans and specifications for the City permit submission. The PG&E application fee was paid during this reporting period.

During December 2024, there was no draw down due to the lump sum draw that was received in January 2025.

Challenges:

- Construction funding continues to depend on City support for the project and the project's Planning Application remains in process in anticipation of the City Manager's approval.

- SAI has not yet received City Planning Approval and asked for a Campus-wide site plan as part of the current Planning submission. The absence of approval could cause delays and increased design costs if the City imposes additional site changes.

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
Personnel/Salaries	$124,519.00	$135,103.00
Capital	$42,004.90	$15,050.00
Total Expenditures	$166,523.90	$150,152.60

ARP PERFORMANCE PROGRESS REPORT

Title Project:	"Eat Well, Age Well Yolo County"
Name of the organization:	Meals on Wheels Yolo County, Inc.

Reporting Period: October 1, 2024 – December 31, 2024

Purpose/Goal:

"Eat Well, Age Well Yolo County" is a movement intended to address the escalating need for more predictable healthy outcomes for more seniors, prioritizing nutritious food security and socialization in Yolo County's cities and rural communities. It represents the ability to sustain MOW Yolo's impactful 150%+ uplift over the past two years, nourishing and engaging more seniors than ever before in MOW Yolo's history with:

- *Fresh, local, nutritious food*
- *Medically tailored meals*
- *Expanded "Café Yolo" social dining options*
- *More rural meals access*

Progress Report:

- **Key Project Updates:** *this project made a transformational difference over the course of the funding period in aging adults' food security in West Sacramento and Yolo County's rural communities. During this final reporting period, the now five-month-old Capay Valley home-delivered meals route consistently served 17 seniors via 1x/week delivery of five frozen meals, the Dunnigan route increased to reach 17 seniors, Clarksburg hovered between 7-9 seniors, and MOW Yolo completed its nutrition support for ~30 seniors at the Davis and Madison Migrant Centers (first season of such service). Additionally, Café Yolo Social Dining continued in Esparto (following a September 2024 debut) at the Capay Valley Health Center in partnership with RISE, Inc., with increasing attendance.*

  In West Sacramento, 1x/week Café Yolo Social Dining at the West Sacramento Community Center attracted 20-25 senior diners most Wednesdays. The program re-launched at that location in July 2024 following an extended pandemic hiatus. Home-delivered meals demand continued to grow, now with close to 245 West Sacramento seniors receiving five meals/week via three deliveries/week, a combination of hot and frozen meals. West Sacramento also continues to represent the largest concentration of "Weekend Food Project" recipients in the county, with MOW Yolo providing shelf-

stable meals 2x/month to nearly every West Sacramento senior enrolled. This program is intended for the very lowest-income seniors served by MOW Yolo.

- ARP Performance Measures (from contract):

Performance Measures Framework	Outcome Measure	Data Collection Method	Data Tracking Frequency	Outcome Link to ARP Narrative
How much did we do?	**GOAL:** at least 1,200 seniors consistently nourished countywide by 12/31/24 **STATUS 12/31/24:** 1,007 seniors receiving five meals/week. Strategic goal is to achieve 1,250 nourished consistently by 6/30/25.	Meal delivery tracking	5x/week, Monday-Friday	Nexus to the pandemic: pre-existing gaps, direct impacts, and recovery
How well did we do it?	**GOAL:** emphasis on increased West Sacramento and rural meals access, congregate/social dining, fresh/local ingredients, medically tailored meals. **STATUS 12/31/24:** Sustenance and growth of rural home-delivery routes and the Esparto Café Yolo location is ongoing.	Kitchen procurement and menu development records, delivery route tracking	Monthly	Needs based/data informed

	Continued growth of the West Sacramento Café Yolo meal gatherings. Home delivery growth in the city continued to outpace the availability of volunteer (or staff) drivers to fulfill them. A part-time staff driver role now is being recruited to address this.			
Is anyone better off?	**GOAL:** seniors remain at home as appropriate, experience increased access to regular healthy meals, reduced hospitalizations and medical intervention. **STATUS 12/31/24:** Analysis of annual client survey results is ongoing to determine impacts and outcomes. Anecdotally, seniors report a feeling of safety assurance provided by volunteer visits, more access to fruits/vegetables, and healthier and more dependable meals than they are capable to prepare on their own.	Phone and/or in-person reassessments	Quarterly	Transformational projects

- Challenges (if applicable): *the primary challenge has only intensified: sustained funding for operations and escalation of services to at-risk seniors in need of nutrition, especially given the approaching "silver tsunami" now that the entire baby boom generation is age 60+. The sunsetting of Yolo County ARP funding now pairs with the more recent threats to the stability of MOW Yolo's federal Older Americans Act funding (~15% of annual operating budget) to create a potentially unstable future. However, MOW Yolo is proceeding to prepare for this circumstance by emphasizing private philanthropy and pursuing reimbursement revenue opportunities to avoid a scale-back in services that could un-do much of what this and the previous two rounds of ARP funding achieved. It's our intention to ensure a favorable return on the ARP investments made by both Yolo County and the federal government.*

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
Personnel	$17,723.59	$60,794.34
Lease/Rent	$0	$0
Food/Supplies/Transportation	$3,108.00	$13,374.07
Total Expenditures	$20,831.59	$74,168.41

ARP PERFORMANCE PROGRESS REPORT

Title Project:	Food and Equipment for RISE Food Closet
Name of the organization:	RISE, Inc.

Reporting Period: October 1, 2024 – December 31, 2024

Purpose/Goal:

The purpose of this program is to acquire equipment that will enhance the program capabilities and expand the variety of food items offered at our RISE Food Closet and Food Distributions.

Progress Report:

- Key Project Updates:
- ARP Performance Measures (from contract):

Key Project Updates:

From October to December 2024, we expanded our outreach efforts to inform the community about the increased availability of food items at our Food Pantry and Food Closet. This included social media posts with images of items available at each event and coverage in the local newspaper. Additionally, at the end of December we initiated collaborative efforts with local farms to increase our produce inventory, ensuring greater access to fresh, nutritious food for those in need.

ARP Performance Measures:

How Much Did We Do?

From October to December 2024, RISE provided food assistance through our Food Closet/Pantry and larger Food Distribution events:

- **Winters Food Pantry:** Served 8-10 individuals weekly, impacting nearly 300 individuals in the Winters community.
- **Esparto Friday Food Closet:** Served an average of 26 individuals per week, with a notable increase in November. These efforts provided free food to approximately 1,250 individuals in the Esparto, Madison, and Capay Valley communities.
- **Larger Distributions (2x/month):** Large-scale food distribution events at the Esparto and Winters sites served over 4,400 individuals across the Winters, Esparto, Madison, and Capay Valley communities. Each event supported an average of 365 individuals in Winters and 375 in Esparto/Madison/Capay Valley.

How Well Did We Do It?

During this quarter, we saw an increase in participants at the Esparto Friday Food Closet, particularly in November, when the average rose to 36 individuals per week, impacting a total of 596 people. Across all programs—Winters Food Pantry, Esparto Friday Food Closet, and our larger distributions—we served:

- **October:** 1,889 individuals impacted in Winters & Esparto.
- **November:** 2,261 individuals impacted in Winters & Esparto.
- **December:** 1,798 individuals impacted in Winters & Esparto.

Is Anyone Better Off?

Beyond the numbers, these programs have provided critical food security for hundreds of families, reducing food hardship, and ensuring access to nutritious meals. Many participants have expressed relief knowing they can depend on these resources, particularly during the holiday season when financial strain is higher. Homeless individuals have shared that after RISE distributed donated can openers to them, they are now able to take and consume canned goods from the Food Pantry, improving their access to essential food items.

Challenges (if applicable):

The holiday season brought increased demand and logistical challenges, particularly with our large holiday distributions in November and December. With only one team member coordinating this project, efforts to collaborate with local farms were delayed until late December.

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
Program Supplies		
Equipment:	$0.00	$11,399.04
Food:	$160.55	$49.02
Total Expenditures	$160.55	$11,448.06

ARP PERFORMANCE PROGRESS REPORT

Title Project:	Electrification Retrofit Rebate Outreach (ERRO) Program
Name of the organization:	Valley Clean Energy (VCE)

Reporting Period: October 1, 2024 – December 31, 2024

Purpose/Goal:

The Electrification Retrofit Rebate Outreach (ERRO) Program is a two-year comprehensive outreach program to encourage low-income households in unincorporated Yolo County to access $1 billion in available State electrification rebates, as well as other related electrification retrofit rebates for existing residential homes. Helping these households reduce ongoing costs will have long-term economic benefits as well as reduce greenhouse gas emissions associated with higher electricity use. Project success will be measured by the number of households reached and the dollar amount of rebates accessed successfully.

Progress Report:

- Key Project Updates:
  - Outreach Strategy has been deployed.
  - Rebate assistance is being given to customers.
  - Monthly progress meetings are being observed.
  - Concierge Service (Electric Advisor) is live and customer-facing.
  - Email publicizing the free service was sent out to 40,000+ VCE customers.
  - Over 3,000 Electric Advisor website visits in December after email was sent.
  - Collateral has been finalized, social media and website updates have been posted, and outreach to community-based organizations has happened.
  - Multiple channels are available for customers to connect with money-saving electrification home upgrades, including chat and phone. Customers are actively participating in the service, and low-income status is being tracked (where possible).
- ARP Performance Measures (from contract):

Performance Measures Framework	**Outcome Measure**	**Data Tracking Frequency**	**Outcome Link to ARP Narrative**

How much did we do?	Number of people reached	Quarterly	Measure E-2: Reduce Energy Consumption in Existing Residential and Non-Residential Buildings of the *Yolo County Climate Action Plan*
How well did we do it?	Number of existing homes converted to all electric	Quarterly	Measure E-2: Reduce Energy Consumption in Existing Residential and Non-Residential Buildings of the *Yolo County Climate Action Plan*
Is anyone better off?	Associated greenhouse gas reduction quantification	Quarterly	Measure E-2: Reduce Energy Consumption in Existing Residential and Non-Residential Buildings of the *Yolo County Climate Action Plan*

- Challenges (if applicable): Concierge Service (Electric Advisor) has seen several implementation delays. The service is live, but has not seen sufficient time to adequately measure impact. VCE did ascertain that the project partners will have more time to report customer impact, and VCE anticipates being able to report on further progress on program goals in Q1 and Q2 of 2025.

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
Personnel/Salaries	$672.06	$45,620
Operating Expense	$65,778.60	
Operating Expense	$5,690	
Total Expenditures	$72,140.66*	

*Please note that VCE will only invoice for $50,097.12 of expenses for the period Oct-Dec 2024 because the incurred expenses exceed the $100,000 awarded to VCE as a subgrantee.

West Sac Motels

Performance Measures:

Performance Measures Framework	Outcome Measure	Data Collection Method	Data Tracking Frequency	Outcome Link to ARP Narrative
How much did we do? # Individuals served **28 Individuals served between October 1, 2024 and December 31, 2024**	50 individuals annually	HMIS	Monthly	The Interim Homeless Housing Program seeks to provide emergency housing for West Sacramento homeless residents. The program will provide supportive services to program participants, including getting them document ready by assisting with procuring their government ID, birth certificate and social security card, to enable them to be placed in permanent housing.
How well did we do it? # of individuals who increased their financial support **1 Individuals increased their financial support between October 1st 2024 and December 31st 2024.** # of individuals who increase their physical and behavioral health engagement **5 Individuals increased their physical and behavioral health engagement between October 1st 2024 and December 31st 2024.**	10 individuals annually 25 individuals annually	HMIS	Monthly	Program participants will receive supportive services to enable them to be placed into permanent housing. Supportive services will assist program participants to apply for SS/SSI, medical and other financial assistance programs. Additionally, program participants will be assisted to apply for and receive health benefits.

Is anyone better off? # of individuals who obtain stable, affordable permanent housing. **1 clients attained permanent housing between October 1st, 2024 and December 31st, 2024**	15 individuals annually	HMIS	Monthly	The ultimate goal of the program is to stabilize program participants by getting them the medical assistance that they need, assisting them with applying for any financial benefits and getting them document ready by assisting with procuring their government ID, birth certificate and social security card so that they may be independent and transition into permanent housing.

Key Project Updates and Challenges:

One client was discharged from the program into permanent housing this quarter. This client had been enrolled in Project Roomkey prior to the transfer to the Flamingo Motel. Through her participation in both programs and intensive case management at the Flamingo, the client was able to attain regular medical care, employment, and eventually earned the opportunity to move into a two-bedroom apartment with her teenage son who was previously residing with another family member.

On October 24th, 2024, Flamingo Motel room 31 experienced a fire likely caused by the unattended use of candles by the program participants inside of the room. Fortunately, no clients were harmed during the incident and the damages from the fire only impacted the single room. City staff are working towards completing restoration to the room but as of December 31st, 2025, the room remains out of commission until repairs are completed. Since the fire, City staff have made amendments to program rules provided to participants that ban the use of any candles or flammable cooking apparatus (propane stoves with open flame).

ARP PERFORMANCE PROGRESS REPORT

Title Project:	Farm to Folks
Name of the organization:	Woodland Food Closet

Reporting Period: October 1, 2024 through December 31, 2024

Purpose/Goal:

To work with local small farmers to recover locally grown fruits and vegetables that otherwise would go to waste, then distribute them to community members via the Woodland Food Closet.

Progress Report:

- Key Project Updates: 411 lbs. of locally grown fruits and vegetables have been recovered and distributed to community members facing food insecurity during this reporting period. In total, this program recovered and distributed 4,613 lbs. of fresh fruits and vegetables
- ARP Performance Measures (from contract): We have far exceeded our original goal of recovering 2,000 lbs. of edible fruits and vegetables.
- We created a flyer that volunteers distributed to homes where a citrus tree was visible from the street, offering to pick the fruit. We had over 10 homeowners take us up on our offer and we are continuing to receive phone calls.
- Challenges (if applicable): Not Applicable

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
Personnel/Salaries	$10,443.36	$9,238.28
Operating Expenses	$553.15	$1,401.07
Program Supplies	$6589.22	$406.49
Capital Expenses	$25,000	$0
Total Expenditures	$42,585.73	$11,045.84

Yolo County OFFICE OF EDUCATION

Garth Lewis
Yolo County Superintendent of Schools

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www.ycoe.org

TO: Berenice Espitia

American Rescue Plan Project Manager, County of Yolo

FROM: Le Taunya Westergaard

Project Coordinator, Yolo County Office of Education

RE: OBJ Sustaining Childcare and Early Learning in Yolo County at Greengate ARP (American Rescue Plan) Quarterly Report

4th Quarter 2024: October 1, 2024 – December 31, 2024

DATE: 01/29/2025

The following is presented as an update on fourth quarter reporting of the Yolo County at Greengate ARP (American Rescue Plan) Quarterly Report. With construction nearing completion, all funds expended, and eligibility for enrollment at the childcare site, this will act as a final quarterly report and Yolo County Office of Education (YCOE) will provide a final report upon.

Project Update:

During this quarter, significant progress has been made on the construction project. The majority of the work has been completed, with only a few tasks remaining due to architectural modifications and pending staffing. Despite the project being delayed due to change orders in the architectural and construction plans, we anticipate having the project closed out by March 31, 2025.

The TOTAL expenses to date are $1,161,074.66 which includes funding from multiple resources. YCOE has invoiced and received funding from the City of Woodland in the amount of $400,000 and has provided all required documentation. No additional funds remain.

Project Background:

The 2020 Yolo County Local Childcare Planning Council Needs Assessment stated an immediate need for the following in Yolo County:

- Strengthening the childcare workforce.
- Continued training and technical support to childcare providers.
- Establishing a unified early learning infrastructure.
- Increased awareness and increased funding for quality subsidized childcare.

The highest need is for infant and toddler care with a gap of 3,834 licensed childcare slots specifically to care for children 0-2 in Yolo County. This project, Sustaining Childcare and Early Learning in Yolo County at Greengate Project is for the installation of a vacant portable classroom donated to YCOE and will be used to provide an infant and toddler center in Woodland, resulting in 16 additional slots.

This site would allow teen parents attending Cesar Chavez Community School to have their infant and toddler receive childcare services at the school site, which will also be available for community participation.

This proposal will allow for growth and expansion of much needed childcare slots for infants and toddlers. Additionally, professional development for providers caring for vulnerable children can improve the quality of care.

To: Yolo County Board of Supervisors

From: Jessica Hubbard, Executive Director, Yolo Community Foundation

Date: December 31, 2024

Re: Grant Report, Yolo NEON (Subaward #5354)

I am pleased to share our progress on the Yolo NEON project. Yolo Community Foundation has made some tremendous progress towards kicking off our pilot cohort which will begin in January 2025 and continue to be on track to meet deliverables.

Project History & Objectives

Yolo NEON is a program of the Yolo Community Foundation, funded by Yolo County. It will help 25- 50 Yolo County-based nonprofits to increase efficiency and decrease risk by strengthening their operational foundation (e.g., finance, HR, legal, etc.), thus increasing their capacity to serve the people of Yolo County. Through this project, we will guide nonprofits through the process of refining their back-office policies and procedures, for the purpose of maximizing impact by increasing efficiency and decreasing risk. Back office functions that are addressed through this program may include finance, legal & risk management, human resources, technology & security, etc.

First, in partnership with relevant subject matter experts, we will create a checklist or roadmap in each of our priority operations areas that covers the policies, processes, and procedures that a well-run nonprofit should have in place. Then, in partnership with our experts, we will build on this checklist with a six-part program: 1. Assessment Tool (help nonprofits identify priority focus areas), 2. Best Practice Library (sample policies, templates, checklists, etc. To minimize the workload for participating nonprofits and maximize the quality of the resulting policies and procedures), 3. Expert support (group and on-on-one training), 4. Seal of operational excellence (exploring possibility of “good housekeeping seal” for nonprofits that successfully complete the program), 5. Cohort model (20-35 nonprofits to complete the program as a cohort, offering one another peer learning and support), 6. NPLA expansion (20-40 nonprofits to engage with the program through one-off workshops on specific topic areas, through the framework of our existing Yolo County Nonprofit Leaders Alliance initiative).

Key Project Updates

This report covers grant activities from October through December 2024. Our primary focus in the past couple months has been on to areas: 1) Selecting our subcontractors as subject matter experts, as well as finalizing their contracts and scopes of work. (Specifically, we sought subject matter experts to train and support participating nonprofits in the areas of Finance and Accounting; Human Resources; Legal, Governance, and Compliance; and Information Technology. We also sought subcontractors to support

YCF in delivering this program in the areas of Project Management, Communications, Event Planning, and Legal.) 2) Selecting nonprofits to participate in our pilot cohort.

Subcontractors

In November, YCF finalize our roster of subject matter experts and reached out to our selected subcontractors to notify them of their selection. Specifically, Consero Solutions, in partnership with Creative Legal Solutions and Nelson and Associates, will provide training in Finance & Accounting, Legal, Governance, and Compliance, and Human Resources. , while and Geospatial Clarity will provide the IT training. Additionally, Creative Legal Solutions will provide legal services to YCF as we implement the Yolo NEON program, Community Event Co. will provide support to YCF in the area of event planning and project management, and Mikaela Leach Consulting will provide marketing and communications support. We are in the process of finalizing contracts and scopes of work with these subcontractors, with most very close to final signatures; we anticipate that all contracts and scopes of work will be finalized by mid-January.

Outside of the subcontractors that we selected to be subject matter experts, we also qualified several applicants based on their scores to have the opportunity to provide trainings in addition to the contracted subject matter experts as needed. The following consultants were qualified to provide services and we may call upon them to support depending on the budget: JNM Coaching & Consulting, Savvy CMO, Impact Foundry, Stacy Frerichs, ClearRode Financial Group, CA Employers Association, and Pi-Economics. These subject matter experts have also been qualified to provide additional Yolo NEON trainings through our Yolo County Nonprofit Leaders Alliance program.

Pilot Cohort

YCF's goal is to run a pilot with 6-8 nonprofit participants. The pilot should meet the programmatic goals for the participants – that is, should help these Yolo County nonprofits to reduce risk and increase efficiency by improving back office policies and procedures. In addition, the pilot should help YCF and its subcontractors to refine the program before bringing it to a larger group of nonprofits. YCF therefore sought to include nonprofits in the pilot that could help answer research questions, such as what size nonprofits could benefit from this program, how to design the program to allow volunteer-run nonprofits to participate, etc. In addition, we sought to include nonprofits from throughout the county and representing a range of causes, demographic groups, etc.

To ensure that we obtained the right mix of nonprofits to meet these needs, we conducted an invite-only selection process. (Please note that we anticipate that future cohorts will be selected through an open application process.) To inform our invitation list, YCF reached out to the Yolo County Board of Supervisors for recommendations of nonprofits in their regions that they would be a good fit for Yolo NEON. After receiving the lists from each supervisor who chose to offer nominations, we created a list of organizations based on size and budget and selected 2-3 from each region. We then reviewed to ensure that the organizations were varied based on geography and causes they serve. YCF then held meetings

with the selected organizations to share information about the Yolo NEON program, including nonprofit expectations, and assessed interest.

We have received very positive feedback from organizations and all organizations YCF identified have indicated interest in participating, though we are waiting on a final commitment from some (which has been slowed down a bit by holiday vacation schedules). At present the organizations who have expressed interest in participating in the pilot cohort are Yolo Farm to Fork, All Leaders Must Serve, Friends of the 1883 Clarksburg Schoolhouse, Thriving Pink, RISE, Mercy Coalition, Yolo Healthy Aging Alliance, and Winter's Community Corazon. Once nonprofits have opted into the program, we asked them to complete a short survey to understand their starting point and the current capacity of their organization. Lastly, we also provided organizations a basic agreement to understand the time obligations on their part and what they can expect to get out of participating in the pilot cohort. At present we have received 1 agreement back, however, nonprofits have until January 6 to return the agreement before we consider asking another organization to fill in the open space.

Finally, we have finalized the calendar for our pilot. The cohort will meet on the following dates starting in January. (Please note that the meeting times may be refined, within the stated windows.)

- JANUARY 1/16 12-4
- FEBRUARY 2/25 9-1
- MARCH 3/13 12-4
- APRIL 4/24 12-4
- MAY 5/22 12-4
- JUNE 6/5 2-6PM

Challenges

One of the main challenges we've experienced as we worked towards selecting subcontractors was the more formal procurement process required when using federal funds. This was YCF's first experience with such a procurement process. Knowing the funds provided are government dollars, YCF wanted to ensure that we thoroughly understood the procurement requirements when using ARP funds and that we were scrupulously accurate in following them, including in our assessment of subcontractor applications. As a result, we moved through the procurement process more slowly than we initially anticipated; however, we feel confident in the process we created and followed and thus in the subcontractors whom we hired for the Yolo NEON program.

As we have been gearing up to work with the contractors in the month of December, creating a cohesive scope of work (SOW) within the anticipated budget for the program has required some puzzle piecing of offerings and pricing. Initially, subcontractors offered a much deeper dive into offerings for the participating nonprofit partners. We have met with the subcontractors three times as well as several email communications to have clarifying conversations around expectations as well as nonprofit take aways based on their existing systems. We agreed that the initial proposal provided more depth and

breadth than was realistic given the constraints of time, financial resources, and nonprofit participants' capacity to engage with the program. Subcontractors then went back to the original SOW and modified it to be more concise and to ensure that basic foundations could be laid for all organizations in the group. We then discussed that if organizations wanted to dive deeper, this is something they would be able to explore during their office hours sessions with the subcontractors. As a result of this budget negotiation, we also introduced small-group office hours sessions, in addition to the one-on-one sessions we initially envisioned. During the pilot, we will assess the relative impact of both one-on-one and small-group office hours and determine how to proceed for future cohorts.

While our initial proposal included work through year-end 2026, during the contracting process the County asked us to plan to complete programming by the end of 2025. Based on how the budget is shaping up, as well as the fact that we're launching the pilot a few months later than planned due to staffing challenges (addressed in our Q3 report), we currently believe we could maximize our impact by continuing programming into 2026. We are continuing to plan to complete all programming by the end of 2025, but as we finalize the subcontractor budget over the coming weeks and thus have a clearer understanding of how much additional training we can afford to offer, we will likely reach out to the County to discuss whether there is flexibility to continue programming into 2026.

Yolo Food Bank ARP Quarterly Report	
Subrecipient Legal Name:	Yolo Food Bank
Project Title:	High School Student Farmers Market (SFM) Project
Project Period:	May 1, 2024 – December 30, 2024

Quarter 2: Oct 1 – December 31, 2024	**Quarterly (Final) Report Due: 2/28/2025**
Program Lead: Genevieve Pyeatt; 530-668-0690 ext. 123	**Grant Report:** Alex Simmons; 530-668-0690 ext. 504 / grants@yolofoodbank.org
Provided to: berenice.espitia@yolocounty.org	

Description of the Project's Purpose:
The purpose of this project is to pilot Yolo Food Bank's Student Farmers Market (SFM) experience at three high schools in Yolo County. At these markets, YFB will provide free, culturally-appropriate seasonal produce, culinary experience, and nutrition education. Student access to fresh produce will be increased.

Desired Outcomes overall from the project:

- Increase community access to fresh fruits and vegetables.
- Reduce food insecurity in Yolo County.
- Improve nutrition in Yolo County.

How the outcomes are measured:

- Surveys & Evaluations
- Food distribution metrics such as pounds distributed, and number of people served.

Project Quarterly Reporting

Quarter	Activities
October 1 – December 31, 2024	There were two high school SFM events held during this quarter – one at Pioneer High School and one at Woodland Senior High School. At Woodland Senior High, 75 students participated, and at Pioneer High, 100 students participated. A total of 2,748 pounds of locally-sourced, farm-fresh produce was distributed – half the amount to each school. Unfortunately, Winters High School decided that they are not able to participate in this program at this time, so no events were held or food was distributed at Winters HS.

Budget update: As of December 31, 2024, there was a remaining balance of $0.05.

Yolo Food Bank ARP NY Quarterly Reports

Nurture Yolo – An Equitable, Sustainable Local Food System for the Health and Wellness of All Yolo County Residents.

February 28, 2025 (October-December report)

Subrecipient Legal Name:	Yolo Food Bank, a California nonprofit public benefit corporation
Project Title:	Nurture Yolo – An Equitable, Sustainable Local Food System for the Health and Wellness of All Yolo County Residents.
Project Period:	May 1, 2022- December 31, 2025

Program Lead: Genevieve Pyeatt, 530-668-0690 ext. 123	**Grant Report:** Alex Simmons, Grants@yolofoodbank.org
Provided To: Berenice Espitia	berenice.espitia@yolocounty.org

Description of the Project's Purpose:
The purpose of this project is to assist Yolo Food Bank in addressing continued need for related support across Yolo County, particularly related to job loss, underemployment, and cost of food related to the COVID-19 crisis. Yolo Food Bank will reinforce the distribution system including the purchase of fixed assets or equipment to increase or sustain enhanced food distribution, food materials, salaries and overhead to support Countywide distribution. This project will sustain and increase current food security in Yolo County, by the continued development of an equitable, sustainable local food system to address these issues.

Desired Outcomes overall from the project:

- Sustain and/or increase number of program recipients
- Sustain and/or increase number of pounds provided

How the outcomes are measured:

- Surveys and evaluations
- Metrics such as pounds of food distributed and number of people served

Program information

- **Public Community Food Distributions (formerly Eat Well Yolo)** - An Equitable, Sustainable Local Food System for the Health and Wellness of Yolo County Residents. This program was recently rebranded to the new name "Public Community Food Distributions".
- **Private Community Food Distributions (formerly Eat Home Yolo)** - Our Private Community Food Distributions deliver groceries to immunocompromised, elderly, or mobility restricted neighbors. This program was recently rebranded to the new name "Private Community Food Distributions".
- **Student Farmers Market (formerly Kids Farmers Market)** - This program provides elementary school children access to local produce and nutrition education. Students enjoy fruits and

vegetables procured directly from local farmers in the area. This program was recently rebranded to the new name “Student Farmers Market” (SFM).

Project Quarterly Reporting

Quarter	Activities	Tools for Measurement
October 1, 2024 – December 31, 2024	● During this quarter we distributed 1,287,739 lbs. of edible food through our **Public Community Food Distributions** and served 33,260 households (duplicated data). ● Through our **Private Community Food Distributions**, we distributed 107,390 lbs. of edible food to 2,788 households (duplicated data). ● During this period, we held a total of 118 **Student Farmers Market** events, and at these events we distributed 68,389 lbs. of edible food.	● Primarius software was used to track pounds of food coming in and going out in each of our programs. We use sign in sheets at our distributions to track households served. ● We use sign in sheets at our distributions to track households served.

Yolo Food Hub Network

October 1, 2024-December 31, 2024

9th quarter report

Program lead and contact information				
James Durst, (530)681-6578, jdurst@durstorganicgrowers.com				
Program purpose and statement				
New Season Community Development Corporation (NSCDC), in parnership with a consortium of private and public/non-profit groups, is creating a regional Food Hub Network that will strengthen local food supply chains, mitigate pandemic-related market disruptions for local consumers, promote resiliency and cooperation among Yolo County farmers by allowing them to more flexibly manage and extend market channels during recovery and meet the needs of institutional buyers, wholesale buyers, and retail seeking to purchase locallly grown food.				
Performance measures Framework	**Outcome measure**	**Data Collection Method**	**Data Tracking Frequency**	**Outcome Link to ARP Narrative**
What did we do during quarter 9	ongoing planning and reporting meetings held by YFH steering committee to include New Season, Valley Vision, Capay Farm Shop, Spork Food Hub, Durst Organic Growers, and Lon Hatamiya.		ongoing	On going planning meetings with YFH partners, mainly Valley Vision, New Season, Capay Farm Shop, and Project manager and architect.
	fundraising committee continues to meet and pursue granting opportunities		ongoing	Facilities: New Season board member Sue Heitman and grantwriter Rebecca Brams hadreceived notice we will be receiving a RFSI grant for construction in October 2024.We were noticed in December that the grant will be postponed due to environmental studies to be performed on all grantees properties. This puts this grant out until at least the summer of 2025. We continue to pursue other grant requests.
	Project Manger and Architect meetings		one time	our architectual firm has been working on the permitting process for the Oakdale Ranch barn. Drawings and engineering have been submitted and under review. In December, our project manager was placed on leave while we await funding.
	Recruiting tenants		one time	Capay Mills is using the Oakdale Ranch site to store equipment and grains supplies on an interim basis for a small monthly charge.No other tenants have been approached while the construction is on hold.
	Project manager		ongoing	Project manager has been placed on leave in December when notification of RFSI grant delays became evident.
	On going meetings with other potential partners		ongoing	Continuing research for YFH operations, fresh cut operations, School Districts participation, and Food Hubs participation.
How well did we do it?	jobs created			
	Jobs created		ongoing	no new jobs were created during this quarter.
	New Season			New Season executive director Sue Heitman has resigned from the New Season ED position and is instead working on the ED duties as a board member. This is a non-paid position
	1 job (grant writer)		ongoing	Rebecca Brams continues to work as a grant writer in conjunction with board member Sue Heitman.

YHHA Contracts

ARP Performance Measures Template				
Purpose Statement: Program will provide expanded food access that includes a social aspect and connection to additional services to low income older adults throughout Yolo County with an emphasis on reaching persons in rural areas.				
Performance Measures Framework	**Outcomes Measure**	**Data Collection Method**	**Data Tracking F**	**Outcome Link to ARP narrative**
How much did we do?	Increase the number of older adults receiving meals and connection to services.	Food truck event sign in sheets and case management reports	Monthly	More older adults will receive prepared meals in a social environment that includes access to connections to additional needed services.
West Sacramento Totals	October 2024 - 122 November 2024- 127 December 2024- 132 ($20/person = $7,620 total)			
Woodland Totals	October 2024 - 51 November 2024- 55 December 2024- 51 ($20/person = $ 3,140 total)			
Esparto Totals	October 2024 - 50 November 2024- 50 December 2024- 55 ($20/person = $3,100 total)			
Davis Totals	October 2024 - 32 November 2024- 34 December 2024- 34 ($20/person = $2,000 total)			
Winters Totals	October 2024 - 52 November 2024- 51 December 2024- 51 ($20/person = $3,080 total)			
Knights Landing Totals	October 2024 - 110 November 2024- 122 December 2024- 120 ($20/person = $7,040 total)			
How well did we do it?	Participants report connection to food and needed services.	Surveys at food truck every 3 months	Quarterly	Surveys will show satisfaction with meals and response to requests for services.
Survey	See attached evaluation.			
Is anyone better off?	More rural older adults will have access to food and services.	Participant mapping.	Monthly	At least 66% of meals delivered will be in rural areas.
Impact Notes	This project is an expansion of our food truck project additionally funded by Agency on Aging-Area 4. Totals list above include blended funding of both Yolo ARP and AAA4. Yolo ARP funds allow us to serve more rural older adults. Each meal includes an educational flyer, examples during this time period include ITIN information, nutritional resources, and cold/flu/Covid health information. Each event includes opportunities for socialization with our staff and volunteers and access to our case manager for connection to services.			

ARP PERFORMANCE PROGRESS REPORT

Title Project:	Galileo Place Adult Day Program
Name of the organization:	Yolo Hospice, Inc., dba YoloCares

Reporting Period: Q2 – October 1, 2024 – December 31, 2024

Purpose/Goal:

Galileo Place is part of YoloCares' Center for Caregiver Support (CCS), established as part of YoloCares in 2022. However, CCS's roots stem from "Citizens Who Care," a 50-year-old Yolo County nonprofit that merged into YoloCares in 2018. Funding from Yolo County will ensure that low-income families receive caregiver respite services provided by Galileo Place adult day program.

Progress Report:

- Key Project Updates: In Q2, Galileo Place continued to serve low-income families with daily respite care at Galileo Place. An example of the profound impact of the program is the following letters from the loved ones of two different participants:
    - My name is Melissa, and I am writing this letter to express my gratitude not only for Galileo Place and its staff and volunteers but also and especially the grant that makes it possible for my mom to attend this amazing program. My mom has a very limited income, but just dollars over the amount that qualifies her for any kind of government assistance. My brother is a stay home dad with a busy schedule and I work part time as well as helping to care for our father and my in-laws who are also aging and living in Davis. We do not have the time nor financial resources to properly provide care for my mom, but we both know that she was not getting what she needed, nor did we have any ideas as to what to do about it. After the worst part of COVID was past, my brother Rob and I realized that Mom was very isolated at home and that her health and memory were declining rapidly as a result. We had been trying, to no avail, to get her back to some of her pre-COVID activities like church, volunteering, swimming and meeting with her (few) friends. We did not know how to help her, and we knew time was slipping away as Mom declined. A friend of mine had toured Galileo Place and thought it might be a nice fit for Mom as there was a scholarship program and it was for folks in the earlier stages of memory loss with the goal of keeping them at home longer-which is just what we needed! I went over to visit Galileo Place myself after speaking with Louise Joyce on the phone and could not believe that mom might actually be able to attend such a well-designed and thought-out program. As I went through the many steps, appointments and paperwork to get Mom eligible to participate, Louise continued to encourage me to keep working on the application as she felt it would really benefit Mom, and finally the day came for her to try it out. Though Mom was a little unsure of going at first, she really was made to feel welcome and wanted there. Everyone made an

effort to know what she would enjoy and before long we noticed the days she went to Galileo Place she was much better at getting herself ready to go! Fast forward to the present and Rob and I agree this is the best thing that could have happened to our family, especially Mom! Instead of spending long days alone with the TV and a book, she now comes to the day program at Galileo 3x/week. We have developed a very nice routine, and we can ask about her day and what she did. She looks forward to days at Galileo Place. She now has people that she recognizes and interacts with regularly. She particularly enjoys the garden and bike rides. The decline of memory and physical fitness seems to have flattened out to a degree, and we fervently hope it keeps this pattern for a long time. Knowing that she is safe and interacting with others as well as doing activities that engage the mind is a huge comfort and relief as well. We absolutely believe that Galileo Place has changed Mom's life for the better, and ours as well. With sincere gratitude, Melissa Collier and Rob Blankenship Judi Williams' children

- Dear Ms. Joyce, I wanted to share with you and your donors how impactful your scholarship to attend Galileo Place has been for me and my brother, Rey Anthony. My brother has been living with multiple sclerosis and bi-polar disorder for three decades. It's challenging caring for someone with a physical and mental illness. The hardest part is remembering how to care for the whole person, and this is exactly what Galileo Place excels at. I am fortunate to have an extended family to help me care for my brother, but we live in different counties. This presents financial challenges because my brother's programs are county-based, so when he stays with me, I need to pay out-of-pocket to provide the same level of services my brother uses in Monterey County. When I was in search of a day program for my brother, I was drawn to Galileo Place because it was a beautiful, inviting space that felt like a refuge. Only, I couldn't afford to send Rey Anthony to Galileo Place on a daily basis. I had bookmarked the program as a "wish list," something that would be nice to have, but not realistic. So, when you contacted me to let me know that you had secured grant money for my brother to attend, I felt like I had won the lottery. Without Galileo Place, Rey Anthony would be isolated and spend most of his time sitting alone and playing on his phone. When I ask my brother about what he likes about Galileo Place he immediately says, "The people. I like being around them and talking to them." His favorite activity aside from talking to his fellow participants is taking a bike ride and enjoying the views of Davis. He also enjoys baking so he can eat his handiwork. From my perspective, I see how Rey Anthony lights up when he comes to the program. He smiles easily and I'm overcome with gratitude on what Galileo Place gets so right: attending to human connection and making everyone feel welcome and seen. When I asked Rey Anthony how Galileo Place makes him feel, he answered "It makes me feel hopeful." And that's probably the greatest gift you can give to anyone. Thank you for your generosity and giving the gift of hope to my brother. Gratefully, Liza Osoteo

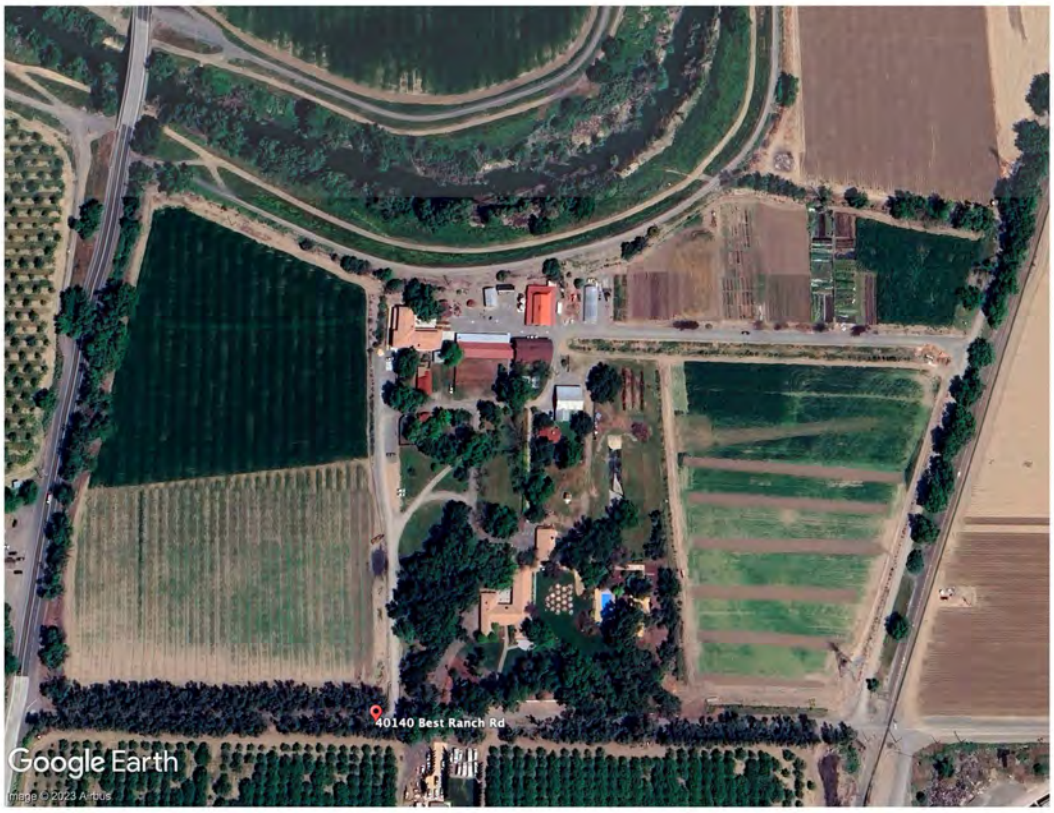
- ARP Performance Measures (from contract): In Q2, 9 individual clients were served with 430 total days of service provided. $44,335 of funding was spent for these services. Personnel costs reflect 25% of total personnel budget of $75,000 for the full grant period.
- Challenges (if applicable): The overriding challenge is that this grant is coming to an end, and we do not yet have replacement funding secured to continue to serve the 9-10 clients who have come to count on YoloCares. We are searching for funding that will allow these elders to continue to receive the excellent care they had in 2024, but funding has so far been elusive. We also continue to struggle with transportation as a major barrier to nearly everyone not living in Davis.

Budget:

Budget Line Item (from the scope of work)	Current Period Expenditures	Previous Period Expenditures
Personnel	$18,750	$18,750
Direct Services/480 Days Care provided	$41,570	$44,335
Total Expenditures	$60,320	$49,495

Carbon Farm Plan

The Maples Farm



Prepared by:

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In collaboration with:

The Yolo Carbon Farming Partnership
June 2023

CENTER FOR LAND-BASED LEARNING
The Maples Farm

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Table of Contents

Tables and Figures

Introduction

Guide to document acronyms and abbreviations:

BIPOC – Black, Indigenous and People of Color
BOS - Board of Supervisors
CAAP – Climate Action and Adaptation Plan
CFP – Carbon Farm Plan
CCI – Carbon Cycle Institute
CLBL – Center for Land-Based Learning
CO2 - Carbon dioxide
CO2e - "carbon dioxide equivalent," a measurement of the total greenhouse gasses emitted, expressed in terms of the equivalent measurement of carbon dioxide.
GHG – Greenhouse gas
MT - Metric ton
NRCS – Natural Resources Conservation Service
SOC - Soil organic carbon
SOM - Soil organic matter
USFWS - United States Fish and Wildlife Service
YCCAC - Yolo County Climate Action Commission
Yolo RCD – Yolo County Resource Conservation District
YLT – Yolo Land Trust

The Center for Land-Based Learning

The Center for Land-Based Learning is a non-profit organization with a mission to inspire, educate, and cultivate future generations of farmers, agricultural leaders, and natural resources stewards. It began in 1993 with the FARMS Leadership program for high school students and has since grown to include multiple youth programs and a California Farm Academy (CFA) with a suite of training and outreach programs for prospective farmers. CFA programs include a farm business incubator program, a 7-month new farmer training course, an introductory training course, and an apprenticeship program for future farm managers. CLBL's farm "campuses" include Maples Farm and several small urban farms in West Sacramento. Produce grown on these farms supplies our Mobile Farmers' Market truck which makes regular stops at low-income communities in West Sacramento. A second Mobile Farmers Market truck will provide a similar service in Woodland beginning in June 2024.

CLBL's statewide diverse youth programs, including FARMS and SLEWS, allow high school students to explore and experience a variety of careers and college pathways in the fields of agriculture and environmental sciences. Since 2001, over 8000 students in the SLEWS program have planted over 140 miles of hedgerows, over 300,000 native grass plugs, and 80,000 trees.

CLBL's Farm and Climate Program addresses the dual challenges of climate change and declining biodiversity by promoting measures that increase the rate at which CO2 and other greenhouse gasses are sequestered in agricultural soils while improving other measures of ecological health such as native habitat, biodiversity, and drought resilience. The Yolo Carbon Farming Partnership is one of our flagship initiatives.

The Yolo Carbon Farming Partnership

Yolo County has been a leader in agricultural land conservation for decades and is poised to become a leader in climate change mitigation as well. In 2020, the Yolo County Board of Supervisors passed an emergency resolution declaring a climate emergency and calling for an urgent mobilization of resources to initiate a just transition to an inclusive, equitable, sustainable, and resilient economy. With 85 percent of Yolo County lands designated for agricultural use, farm and ranch lands are arguably our most valuable resource for increasing carbon sequestration and mitigating climate change.

In response to the emergency declaration, the County formed the Yolo County Climate Action Commission in 2021 which identified a set of Early Action projects that could be implemented in the short-term while preparing a new Climate Action and Adaptation Plan (CAAP). The Yolo Carbon Farming Partnership, a collaborative effort between the Center for Land-Based Learning, the Yolo County Resource Conservation District, the Carbon Cycle Institute, Yolo Land Trust, and the County, is one of those Early Actions. The Partnership is working to rapidly increase the pace and scale of Carbon Farming and carbon sequestration in Yolo County over the next two years by delivering:

- 3 Carbon Farm Plans that can serve as models to Yolo County growers
- Training workshops on carbon farm planning and climate-beneficial practices tailored to Yolo County growers
- A replicable training curriculum in English and Spanish

What is Carbon Farming?

The term "carbon farming" refers to proven and measurable practices that increase the rate at which CO_2 and other greenhouse gasses (GHG) are removed from the atmosphere and stored over the long term in soil and plant material. Technically, all farming is "carbon farming," because all agricultural production depends on photosynthesis to move CO_2 out of the

atmosphere and into plants, where it is transformed into products like food, flora, fuel or fiber. Carbon entering the farm from the atmosphere can end up in several locations: in the harvested portion of the crop, in the soil as root exudates and soil organic matter (SOM), in "waste" materials such as compost or manure, in standing carbon stocks, such as grassland vegetation or woody perennials (trees, vines, orchards, etc.), or in other permanent vegetation such as windbreaks, vegetated filter strips, or riparian forests and woodlands.

While all farming is completely dependent upon atmospheric CO_2, different farming practices, and different farm systems, can lead to very different amounts of on-farm carbon capture and storage. The Carbon Farm Planning (CFP) process differs from other approaches to land use planning by focusing on increasing the capacity of the farm to capture carbon and to store it beneficially; in the crop, as standing carbon stocks in permanent vegetation, and/or as SOM.

While agricultural practices often lead to a gradual loss of carbon from the farm system, a CFP is successful when it leads to a net increase in farm-system carbon. By increasing the amount of photosynthetically captured carbon stored, or "sequestered," in long-term carbon pools on the farm, carbon farming results in a direct reduction in the amount of CO_2 in the atmosphere, while supporting crop production and farm resilience to environmental stress, including flood and drought.

On-farm carbon in all its forms (SOM, perennial and annual herbaceous vegetation, plant roots, root exudates, and standing woody biomass), contains energy, which originated as the solar energy used by the plants in photosynthesis. The carbon in plants and SOM can thus be understood as the embodied solar energy that drives on-farm processes, including the essential soil ecological processes that determine water and nutrient holding capacity and availability for the growing crop. Consequently, CFP places carbon at the center of the planning process and views carbon as the single most important element, upon which all other on-farm processes depend (Figure 1).

The Carbon Farm Planning Process

A carbon farm plan is a living document through which a landowner or land manager identifies and evaluates the range of carbon-beneficial practices that make sense for a particular farm, ranch, company, or and/or family. Carbon Farm Planning is based upon the USDA NRCS Conservation Planning process, but uses carbon and carbon capture as the organizing principle around which the plan is constructed. This simplifies the planning process and connects on-farm practices directly with ecosystem processes, including climate change mitigation and increases in on-farm climate resilience, water holding capacity, soil health and biodiversity.

Like NRCS Conservation Planning, a CFP begins with a conversation with the land manager or owner and an overall inventory of natural resource conditions on the property. Unlike the classic NRCS conservation planning process, however, the focus is on identification of all on-farm opportunities for reduction of greenhouse gas emissions and enhanced carbon capture and storage by both plants and soil. Enhancing working land carbon, whether in plants or soils, results in beneficial changes in a wide array of system attributes, including; water holding capacity of soil and hydrological function, biodiversity, soil fertility, and resilience to drought and flood, along with increasing agricultural productivity.

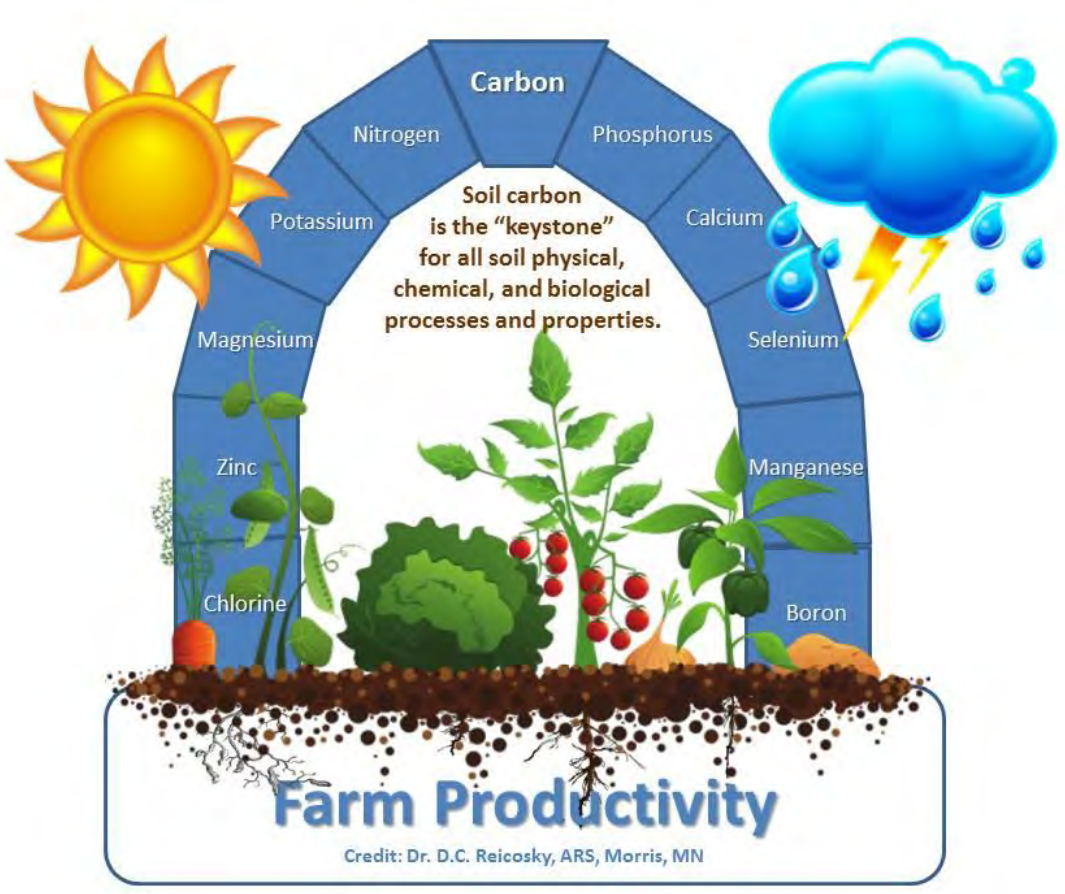

Figure 1. Carbon as the Key to Working Land Productivity and Resilience

History of Maples Farm

CLBL relocated its headquarters to Maples Farm in May of 2020. Located on 50 acres, the site includes 20 acres of prime farmland just north of the City of Woodland. The farm is bordered by a ¼ mile reach of Cache Creek to the north, which provides significant habitat value and carbon sequestration potential.

The property is owned by the Clark Collective which leases the land to CLBL through a long-term (25+ years) lease.

The Maples Farm was part of the Rancho Rio de Jesus Maria, a 26,637 acre Mexican land grant given in 1843 by Governor Manuel Micheltorena to Thomas M. Hardy. The name refers to Rio de Jesus Maria, now known as Cache Creek. In the late 1870s, the land known then and now as "The Maples" was purchased by Benjamin and Sophia Peart. The Pearts built a race track near Cache Creek in what we now call the Northeast field and also planted the majestic olive trees that line the main driveway. The land was sold to Camelia Nelson who ran a cattle and grain company that was later taken over by his son CQ Nelson who raised trotting horses. Eventually the land was sold to the Best Family which raised some of the finest 5 gaited horses in the area. For many years, the Best Family and their descendants ran short-horned cows in the pasture lands.

The property was purchased by Bob and Don Clark of Clark Pacific in 2010, who restored a portion of the property to be the Maples event center and leased the farmland to Rich and Steve Weiss who grew sunflower, alfalfa and other annual crops.

Current Land Use

The NRCS Conservation Plan for Maples Farm (2020) delineates five land units (fields 4 - 8) at the farm. However, for the purposes of this plan, the farmland at Maples is broken into six main fields/areas, according to their current and planned use (Table 1 and Figure 2)

Table 1. Current and planned land use Maples Farm fields

Field name	Land Unit	acres	Land use prior to CLBL (2011 - 2020)	Current/planned use
Southwest	7	5	alfalfa	Olive orchard/biochar research
Northwest	7	6	alfalfa	Incubator farmers/orchard
Northeast	4	3	pasture cover crop 2018-2020	Incubator farmers and training plot
Southeast	5	6	sunflower seed crop 2017-2018 Cover crop	Incubator farmers/grain
Riparian	8	11	Arundo treated in 2021-2	Cache creek riparian habitat
Human use	6	1.5	Construction completed 2020	Office building, barns, parking

Figure 2. Maples Farm main fields and riparian zone

Approximately 14 acres at Maples Farm is designated for incubator farmers who lease land to grow their nascent agricultural ventures. These farmers may lease from ¼ acre to 1 acre and can stay in the program for up to four years. They make all the decisions related to their operations including nutrient management, irrigation, weed control, crops grown, harvesting, and marketing. They are required to utilize cover cropping if fields are bare. To date, incubator farmers have grown mixed vegetables, cut flowers, heirloom grains, and mushrooms.

One acre at Maples Farm is dedicated to the new farmer training program, where trainees learn how to create beds, propagate plants, grow crops, harvest, and develop business plans. The remaining farmland (approximately 5 acres) has been converted to an olive orchard and research site for a CDFA Healthy Soils demonstration grant. Additional orchard crops or other perennial crops are also being considered in the Northwest and Southeast fields as well.

Maples Farm includes extensive "farm edges," many of which have already been planted with hedgerows and pollinator plantings. Some of these hedgerows include a native grass understory (i.e. conservation cover) and some are mulched with straw and/or wood chips.

Finally, Maples Farm features a 0.06 acre native grass demonstration garden showcasing 12 species (11 grasses and 1 sedge) commonly used in restoration projects.

Buildings on site include CLBL's 5400 square foot headquarters building, a large historic barn, a wash-and-pack facility for the incubator program, a welding barn, and two additional small outbuildings.

Farm Goals and Objectives

1. Transform Maples Farm into an innovation hub to demonstrate carbon-beneficial practices to other growers, agricultural leaders, students, and the general public
2. Implement hedgerows and/or windbreaks on all field edges with specific attention to pollinator species
3. Increase soil organic matter compared to baseline in all farm fields and habitat sites
4. Successfully complete a CDFA Healthy Soils Demonstration project using biochar and compost in our planned olive orchard and share findings with other growers through field days and social media.
5. Restore 5 acres of riparian habitat on Cache Creek and recruit neighboring landowners to restore additional sections of the creek.
6. Maintain cover cropping and compost applications to the extent practicable on all crop and orchard fields
7. Explore alley cropping or other perennial crops in the Northwest, Southwest, and Southeast fields.
8. Continue to partner with CDFA's Healthy Soils Program, NRCS's EQIP program and agricultural ventures to develop new demonstration projects as opportunities arise.
9. Minimize tillage
10. Incorporate research findings and highlight carbon beneficial practices in CLBL's youth programs and Farm Academy training programs for beginning farmers and apprentices.
11. Share information and data about deep-rooted native perennial grasses through our Native Grass Demonstration Garden and hedgerow projects that incorporate conservation cover.
12. Partner with Yocha Dehe Wintun Nation and other indigenous peoples to showcase native land management practices through workshops and site tours.

Current Land Use and Resource Inventory

Climate and Topography

Located at the southern end of the Sacramento Valley, Maples Farm enjoys a Mediterranean climate with hot dry summers and cool wet winters. Woodland gets an average of 20 inches of rain a year and no snow, with approximately 67 days with precipitation each year. Temperatures range from summer highs of 94°F and winter lows of 39°F and are rarely below 30°F or above 102°F. Like the surrounding area, Maples Farm experiences occasional strong winds, especially between January and September with average wind speeds of more than 6.5 mph. July is typically the windiest month with an average hourly wind speed of 7.1 mph. Intense hot dry north winds in excess of 30 mph are not uncommon in summer months.

The elevation at Maples Farm is 59 feet above sea level and the topography is flat.

Soils

According to the NRCS Web Soil Survey, the majority of soil at Maples Farm is Reiff very fine sandy loam (Ra) with the riparian soils composed of riverwash (Rh) (See Figure 3). The full Web Soil Survey report is given in Appendix 4.

The primary goal of this Carbon Farm Plan is to increase soil organic matter throughout Maples Farm. Consequently, measuring and monitoring soil carbon according to a consistent protocol over time is very important. CLBL developed a soil monitoring protocol based on available sources. The full protocol is given in Appendix 3.

CLBL took baseline samples of soil organic carbon (SOC) in all of its fields and most of the current habitat projects in November 2021 We also took baseline samples specifically for the biochar and compost demonstration project in December 2022. We measured SOC using the dry combustion method, which is considered more accurate than the loss on ignition method. Soil samples were analyzed by Ward Labs. The results of these soil tests are shown in Tables 2a and 2b. Soil organic matter (SOM) is calculated as 1.72 times the SOC measurement (Sullivan et. al 2019).

Figure 3. Soil Map (USDA Web Soil Survey)

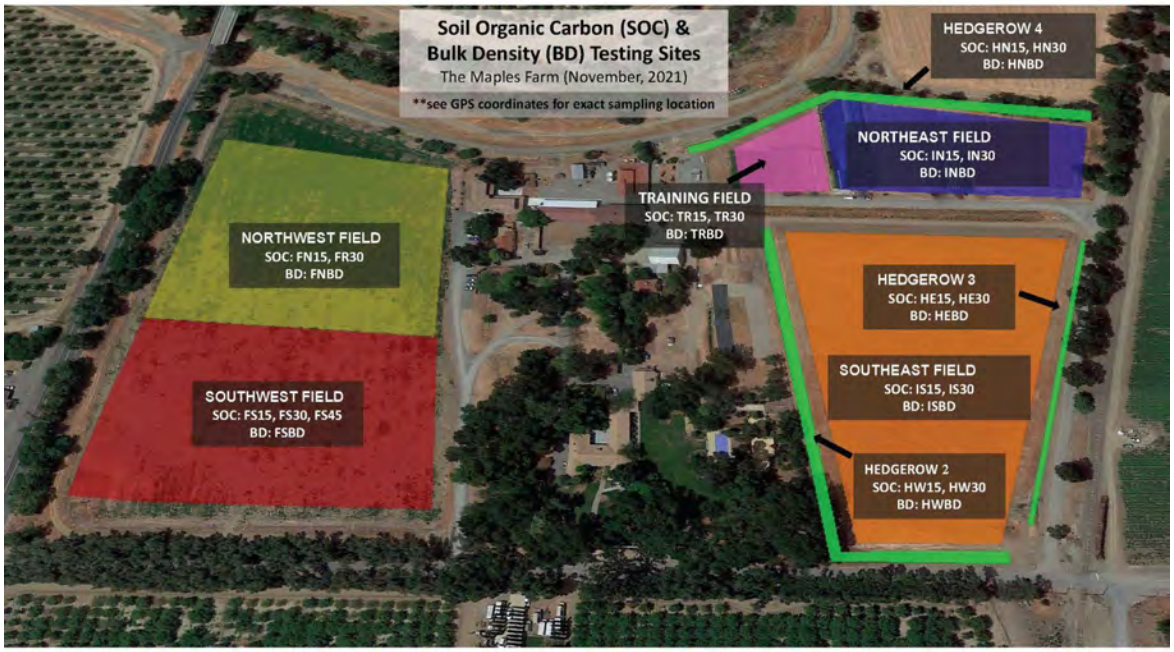

Figure 4. Soil Sampling Locations

Table 2a. Soil organic carbon (SOC), soil organic matter (SOM) and bulk density in Maples Farm fields (sampled November 2021)

Field	acres	bulk density g/L	depth cm	SOC %	SOM* %	Notes
South west	5	338.98	15	.996	1.71	Olive orchard field.
			30	.971	1.67	
North west	6	284.23	15	.977	1.68	Future incubator plots
			30	.864	1.49	
North east a	2	222.6	15	1.77	3.04	Current Incubator plots, sampled separately from the training field (see below)
			30	1.23	2.12	
North east b	1	247.18	15	2.406	4.14	Current training field, sampled separately from the incubator plots (see above)
			30	1.853	3.19	
South east	6		15	1.243	2.14	Current incubator plots and 4 acre grain field
			30	.889	1.53	

*SOM is calculated as 1.72 times the SOC measurement (Sullivan et. al 2019).

Table 2b. Soil organic carbon (SOC), soil organic matter (SOM) and bulk density at Maples Farm habitat projects (November 2021)

Field	linear feet/ acres	bulk density g/L	depth cm	SOC %	SOM* %	Notes
HR1 (2 row)	1400					"Bioswale". Planted fall/winter 2020 but no soil samples taken
HR2 (1 row)	910	291.24	15	1.277	2.2	Planted winter 2020/21. Single row hedgerow with conservation cover
			30	.531	0.96	
HR3	680	295.33	15	1.255	2.16	Planted January 2022. Single row

(1 row)			30	0.936	1.61	hedgerow with wood mulch.
HR4 (2-3 row)	1860	288.28	15	1.385	2.38	Planted Feb-March 2022. 2-3 row hedgerow mulched with rice straw, native grass straw and woodchips.
			30	1.037	1.78	
Native grass garden	0.06 acre		15	2.406	4.14	Planted Feb 2022. Data are from the training field samples, which are very close to the Garden. Management of both areas was the same so we expect the results would be similar
			30	1.853	3.19	

*SOM is calculated as 1.72 times the SOC measurement (Sullivan et al, 2019).
**Linear feet is calculated as the sum of rows within the hedgerow.

Our target soil organic matter across the farm is 5%, which is considered at the higher end of SOM in productive agricultural soils. One percent is considered very low while 2-4% is considered average (Biernbaum, 2012). All of the practices in this Carbon Farm Plan will support this goal.

The results of these baseline soil samples show that the northeast field, which contains our training program plot and incubator farmers has the highest SOM on the farm at 4% and 3% respectively. This is not surprising considering these fields have been treated with compost application at a rate of 20 tons per acre each year on average since 2020. The south east field is lower at 2% SOM. The lowest soil organic matter measurements were taken in the northwest field and the southwest field at 1.7% SOM. Prior to planting the olive orchard, this field was farmed for alfalfa.

According to this Carbon Farm Plan, all of the fields will continue to receive compost treatments and cover cropping. We also expect that SOM in the southwest field will increase as the olive orchard matures. Consistent monitoring of soil organic matter over time will demonstrate the effectiveness of these measures (see Appendix 3 for CLBL's soil sampling protocol).

Wildlife

Wildlife seen at Maples Farm is in large part influenced by the wildlife corridor of Cache Creek, which offers significant habitat value. CLBL has been documenting wildlife's use of the farm and surrounding areas using wildlife cameras, bird surveys, and pollinator monitoring. Wildlife regularly documented by our wildlife cameras includes bobcats, coyotes, mule deer, jack rabbits, brush rabbits, and raccoons. Additional results of this monitoring are listed in Appendix 2.

Wildlife cameras at Maples Farm document use of hedgerows by bobcats and coyotes

Riparian habitat and other native flora

Cache Creek borders the north side of Maples Farm for about ¼ mile, providing approximately 11 acres of native riparian habitat. The creek is deeply incised and banks are steep, but a significant stand of native woody vegetation remains on site. The overstory is dominated by Fremont cottonwood and valley oak. Understory shrubs include blue elderberry, California wild rose, coffeeberry, and wild grape. The herbaceous understory is dominated by non-native annual grasses and forbs including slender wild oat, Italian ryegrass, foxtail barley, soft chess, wild radish, field mustard, and milk thistle. Native herbaceous plants in the understory include mugwort, common fiddleneck and wild cucumber. The site is also invaded by giant reed and tamarisk. Most of the giant reed was treated in 2020-2022 through the Yolo RCD's Putah-Cache Creek Arundo removal project but will need follow-up treatment of resprouts. The tamarisk has not been treated to date, but will be as part of riparian restoration. Some of the native species found at the creek are also found in scattered small stands throughout the farm, especially elderberry, valley oak, coast live oak and black walnut.

Resource concerns

The primary resource concern with respect to this Carbon Farm Plan is the relatively low levels of soil organic matter in our farm fields, as measured by tests for soil organic carbon. Our southwest and northwest fields had the lowest levels of SOM while the northeast field had the highest levels. This disparity is likely due to the fact that compost has been added to the northeast field at a rate of approximately 20 tons/acre since 2020 through our incubator and training programs. As we implement more composting and cover cropping in all of the fields, as well as installing an olive orchard, we expect overall SOM numbers to increase.

Another resource concern is soil erosion due to wind. Maples Farm experiences occasional strong winds, especially between January and September with average wind speeds of more than 6.5 mph.

During high rain events, the southwest corner of our southwest field drains poorly and experiences significant ponding. We are considering installing a seasonal wildlife pond to capture some of that run-off. The installation of the olive orchard may also improve drainage.

The riparian area on Cache Creek supports a narrow band of native riparian trees along the creek itself. Giant reed (*Arundo donax*) has been treated by the Yolo RCD's Putah-Cache Creek Arundo Eradication project, however a significant amount of invasive tamarisk remains. The upper bank is heavily invaded by non-native annual grasses and forbs and there is little understory vegetation associated with the riparian forest. This results in significant erosion during high flow events.

Finally, we are aiming to increase on-farm biodiversity through a range of conservation practices. Because of proximity to Cache Creek, we have documented a fairly wide range of animal species on the farm (see appendix 2). We have added nest boxes for songbirds and installed two barn owl boxes to help control rodents. We upload data about the nest box success to the Cornell Lab of Ornithology's Nest Watch website. To date, however, we have little data on the diversity of pollinators at our farm. Consequently, we have deployed the Xerces Society's Streamlined Monitoring Protocol for Assessing Pollinator Habitat in several of our hedgerows to track numbers of native bees compared to honey bees. We are also monitoring one of our hedgerows (HR1) for monarch butterfly habitat.

Existing and historical carbon beneficial practices

Installation of carbon-beneficial practices at Maples Farm began even before the organization relocated to its new headquarters in May 2020. To mitigate flood risk due to the new construction, CLBL was required to install a large flood water retention basin. Funding from the USFWS and the Xerces Society allowed CLBL to install pollinator hedgerows and conservation cover on both sides of the swale. This early project became known as the "bioswale" (photo, right). In 2021 and 2022, CLBL installed additional hedgerows on three sides of the Southeast field as well as the north side of the Northeast field.

As soon as CLBL took over management of the farm fields, it planted cover crops in all of the fields except the Southwest and Northwest fields which were leased to an alfalfa grower until spring of 2021. Cover crops were added to the Northwest field in fall 2022. Finally, CLBL installed an olive orchard in the SW field and will be tracking changes in soil carbon and other measures of soil health.

CLBL began implementing cover cropping in 2019

CLBL is currently conducting research in the olive orchard on biochar and compost as part of the CDFA Healthy Soils demonstration project. Existing practices are shown in Table 3.

Because CLBL leases part of its fields to participants in the Farm Business Incubator Program, it does not have total control over agricultural practices. Rather, the individual incubator farmers are encouraged to practice cultivation methods that maximize soil health. To date, all of the incubator farmers have added compost to their fields and they are required to plant a cover crop if the field is expected to be fallow during the winter.

Compost is applied in CLBL's training field (far right).

Native grass garden (right).

Table 3. Current carbon-beneficial practices at Maples Farm

Practices already implemented (NRCS CPS #)	Field and acres or linear ft	Description	Co-Benefits
Compost Application (336) - Training field 1 acre - Incubator fields 2 acres	NE field 3 acres	Actual application rates vary by incubator farmer.	Improved water holding capacity, soil quality and fertility, net primary productivity and forage production.
- Cover cropping (340) - Training field (1 acre) - Incubator Phase 1 (2 acres) - Incubator Phase 2 (6 acres) - Incubator Phase 3 (6 acres)	NW, NE and SE fields 15 acres	Cover cropping practices vary by incubator farmer. This estimate assumes all available fields are cover cropped every year	Decrease soil erosion from wind and water, better rainwater infiltration, and wildlife habitat
Hedgerows (422) HR1 2 row 1400 ft HR2 single row 925 ft HR3 single row 680 ft HR4 2-3 row 1860 ft -	NE, SE fields 4865 ft	Plant selection follows NRCS guidelines so that bloom time is staggered across the year. The bioswale (HR1) and HR2 utilized Xerces Society pollinator plant kits.	Wildlife habitat, pollinator habitat, carbon sequestration, improve microclimate stabilize soils, improve water quality, and reduce water loss.
Conservation cover (herbaceous understory) (327) HR1, HR2, portions of HR4, HR 5, native grass garden	NE, SE fields 2.2 acres	Native grasses were seeded in conjunction with two hedgerows and in preparation for a future hedgerow. Width of the seedings ranges from 10 to 20 feet	Stabilize soils and stream banks and channels, water capture, soil moisture and organic matter, wildlife habitat structural and species diversity
Mulching (484) HR3 and HR4	SE and NE 0.65 acres	Applied wood chips to mulch east hedgerow (HR3) and HR4. Mulch is 8 inches deep.	Improved efficiency of water. Improved plant productivity and health. Decreased soil erosion. Increased soil organic matter.
Olive orchard	SW field 5 acres	CLBL planted 777 olive trees in June 2023. The orchard is the site of our CDFA Healthy Soil Demonstration project looking at the effects of biochar and compost	Improved wildlife habitat, carbon sequestration, improved microclimate, stabilize soils, improve water quality, and reduce water loss.

Planned and Prospective Carbon-Beneficial Practices

Opportunities for carbon sequestration at Maples Farm have been identified and described below by NRCS Conservation Practice for agroforestry systems, the riparian system, and cropland systems. We used the CDFA Healthy Soils version of Comet Planner (www.comet-planner-cdfahsp.com), accessed in 2023, to calculate the sequestration benefits of these practices. The GHG benefits are shown in Tables 7a - 7c and discussed below for the individual practices.

Agroforestry systems

Agroforestry is the practice of integrating trees and woody shrubs into crop and animal production systems. Agroforestry practices can: increase on-farm biological and structural diversity; help control pests by providing habitat for beneficial insects and birds; protect crops and livestock by creating microclimates to reduce cold and heat stress on animals by providing shade and shelter; slow runoff to reduce flooding, soil erosion, and water pollution while increasing water infiltration; reduce crop evapotranspiration by reducing wind speed; and provide multiple products, including forage, fruit, nuts, timber, fence posts and wildlife habitat (Table 6).

Agroforestry practices currently in place or under consideration at Maples Farm include: hedgerows, a windbreak, tree and shrub establishment (olive orchard), and alley cropping.

Hedgerows (CPS 422)

Hedgerows are single or multiple rows of woody and semi-woody vegetation planted in linear configurations, usually along field edges. These plantings can increase carbon storage in biomass and soils, reduce soil erosion and loss of soil moisture from wind, protect infrastructure, pastures and crops from wind and sun-related damage, improve the microclimate for buildings and plant growth, provide shelter for livestock, enhance wildlife habitat, provide noise and visual screens, improve irrigation efficiency, and increase biodiversity. Hedgerows can provide habitat for a wide variety of native wildlife, including nectar and host plants for native pollinators and other beneficial insects. To date, CLBL has installed 4 hedgerows of varying length and width and plans to install 4 more (see Table 4 and Figure 5).

The species mix chosen for the hedgerow is based on NRCS guidelines to ensure there are some trees, shrubs, or forbs blooming throughout the year. Each hedgerow varies slightly in its planting palette due to site conditions. A master list of hedgerow species is shown in

CLBL hedgerows support several species of milkweed which serve as host plants for monarch butterfly caterpillars.

Appendix 1. All of our hedgerow plantings have been augmented by "pollinator kits" from the Xerces Society to provide a suite of pollinator friendly species, especially milkweed. These milkweeds began attracting monarch butterflies the same year they were planted (photo, above right). Four new hedgerows will be installed in fall-winter 2023, also augmented by Xerces kits.

Table 4 and Figure 5 show all implemented and planned hedgerows and one windbreak (HR7). Once all the hedgerows have been planted at Maples Farm, the total CO2e sequestered is estimated to be 16 MT annually and 320 MT CO2e over twenty years (see Tables 7a-7c).

Windbreak (CPS 380)

Like the surrounding area, Maples Farm experiences occasional strong winds, especially between January and September with average wind speeds of more than 6.5 mph. July is typically the windiest month with an average wind speed of 7.1 mph. Intense, hot dry north winds in excess of 30 mph are not uncommon in summer months.

Windbreaks differ from hedgerow plantings primarily in their objective, but also in structure and design. The objectives of a windbreak are to reduce soil erosion from wind, enhance plant health and productivity by protecting plants from wind-related damage, improve moisture management by reducing transpiration and evaporation losses and improving irrigation efficiency. Like hedgerows, windbreaks can increase carbon storage in biomass and soils.

While hedgerows planted for beneficial insects and wildlife habitat can also serve as windbreaks, when planning a windbreak more consideration is given to the location, size, spacing and phenology of the species to maximize their ability to intercept wind. CLBL has added a fourth row to its 2-3 row hedgerow along the north side of the NE field (HR4). These trees (mostly valley oak and coast live oak) are planted in line with existing black walnut trees to widen the hedgerow and when mature, to provide a windbreak. In addition, CLBL is planning a windbreak/hedgerow on the north side of its NW field (HR7). This will be a two row windbreak using native trees and shrubs with an emphasis on evergreen species to maximize wind protection year round.

Because the greenhouse gas benefits of a windbreak as quantified via COMET-Planner are similar to a hedgerow, we have included the windbreak in our hedgerow calculations. The single windbreak at HR7 will sequester 2 MT CO2e in one year and 80 MT over twenty years.

Figure 5. Current (green) and planned (pink) hedgerows at Maples Farm 2023

Table 4. Current and planned hedgerows and windbreak at Maples Farm

#	Rows	Location and description	Date planted	Length*
HR1	2	On the floodwater retention basin between the NE and SE field - the"Bioswale." Low stature shrubs and Xerces Society pollinator kits. Seeded with native grasses and forbs.	Dec 2019	1400 ft.
HR2	1	Along the west and south sides of the SE field. Medium to tall stature trees and shrubs, seeded with native grass.	Jan 2021	925 ft.
HR3	1	On the east side of the SE field. Low statured shrubs and milkweed with some volunteer elderberries. Mulched with wood chips.	Jan 2022	680 ft.
HR4	2-3	On the north side of the NE field. Ranges from a single row section to 2-3 rows with fourth row of oak trees added between existing black walnuts.	Jan-Feb 2022	1860 ft.
HR5	2	On the east side of the NE field. Planned as a two row planting. Seeded with native grasses. Xerces Society pollinator kit.	Dec 2023 planned	440 ft.
HR6	1	On the east side of the NW and SW fields. Low-statured plants with some sycamore trees along the split rail fence. Some plants on the north end were planted in 2020. Xerces Society pollinator kit.	2020 Dec 2023 planned	780 ft.
HR7/ WB	1	On the north side of the NW field. Planned as a windbreak. Will be seeded with native grasses. Xerces Society pollinator kit.	Jan 2024 planned	1072
HR8	2	On west side of SW and NW fields along fence line on Hwy 113. Will be mulched with wood chips. Xerces Society pollinator kit.	Jan 2024 planned	1026 ft.
Total				8183 ft.
	MT CO2e sequestered annually, beginning in 2023**			16
	MT CO2e sequestered by year 20			320

*for multi-row hedgerows, the length is the sum of the total row lengths

** GHG estimates derived from CDFA version of COMET Planner, accessed April, 2023. See also Chiartas, et. al 2022

Tree and shrub establishment - olive orchard (CPS 612)

CLBL has converted a 5 acre field, formerly in alfalfa, into an olive orchard. While tree and shrub establishment is a conservation practice typically associated with establishing native forest, a farm woodlot, or riparian cover, many of the benefits apply to an orchard planting as well. The most significant benefit with respect to a carbon farm plan is the amount of carbon that will be captured and stored by the olive trees. We also expect the orchard to improve water infiltration and water holding capacity in the field.

The olive orchard is part of the CDFA Healthy Soils Demonstration project that is measuring the impacts of using compost and biochar, alone and in combination, on soil health and productivity. The orchard spacing is 20 feet between rows and 14 feet between trees which is considered a medium density planting. The planting density is 155 trees per acre. This medium density will allow CLBL to consider additional conservation practices. If feasible, we will pursue alley cropping (see below) and/or cover cropping between the rows.

Studies of olive orchards have shown that olive trees can sequester a high level of greenhouse gasses (see for example Lopez-Bellido et. al, 2016). According to COMET-Planner, once mature this five acre orchard will sequester an average of 97 MT of CO2e per year and 1940 MT CO2e over twenty years (see Tables 7a and 7c).

Alley cropping (CPS 311)

Alley cropping refers to the planting of trees and shrubs in rows or corridors with alleys of agronomic crops or forage between. CLBL is considering alley cropping in its NW, SW, and SE fields. In the olive orchard (SW field), we are working with a grower of heritage grains to explore the feasibility of growing perennial grains in between the rows of olive trees. Alley cropping is also being considered in the NW field where stone fruit trees or semi-woody herbs such as lavender and rosemary might be planted in rows running from east to west. This alley cropping will yield marketable crops (e.g. chestnuts, stone fruits, herbs) while also providing training opportunities for CLBL's new farmer training course. Alley cropping would also provide an aesthetically pleasing way to delineate fields of individual incubator farmers. The main drawbacks of alley cropping for these purposes is increased time and costs for maintaining the alleys and reduced flexibility in terms of overall field management.

Alley cropping in our 6 acre NW field and 6 acre SE could sequester 10 MT of CO2e annually and 20 MT CO2e over 20 years.

Riparian Systems

Riparian vegetation is not only critical for wildlife and healthy waterways, it is incredibly adept at sequestering CO_2 and other greenhouse gasses due to the presence of long-lived woody vegetation with deep roots. The Center for Biological Diversity estimates that riparian habitats in California could store 325.7 metric tons of carbon per acre in their biomass and soils while accumulating about 0.81 metric tons of carbon per acre per year.

Cache Creek flows from west to east along the northern boundary of Maples Farm. The creek here is contained by levees managed by the Central Valley Flood Control District. The riparian area sequesters significant amounts of carbon through the existing established riparian vegetation. However, the riparian corridor is also invaded by tamarisk, *Arundo* and non-native annual grasses. Carbon beneficial practices CLBL is considering include prescribed burning or prescribed grazing with goats and/or sheep to remove non-native annual grasses, planting riparian shrubs on the upper terrace of the creek, plug planting on the upper banks to reduce erosion, and replacing the non-native annual grasses with perennial native species.

Riparian forest buffer (CPS 391)

A riparian forest buffer consists of trees and shrubs located adjacent to and up-gradient from a watercourse or water body. Along with a riparian herbaceous buffer, this practice reduces transport of sediment to surface water, and reduces transport of pathogens, chemicals and nutrients to surface and groundwater. Riparian forest buffers improve the quantity and quality of terrestrial and aquatic habitat for wildlife, invertebrate species, fish, and other organisms and maintain or increase total carbon stored in soils and/or perennial biomass to reduce atmospheric concentrations of greenhouse gasses. By shading the watercourse, this practice also lowers stream water temperatures to improve habitat for aquatic organisms.

The riparian vegetation along Cache Creek near Maples Farm supports a suite of native riparian tree and shrub species including Fremont cottonwood, valley oak, blue elderberry, wildrose, wild grape, and willow. However, the site is also invaded by giant reed (*Arundo donax*) and tamarisk. Most of the giant reed was treated in 2020-2022 through the Yolo RCD's Putah-Cache Creek Arundo removal project but will need follow-up treatment of resprouts. CLBL will treat the remaining resprouts and the tamarisk as part of a larger riparian restoration project. The project will also plant additional trees and shrubs to widen the riparian corridor.

Riparian herbaceous buffer (CPS 390)

A riparian herbaceous buffer consists of grasses, sedges, rushes, ferns, legumes, and forbs tolerant of intermittent flooding or saturated soils, that are established or managed as the dominant vegetation in the transitional zone between upland and aquatic habitats. In addition

to reducing erosion and improving streambank stability, this practice provides wildlife habitat (including habitat for pollinators), restores native riparian vegetation, improves water quality, and increases net carbon storage in the biomass and soil.

Near Maples Farm, the upper terrace of Cache Creek has a small amount of native herbaceous vegetation (including wild cucumber and mugwort) but it is largely invaded by non-native annual grasses and forbs, especially ripgut brome, wild oats, Italian ryegrass, and foxtail barley. These invasive grasses are shallow-rooted and provide little benefit in reducing erosion, providing wildlife habitat, or storing carbon in the soil. Therefore, as part of a larger riparian restoration project, CLBL will replace the non-native vegetation with a mix of deep-rooted native grasses, sedges, and forbs that will provide a diversity of plant species for pollinator habitat as well as deep-rooted species to reduce erosion and store carbon.

Critical area planting (CPS 342)

This practice is used to establish permanent vegetation on sites that have (or are expected to have) high erosion rates or that have physical, chemical, or biological conditions that prevent establishment of vegetation with normal practices. This practice applies to highly disturbed areas such as road construction areas, conservation practice construction sites, areas needing stabilization before or after natural disasters, eroded banks of natural channels, banks of newly constructed channels, and other areas degraded by human activities or natural events. Benefits include stabilized soils, improved water capture, water quality, habitat structure, and species diversity, and an increase in soil and biomass carbon capture on protected sites.

Creeping wildrye is a rhizomatous native grass that can armor creek banks against erosion.

As part of a riparian restoration, we plan to plant large patches of creeping wildrye (*Elymus triticoides*) and white root sedge (*Carex barbarae*) on the banks of Cache Creek. Both of these species are rhizomatous and spread easily and thoroughly on creek banks, thus helping to armor the banks against erosion. Because the plantings themselves might be susceptible to high flows, we plan to do the plantings early in the fall with supplemental irrigation so that they can get established quickly.

Together, the "stacked" practices of riparian forest buffer, riparian herbaceous cover and critical area planting on this reach of Cache Creek could sequester 15 MT of CO2e annually and 300 MT over 20 years (Table 7b).

Cropland Systems

Compost Application (Soil Carbon Amendment CPS 336)

Compost application entails the use of amendments derived from plant or animal residues to improve the physical, chemical, and biological properties of the soil. Such applications enable increasing soil carbon stocks above what could otherwise be achieved through management of vegetation and soils on a given site. Over time, the carbon content of soils under consistent management will tend to reach equilibrium, where annual carbon inputs and losses tend to balance out. The addition of offsite sources of carbon, such as compost, can elevate soil carbon levels and enable increased carbon capture above that of equilibrium conditions (Ryals and Silver 2013).

Compost application can maintain, increase, or improve soil organic matter quantity and quality, maintain or improve soil aggregate stability and improve habitat for soil organisms, improve plant productivity and health, improve moisture management and enhance the efficient use of irrigation water, and improve air quality by reducing emissions of particulate matter (PM) and PM precursors, GHGs, ozone precursors and airborne reactive nitrogen (NRCS).

Compost is an important part of CLBL's ongoing cropland management. Compost is applied annually to our one acre training field by our new farmer trainees at a rate of approximately 20 tons/acre. In our Farm Business Incubator Program, compost is applied by the individual incubator farmers according to their individual crops and farm needs. Thus, there is no one universal compost application rate. For the purposes of this carbon farm plan, we used a low and high range compost application for all incubator fields.

Currently we are in Phase 2 of our Farm Business Incubator with approximately 9 acres utilized by incubator farmers in the NE and SE fields. Once Phase 3 is in place, incubator farms will take up 14 acres at Maples Farm with the addition of the NW field. In addition, compost has been

and will be applied to our olive orchard according to the research design of our Healthy Soils Program grant. In that, half of the 16 research plots (about 2.5 acres total) receive compost every year at a rate of 10 dry tons per acre per year. Once the 3 year research project is completed, we will continue to add compost to the olive orchard, so we included that acreage in our calculations for carbon sequestration.

Table 5. Carbon sequestration (MT CO2e) potential at 5% SOM at Maples Farm, cropland soils = Reiff very fine sandy loam

Fields	cropland acres	Baseline SOM%*	Gap to 5%	Additional MT/C acre at 5% OM	total additional MT CO2e at 5% OM	MT compost/ acre needed for 5% SOM	Total MT compost needed for 5% SOM
NW, SW, NE, SE	20	2.54	2.46	11.18	41.04	44.72	894.4

Assumptions:
1% SOM = 0.5% SOC = 10 short tons = 9.09 metric tons (MT) SOM per acre (plow layer only)
Compost = 50% OM or 25% C
1" compost = 70 short tons/acre x .25 = 17.5 x 3.67/1.1 = 58.39 MT CO2e/acre
Approximately ½ of compost C is assumed lost annually under tillage
*Baseline is an average of soil tests completed in 2022

Application of 44.72 short tons of compost (at 25% C) to each acre of cropland would represent approximately 41 metric tons (MT) of CO2e per acre, or over 820 MT CO2e across all 20 acres, and bring all 20 acres up to 5% SOM, assuming no carbon losses from these soils (Table 6). The rate at which this could be achieved is dependent upon rates of compost addition and implementation of other carbon-beneficial practices on cropland at Maples Farm. How well this increase in soil SOM could be retained would depend on implemented farming practices, including future additions of compost.

Maintaining 5% SOM on cropland subject to cultivation can be assumed to require periodic reapplication of compost, reduced tillage, cover cropping and implementation of other carbon beneficial conservation practices..

Finally, CLBL does have an on-farm windrow composting operation that composts on-site farm waste, such as field residues and trimmings from individual farmers. Since we don't have an on-site animal operation, there are no manures added to the compost. To date, the operation is too small to produce significant amounts of compost so it is likely the final product will be used primarily as mulch for our hedgerow plantings.

Cover Crops (CPS 340)

A cover crop is a planting that is used primarily to slow erosion, improve soil health, enhance water availability, smother weeds, help control pests and diseases, and increase biodiversity. Cover crops that include legumes (clovers, vetches and beans) help "fix" nitrogen through symbiosis with nitrogen-fixing soil bacteria. Cover crops build soil health by increasing soil organic carbon and nitrogen, while reducing soil compaction. Planting a cover crop with a diversity of species promotes diversity in the soil biology which creates a healthier, more resilient medium for plant growth year-round.

CLBL utilizes cover cropping in all of its fields with the exception of the SW field with the 5 acre olive orchard (cover cropping between the rows of olive trees will begin in fall 2023). The amount of CO2e sequestered when all available fields are cover cropped will be 4 MT annually and 80 MT over 20 years.

Table 6. Carbon Beneficial Practices by field as mapped (see Figure 6)

Location	Field/acres	Practices
1.Incubator Phase 1	NE/2 acre	Compost, cover crop
2. Incubator Phase 2	SE/6 acres	Compost, cover crop, alley cropping
3. Incubator Phase 3	NW/6 acres	Compost cover crop, alley cropping
4. Training field	NE/1 acre	Compost, cover crop
5. Olive orchard	SW/5 acres	Tree and shrub establishment, compost, biochar, cover crop, alley cropping
6. Native grass garden	NE/0.06 acre	Conservation cover
7. Riparian area	5 acres	Riparian forest buffer, riparian herbaceous cover, critical area planting
8. Field edges	all fields	Hedgerows and windbreak (HR1-HR8)

Figure 6. Maples Farm Carbon Farm Practice Map

Additional Carbon Beneficial Practices for Consideration

Biochar

Biochar is a granular carbon substance produced by pyrolysis or thermal decomposition of organic matter in an oxygen starved chamber. It is commercially produced from a variety of feedstocks from forest thinning to agricultural residues. It can also be produced on a small scale using a technique called "conservation burning." The charcoal-like byproduct resists further decomposition and may have beneficial properties in soil. Biochar is not pure carbon, but a mix of carbon, hydrogen, oxygen, nitrogen, sulfur and ash in varying proportions. The central quality of biochar that makes it attractive as a soil amendment is its highly porous structure, potentially responsible for improved water retention and increased soil surface area.

Demonstrated benefits of biochar include increased yields, higher water holding capacity in soils, pathogen and disease suppression, stimulation of soil microbial activity, and increasing soil carbon sequestration (Gelardi and Parikh, 2021). In 2018, the Intergovernmental Panel on Climate Change (IPCC) characterized biochar as "a leading natural climate solution." In a review published in the Proceedings of the National Academy of Sciences (PNAS), Griscom et al. (2017) assert: "The addition of biochar to soil offers the largest maximum [climate] mitigation potential among agricultural pathways." However, this is only true if a full lifecycle analysis reveals that the specific biochar being used has a net negative carbon impact.

While biochar is exploding in popularity, its agronomic and environmental benefits are not consistently realized across different climates, soil types, and cropping systems. It is important to remember that the choice of feedstock and the distance the feedstock has to travel to get to a biochar facility will factor into whether biochar has a net negative effect on carbon emissions. For example, some agricultural wastes might be better suited to on-site composting or mulching. A full life cycle assessment should be performed in order to determine the overall impact of biochar.

Comparatively, the benefits of compost application are more thoroughly demonstrated, including the ability of compost to decrease GHG emissions (Favoino and Hogg 2018). There is potential that biochar and compost would interact synergistically, amplifying the benefits of these two soil amendments. For example, Sanchez-Garcia (2016) found that combined biochar and compost application in olives increased biologically based nitrogen processing by the soil food web, without a corresponding increase in emissions.

While the effects of biochar on GHG emissions will vary with environmental conditions and soil types, research suggests that substantial reductions are possible. In a perennial crop, Miscanthus, biochar applied at 49 tons per hectare suppressed CO_2 emissions by 33 percent compared to unamended soil, with these reductions lasting up to two years (Case et al. 2014). A recent meta-analysis of 129 published papers found that biochar decreased soil N2O emissions by an average of 38 percent, but tended to slightly increase CH4 and emissions by an average of 15 percent and 16 percent respectively (Zhang et al. 2020). The authors suggest that outcomes are dependent on local site factors such as soil pH, the biochar C:N ratio, and the biochar application rate (Zhang et al. 2020).

In 2021, CLBL received a Healthy Soils Program grant from the California Department of Food and Agriculture to study the effects of biochar and compost, alone and in combination, in an olive orchard. The three year demonstration project is investigating the extent to which biochar and compost treatments can increase soil carbon sequestration, decrease GHG emissions, improve biological indicators of soil health, and ultimately improve yields.

The research endeavors to demonstrate that biochar application combined with compost application is a potential climate solution well-suited to large-scale implementation in olive orchards in California. Biochar has been shown to slow the respiration loss of organic carbon and stimulate increased photosynthetic carbon capture. Soil-biochar amendments commonly increase agricultural production on marginal and degraded lands, but may have little or no yield impact on well managed, high quality soils. Laboratory experiments have shown that biochar reduces bulk density and improves aeration in poorly drained soils while also increasing nutrient and water holding capacity in sandy, low-organic matter and otherwise degraded soils. Biochar can be added to compost for greater porosity and aeration for gas exchange, reduce emissions, and to house beneficial microbial communities.

CLBL will share the results of the project with producers through a series of on-farm outreach events and publication of research findings. Once completed, the research results will inform whether CLBL will continue to use biochar as a carbon beneficial practice.

Agrivoltaics

Agrivoltaics is the practice of using the same area of land to obtain both solar energy and agricultural products. In agrivoltaic systems, solar panels coexist with crops on the same surface with a goal of maintaining high efficiency in both systems. Initially, efforts focused on simply growing forage for grazing animals or pollinator habitat among solar panels but more recently the focus has shifted to producing cash crops.

According to a recent study by Oregon State University (Proctor et. al 2021), co-developing land for both solar photovoltaic power and agriculture could provide 20% of total electricity generation in the United States, with an investment of less than 1% of the annual U.S. budget. The study found that wide-scale installation of agrivoltaic systems could lead to an annual reduction of 330,000 tons of carbon dioxide emissions in the U.S – the equivalent of 75,000 cars off the road per year – and the creation of more than 100,000 jobs in rural communities, while minimally impacting crop yield.

Research is ongoing to determine which crop types are best suited for AV conditions and what the optimal panel infrastructure and configuration may be. CLBL is considering a small scale demonstration project at Maples Farm to support further research into this promising technology.

Orchard-Livestock Integration (Prescribed grazing CPS 528)

Small livestock like sheep, goats, and chickens can be integrated into orchard systems to manage understory vegetation, minimize pest and disease outbreaks, and maintain uniform water distribution. Other benefits include greater economic returns, more diversified farming operations, reduction in fuel and chemical inputs and enhanced erosion control, water quality, water use efficiency, soil fertility, and nutrient cycling (Wilson et. al, 2006).

Currently, CLBL does not have the capacity to keep grazing animals on site, but is interested in hiring a contract grazer to provide weed control in the olive orchard. This will especially be true once cover crops are integrated between the rows of olive trees.

The carbon impact of such targeted grazing on a small parcel (5 acres) may be small but the reduction in inputs of fuel and herbicide are worth considering. According to COMET-Planner, prescribed grazing on 5 acres could provide a carbon benefit of 0.10 MT of CO_2e per year

Table 7a. Summary table - Implemented practices

Practices already implemented (NRCS CPS#)	Field/ length or area	Description	CO2e sequestered annually	CO2e sequestered 20 years	Co-benefits	References
Olive grove installation - Tree and shrub establishment (612)	SW field 5 acres	777 trees total	97 MT	1940 MT		COMET-Planner CDFA version, accessed April 2023 Tree and Shrub establishment
Compost Application (336) - Olive orchard research plots	SW field 2.5 acres	Compost applied to 8/16 plots at a rate of 10 (dry) tons per acre/year	12 MT	240 MT	Improved water holding capacity, soil quality and fertility and crop production	COMET-Planner CDFA version, accessed April 2023
Biochar - Olive orchard research plots	SW field 2.5 acres	Biochar applied to 8/16 research plots at a rate of 10 (dry) tons per acre	71 MT *	71 MT**	Increased yields, higher water holding capacity in soils, pathogen and disease suppression, stimulation of soil microbial activity	Jeffrey Creque, personal communication 05/25/2023
Compost application 336) - Training field 1 acre - Incubator fields 2 acres (NE)	NE field 3 acres	Compost application in the training field is 20 tons/acre. Actual application rates vary by incubator farmer but we estimate it is close to 20 tons/acre/year overall.	13 MT	260 MT	Improved water holding capacity, soil quality and fertility and crop production	COMET-Planner CDFA version, accessed April 2023

Cover cropping (340) - Training field 1 acre - Incubator Phase 1 - - -Incubator Phase 2 - Incubator Phase 3	15 acres	Cover cropping practices vary by incubator farmer. This estimate assumes all available fields are cover cropped every year	3 MT	60 MT	Decrease soil erosion from wind and water, better rainwater infiltration, and wildlife habitat	COMET-Planner CDFA version, accessed April 2023
Hedgerows (422) - HR1 2 row 1400 ft - HR2 1 row 925 ft - HR3 1 row 680 ft - HR4 2-3 row 1860 ft	4865 linear ft	To date, hedgerows have been installed along four field edges and the bioswale. Plant selection follows NRCS guidelines so that bloom time is staggered across the year.	9 MT	180 MT	Wildlife habitat, pollinator habitat, carbon sequestration, improve microclimate stabilize soils, improve water quality, and reduce water loss.	COMET-Planner CDFA version, accessed April 2023 Chiartas et al. 2022
Conservation cover (herbaceous understory) (327) HR1, HR2, portions of HR4, native grass garden	2.2 acres	Native grasses were seeded in conjunction with two hedgerows and in preparation for a future hedgerow. Width of the seedings ranges from 10 to 20 feet wide	1 MT	20 MT	Stabilize soils and stream banks and channels, water capture, soil moisture and organic matter, wildlife habitat structural and species diversity	COMET-Planner CDFA version, accessed April 2023
Mulching (484)	.65 acres	Applied wood chips to mulch HR3 and a portion of HR4 . Applied annually	.21 MT	4.2 MT	Improved efficiency of irrigation water. Improved plant productivity and health. Decreased soil erosion. Increase soil organic matter.	COMET-Planner CDFA version, accessed April 2023
TOTAL FOR PRACTICES ALREADY IMPLEMENTED			206.21 MT***	2775.2 MT		

*estimated CO_2e sequestered for biochar application is based on C content of the biochar at 85% applied at a rate of 10 dry tons/acre to 2.5 acres

**because little is known about the long term impacts of biochar we are only counting the CO2e reduction for the year it was applied.
***Annual rate, beginning in 2023 for all practices

Table 7b. Summary table - planned practices

Planned practices (NRCS CPS#)	Field/ total length or area	Description	CO2e sequestered annually	CO2e sequestered 20 years	Co-benefits	References
Cover cropping (340)	SW field 2.5 acres	Between rows of olive orchard-annually	1 MT	20 MT	Reduce erosion from wind and water, increase soil health and organic matter content, suppress weeds, improve soil moisture use efficiency, minimize soil compaction	COMET-Planner CDFA version, accessed April 2023
Alley cropping (311) with stone fruits or low-stature perennial herbs (rosemary, lavender).	NW and SE fields 12 acres	Plant stone fruit trees and/or chestnuts or low stature perennial herbs in strips to divide NW and SE field into discrete incubator plots	10 MT	200 MT	Enhance microclimatic conditions. Reduce surface water runoff and erosion. Improve soil health by increasing utilization and cycling of nutrients. Enhance wildlife and beneficial insect habitat. Increase crop diversity. Increase carbon storage in plant biomass and soils.	COMET Planner describes as replacing 20% of annual crop with single row of trees
Compost application (336)	NW, SW, and SE fields 14.5 acres	Includes additional 2.5 acres in olive orchard after 3 year research project is completed. Annual applications @ 10 tons/acre	64 MT	1280 MT	Improved water holding capacity, soil quality and fertility and crop production	COMET-Planner CDFA version, accessed April 2023

Additional Hedgerows (422) -HR5 900 ft -HR6 780 ft -HR7 (windbreak) 1072 ft. HR8 1026 ft	SW, NW and NE fields 3778 feet	Single row hedgerows on the western and eastern side of the SW and NW field. A 3 row hedgerow will be planted on the east end of the NE field.	7 MT	140 MT	Wildlife habitat, pollinator habitat, carbon sequestration, improve microclimate stabilize soils, improve water quality, and reduce water loss.	COMET-Planner CDFA version, accessed April 2023
Mulching (484)	NW and SW fields 0.5 acre	Mulch will be generated on site from woody debris applied 8 inches deep/10 ft wide on HR6 and 8. Annually	0.21 MT	4.2 MT	Improved efficiency of irrigation water. Improved plant productivity and health. Decreased soil erosion from wind and water. Increase soil organic matter.	COMET-Planner/CSU 2017
Conservation cover under windbreak (327)	NW field 0.5 acres	Native grass understory for windbreak (HR7)	0.38	7.6 MT	Stabilize soils and stream banks water capture, soil moisture and organic matter, wildlife habitat structural and species diversity	COMET-Planner/CSU 2017
Riparian restoration on Cache Creek (390/391) -riparian herbaceous cover -riparian forest buffer	5 acres	replace weedy invasive grasses with native grasses. plant trees and shrubs	14 MT	280 MT	Stabilize soils and stream banks and channels, water capture soil moisture and organic matter, wildlife habitat structural and species diversity.	COMET-Planner/CSU 2017
Critical area planting on Cache Creek	1 acre	plug plant rhizomatous herbaceous species	1 MT	20 MT	Stabilize soils and stream banks water capture soil moisture and organic matter, wildlife habitat structural and species diversity.	COMET-Planner/CSU 2017
TOTAL FOR PLANNED PRACTICES			97.59* MT	1951.8 MT		

Table 7c Summary table - Implemented and planned projects combined (see Tables 7a and 7b for descriptions and references)

Practice	Acreage/ Length	CO2e sequestered annually (MT)	CO2e sequestered over 20 years (MT)
Alley cropping	12 acres	10	200
Biochar	2.5 acres	71	71*
Compost application (annual)	20 acres	89	1780
Conservation cover	2.7 acres	1.38	27.6
Cover cropping (annual)	17.5 acre	4	80
Critical area planting	1 acre	1	20
Hedgerows	8183 feet	16	320
Mulching (annual)	1.15 acres	.42	8.4
Riparian restoration	5 acres	14	280
Tree and shrub establishment	5 acres	97	1940
TOTAL		302.42	4727

*biochar CO2e reduction taken in the first year only

Soil, Water, and Carbon

NRCS suggests that a 1% increase in SOM results in an increase in soil water holding capacity of approximately 1-acre inch, or 27,152 gallons of increased soil water storage capacity per acre. A 1% increase in SOM represents roughly 20,000 pounds (10 short tons) of organic matter, or 5 short tons of organic carbon. Table 9 shows estimated additional water storage capacity associated with soil carbon increases on Maples Farm resulting from implementation of the CFP. Total estimated additional soil water storage capacity associated with soil carbon increases on Maples Farm resulting from implementation of the CFP is estimated to be 16.39 acre-feet by year 20. This analysis is assumed to be conservative, yet reveals the potential significance of even small increases in soil carbon for overall farm dynamics.

Table 8. Estimated Additional Soil Water Holding Capacity (WHC) Maples Farm with Carbon Farm Plan Implementation, Year 20 (see Appendix 4 for WHC calculations)

Practice	Description	20 year SOM Increase (MT)	Soil WHC Increase by Year 20 (AF)
Alley cropping	Orchard trees or perennial herbs in SE and NW fields 12 acres	54.50	0.50
Biochar	2.5 acres in SW field	38.69	0.35
Compost application	All farm fields 20 acres	970.03	8.89
Conservation cover	Under HRs 1, 2, 4 and 7 plus native grass garden	10.9	0.10
Cover cropping	All farm fields minus rows with olive trees 17.5 acres	43.60	0.40
Critical area planting	Associated with riparian restoration 1 acre	5.45	0.05
Hedgerows/ Windbreak	Total of 8 measuring 8183 ft.	87.19	0.80
Mulching	Associated with hedgerows	4.58	0.04
Riparian restoration	5 acres on Cache Creek	76.29	0.70
Tree and shrub establishment	Olive orchard	528.61	4.85
TOTALS		1823.98	16.72

In addition, there is some additional water catchment potential on the farm through diversion of roof runoff from farm buildings to possible future water storage tanks. As shown in Table 10, with Woodland's average annual rainfall of 21.38 inches, total average yearly roof runoff catchment potential is estimated to be 0.57 acre feet, or 184,883 gallons. If all or most of this water could be stored, it would provide a significant source of water that could be used, for example, to irrigate carbon beneficial practices such as hedgerows and riparian restoration or to irrigate landscape plantings.

Table 9. Roof rainfall catchment potential at Maples Farm

Structure	Roof area (sq. feet)	Volume in acre feet at 21.38" rainfall/year
Headquarters building	4031	0.16
Main barn	5025	0.21
Wash and pack barn	3418	0.14
Storage shed	568	0.02
Welding shop	830	0.03
Total	13,872	0.57

Conclusion

Quantification of GHG Benefits

CLBL began implementing carbon-beneficial practices at Maples Farm in 2019, even before moving to the new headquarters. Table 7a, above, lists those conservation practices that have already been implemented. Table 7b lists those carbon beneficial practices identified through the carbon farm planning process as of June 2023. Table 7c lists both implemented and planned practices. Quantification of the carbon capture potential of these practices was derived from the on-farm carbon sequestration planning tool, COMET-Planner (www.comet-planner-cdfahsp.com) or other sources as noted.

With full implementation of this carbon farm plan, the overall total potential carbon sequestered at Maples Farm is estimated to be 298 MT CO2e[1] in the first year and 4727 MT CO2e over 20 years*

According to the U.S. EPA Greenhouse Gas Equivalencies Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) , this is equivalent to: 1052 gasoline powered vehicles driven for one year or 596 homes' energy use for one year.

Summary of plan goals

Maples Farm is a working farm that has an educational mission. Therefore, all of the carbon-beneficial practices identified in this Carbon Farm Plan serve as demonstration sites for visitors, new farm trainees, apprentices, students and the general public. Indeed, CLBL is in the process of transforming Maples Farm into an innovation hub to demonstrate carbon farming principles.

A primary goal is to increase soil organic matter from current levels to 5 percent across the farm and increase water holding capacity. We conducted baseline monitoring of all of the farm fields and habitat areas in 2021 and 2022 (see table 2a and 2b). The Northeast field where our Phase 1 incubator farmers and the training program have their fields is closest to the 5% level now. This is not surprising as we estimate compost has been added at a rate of 20 tons/acre/year over the past two years.

[1] CO2e = "carbon dioxide equivalent". CO2e is a measurement of the total greenhouse gasses emitted, expressed in terms of the equivalent global warming potential of carbon dioxide. Common GHG equivalencies include: 1 MT methane = 84 MT CO2e (over the 12 year life span of CH4 in the atmosphere ; 1 MT of nitrous oxide = 298 MT CO2e (over 100 years or more).

The majority of working farmland at Maples Farm is dedicated to our Farm Business Incubator program through which new farmers are able to lease land at below market rates and develop their farm businesses. By emphasizing carbon beneficial practices through our Farm and Climate Program, CLBL is able to "grow" new farmers who consider the carbon impacts of their practices for years to come. While decisions of how to manage the farmland are up to the individual incubator farmer, the learning environment promotes carbon farming. At a minimum, all incubator farmers are encouraged to utilize compost and cover cropping to maintain or increase soil organic carbon.

At the time this plan was developed, CLBL had already implemented hedgerows around approximately half of the acreage of the farm and secured funding to put in three additional hedgerows and a windbreak in the near future. Once this second round of hedgerows is in place, virtually all of the farm edges that can support hedgerows will be planted accordingly.

Also at the time this plan was developed, CLBL was in the process of installing a new olive orchard on 5 acres of the southwest field. As part of a CDFA demonstration project monitoring the effects of compost and biochar, the orchard will yield important data not only on soil health impacts of those soil amendments, but on the impacts of the orchard itself on soil carbon over time.

One of the most exciting future projects is a riparian restoration project on Cache Creek, which at the time this plan was developed was in its planning phase. Once funding is secured and appropriate permits are obtained, the project will enhance the riparian habitat on this section of the creek with native trees and shrubs. Herbaceous vegetation now dominated by non-native annual grasses will be restored to native perennial grasses, sedges and forbs. These planting will improve the habitat value while also sequestering greenhouse gasses.

FInally, all of these carbon-beneficial practices are being integrated into CLBL's existing education programs for youth and adults. Students who participate in our FARMS and SLEWS program are introduced to the concept of carbon sequestration as a way to mitigate climate change and enhance farm resilience to extreme weather events. They are also given the opportunity to help with this strategy through field days in which they plant native vegetation both here at Maples Farm and at other sites throughout California. We have integrated carbon farm planning into our new farmer training course and the plant sciences course for the Apprenticeship program.

This plan should be viewed as a living document. It should evolve as practices are implemented and new information and new tools become available. Additional carbon-beneficial practices may be considered for inclusion in the plan in the future. GHG values presented here as associated with specific practices are considered to be both conservative and based upon the best available information at the time of this plan's preparation (June 2023).

Short term action plan and timeline

Objectives	2023		2024				2025				2026
	sum	fall	win	spr	sum	fall	win	spr	sum	fall	
Carbon Farming trainings			x	x							
Install 3 additional hedgerows		x	x			x	x				
Install windbreak		x	x								
Initiate riparian restoration											x
Seed native grasses on Cache Creek											x

Monitoring and record keeping

Regular monitoring of the impacts of these practices on soil health and biodiversity at our farm is very important to CLBL's educational mission. Our aim is to document and communicate ecological changes over time with respect to soil organic carbon, native pollinators, wildlife, and vegetation composition.

To that end, we took baseline soil samples in all of our main farm fields and initial habitat projects in fall 2021. Our baseline soil samples were analyzed for soil organic carbon by Ward Laboratories using the dry combustion method. Baseline soil samples were collected in our SW field (olive orchard) for the CDFA demonstration project in December 2022 and analyzed at U.C. Davis using the loss on ignition (LOI) method. Additional soil samples will be collected in fall 2023 for new habitat projects (hedgerows, windbreak, and riparian restoration.

CLBL monitors a variety of indicators of biodiversity. We have established permanent transects in four hedgerows to monitor bees using the Xerces Society's Streamlined Bee Monitoring Protocol for Assessing Pollinator Habitat. We are also monitoring monarch habitat in our "bioswale" (HR1), using the Monarch Butterfly Habitat Quantification Tool. We track the success of our milkweed plantings using the Western Monarch Milkweed Mapper (https://www.monarchmilkweedmapper.org/). We track nest success in our birdbox program using the Cornell Lab of Ornithology's Project Nestwatch (https://nestwatch.org).

Ecological monitoring at Maples Farm

Indicator	Method	References
Soil organic carbon - all fields	Dry combustion method (Ward Laboratory)	Donovan, P. (2013) Measuring soil carbon change CLBL Soil Sampling Protocol (Appendix 3)
Pollinator diversity	Xerces Society Streamlined Bee Monitoring Protocol for Assessing Pollinator Habitat	www.xerces.org/publications/id-monitoring/streamlined-bee-monitoring-protocol
Vegetation cover (riparian)	Line intercept method	Herrick et. al (2005) Monitoring manual for grassland, shrubland and savanna ecosystems
Nest box productivity	Project nestwatch monitoring protocol	nestwatch.org
Monarch habitat quality	Monarch Butterfly Habitat Quantification Tool	Monarch butterfly habitat quantification tool
Bird diversity	Point counts	Bibby et. al 2000. Bird Census Techniques, second edition.
Milkweed abundance	mapping	Western Monarch Milkweed Mapper
Wildlife presence/absence	game camera monitoring	

Funding Opportunities

The Center for Land-Based Learning has benefitted from funding opportunities at the local, state, and federal level and encourages other landowners to seek resources and technical assistance to implement the recommended practices in their Carbon Farm Plans. The following is a non-exhaustive list of funding programs that are available to private landowners. Other funding programs exist through state or federal agencies, such as the Wildlife Conservation Board, California Department of Fish and Wildlife, or the California Coastal Conservancy, however, private individuals may need to partner with a sponsor (e.g., a local Resource Conservation District or nonprofit) to submit an application.

California Department of Food and Agriculture (CDFA)

Healthy Soils Program (HSP) Incentives Program- covers many carbon farm practices including cover cropping, hedgerows, mulching, riparian forest buffer, range seeding, compost application, and prescribed grazing. Funding is based on a fixed rate reimbursement depending on the practice. The reimbursement typically does not cover the full amount. Technical assistance is provided free of cost to the HSP incentives Program applicants and grant awardees.

https://www.cdfa.ca.gov/oefi/healthysoils/incentivesprogram.html

State Water Efficiency & Enhancement Program (SWEEP) - funds implementation of irrigation systems that reduce greenhouse gasses and save water. Funding is based on a fixed rate reimbursement depending on the practice. The reimbursement typically does not cover the full amount.

https://www.cdfa.ca.gov/oefi/sweep/

Natural Resources Conservation Service (NRCS)

Environmental Quality Incentives Program (EQIP) - covers most to all practices in a typical carbon farm plan including supporting practices such as fencing and water development. Funding is based on a fixed rate reimbursement depending on the practice. Landowners typically expect out of pocket expenses of 10% or more.

General information can be accessed at:
https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives.
However, interested producers should contact their local NRCS office directly

Conservation Stewardship Program (CSP) - includes multiple enhancement activities and conservation practices to address resource concerns such as soil health, pollinators, changing weather patterns, western forest health, efficient irrigation, and rangeland health. Funding is based on fixed payment rates for conservation activities. CSP payments occur annually.

https://www.nrcs.usda.gov/programs-initiatives/csp-conservation-stewardship-program

U.S. Fish and Wildlife Service (USFWS)

Partners for Fish and Wildlife - funds conservation projects on private lands with a focus on migratory birds, anadromous fish and/or threatened and endangered species. Priority habitats

are riparian, wetlands, and native grasslands. Funding is based on a 1:1 cost share. Matching funds are preferred but not always required.

https://www.fws.gov/program/partners-fish-and-wildlife

Xerces Society For Invertebrate Conservation

Xerces Society Pollinator Kits - are curated collections of native species specifically chosen as nectar or host plants for pollinator species and awarded to qualified projects. In California qualifying projects include those on working lands, public lands, tribal lands, and private/non-working lands recovering from wildfires. Project proposals are due between February 21 - April 3, 2023. If the proposal is accepted, plants are free of charge but require the recipient to pick up the plants at a designated location and report on project progress.

https://xerces.org/pollinator-conservation/habitat-kits

Zero Foodprint

Restore California - provides funding for implementation of carbon farming practices. Proposals are scored according to the GHG benefits of the project. Grants for up to $25,000. Applicants are required to partner with a Technical Assistance Provider.

https://www.zerofoodprint.org/

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Appendices

Appendix 1. Hedgerow Species and Bloom Times at Maples Farm

Common Name	***Scientific Name***	**Size/Type**	**Early Jan-Mar**	**Middle Apr-Jun**	**Mid/late Jul-Sep**	**Late Oct-Nov**
valley oak*	*Quercus lobata*	Tree				
coast live oak	*Quercus agrifolia*	Tree				
mule-fat*	*Baccharis salicifolia*	Tall Shrub	X	X	X	X
common manzanita	*Arctostaphylos manzanita*	Tall Shrub	X	X		
whiteleaf manzanita	*Arctostaphylos viscida*	Tall Shrub	X	X		
Vine hill manzanita	*Arctostaphylos densiflora*	Shrub	X	X		
buckbrush	*Ceanothus cuneatus*	Shrub	X	X		
blue blossom	*Ceanothus thyrsiflorus*	Shrub	X	X		
western redbud*	*Cercis occidentalis*	Sm. Tree	X	X		
gumplant	*Grindelia camporum*	Forb		X	X	X
coffeeberry*	*Frangula californica*	Shrub		X		
CA flannelbush	*Fremontodendron californicum*	Tall Shrub		X		
toyon*	*Heteromeles arbutifolia*	Tall Shrub		X		
silver bush lupine	*Lupinus albifrons*	Low Shrub		X		
fragrant sumac*	*Rhus aromatica/trilobata*	Shrub		X		
California rose*	*Rosa californica*	Low Shrub		X		
blue elderberry*	*Sambucus nigra*	Tall Shrub		X	X	
yarrow	*Achillea millefolium*	Forb		X	X	
narrow-leaf milkweed	*Asclepias fascicularis*	Forb		X	X	
showy milkweed	*Asclepias speciosa*	Forb		X	X	
Indian hemp	*Apocynum cannabinum*	Forb		X	X	
CA buckwheat*	*Eriogonum fasciculatum*	Low Shrub		X	X	X
Cleveland sage*	*Salvia clevelandii*	Shrub		X	X	
CA goldenrod	*Solidago velutina*	Forb			X	X
Pacific aster	*Symphyotrichum chilense*	Forb			X	X
coyote brush*	*Baccharis pilularis*	Tall Shrub			X	X
California fuschia	*Epilobium canum*	Low Shrub			X	X
deergrass	*Muhlenbergia rigens*	Grass				X

Appendix 2. Wildlife at Maples Farm

Common name	Scientific name
Mammals	
Bobcat	*Lynx rufus*
Botta's pocket gopher	*Apodemus sylvaticus*
Brush rabbit	*Sylvilagus bachmani*
Coyote	*Canis latrans*
Field mouse	*Apodemus sylvaticus*
Gray Fox	*Urocyon cinereoargenteus*
Jackrabbit	*Lepus californicus*
Meadow vole	*Microtus pennsylvanicus*
Mule deer	*Odocoileus hemionus*
Racoon	*Procyon lotor*
Skunk	*Mephitidae*
Birds	
American crow	*Corvus brachyrhynchos*
American robin	*Turdis migratorius*
Anna's hummingbird	*Calypte anna*
Ash-throated flycatcher	*Myiarchus cinerascens*
Barn owl	*Tyto alba*
Belted kingfisher	*Megaceryle alcyon*
Black phoebe	*Sayornis nigricans*
Brewer's blackbird	*Euphagus cyanocephalus*
Bullock's oriole	*Icterus bullokii*
Bushtit	*Psaltriparus minimus*
California quail	*Callipepla californica*
California scrub jay	*Aphelocoma californica*
California towhee	*Melozone crissalis*
Cliff swallow	*Petrochelidon pyrrhonota*
Dark-eyed junco	*Junco hyemalis*
Double-crested cormorant	*Phalacrocorax auritus*
Great blue heron	*Ardea herodias*

Great egret	*Ardea alba*
Great horned owl	*Bubo Virginianus*
House finch	*Haemorpous mexicana*
House wren	*Troglodytes aedon*
Lesser goldfinch	*Spinus psaltria*
Loggerhead shrike	*Lanius ludovicianus*
Mourning dove	*Zenaida macroura*
Northern flicker	*Colaptes chrysoides*
Northern mockingbird	*Mimus polyglottos*
Nuttall's woodpecker	*Dryobates nuttallii*
Pacific slope flycatcher	Empidonax difficilis
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoenicus*
Swainson's hawk	*Buteo swainsoni*
Tree swallow	*Tachycineta bicolor*
Turkey vulture	*Cathartes aura*
Western bluebird	*Sialia mexicana*
Western kingbird	*Tyrannus verticalis*
Wild turkey	*Meleagris gallopavo*
Yellow-rumped warbler	*Setophaga coronata*

Appendix 3. CLBL Soil Sampling Protocol

Soil organic carbon & bulk density monitoring protocol for The Maples Farm

This protocol was prepared by **Alex M. Lintner** during her GrizzlyCorps service term (2021–2022) for the **Center for Land-Based Learning**.

Motivation for designing this monitoring protocol

The Center for Land-Based Learning (CLBL) recently moved to The Maples Farm. CLBL hopes to transform this 30-acre parcel into an education, research, and demonstration hub for regenerative agriculture in the Sacramento Valley. Shortly after their arrival at The Maples Farm, **CLBL identified the need to establish baseline data that captures a snapshot of soil organic carbon (SOC) stocks on the farm before starting active management** (see Appendix A for background information on SOC). These baseline data will be included in The Maples Farm Carbon Farm Plan. As carbon farming practices are deployed across the farm, these baseline data will be invaluable for quantifying the impact of the diverse regenerative land management practices CLBL implements. To track long-term trends in SOC, CLBL will periodically measure SOC stocks after this initial baseline assessment (ideally monitoring will occur once every three years). **This protocol was developed to facilitate baseline SOC monitoring (which took place in November 2021) and future monitoring efforts at The Maples Farm.** By adhering to this protocol, CLBL will reduce noise in the data and ensure confidence in the observed SOC trends across time.

Necessary sampling tools

- ☐ **Soil Probe and hammer** (CLBL's AMS Hammerhead Soil Probe is stored with the Farm and Climate Program equipment in the barn)
- ☐ **Bulk Density (BD) core** (a metal or plastic tube with a 6–8 cm diameter and 12–15 cm height)
- ☐ **Wooden block** (that can cover the top of the BD core)
- ☐ **Hand trowel** (to dig the BD core out of the ground)
- ☐ **Flat blade knife** (to ensure integrity of BD core)
- ☐ **Thee plastic buckets** (for combining soil cores)
- ☐ **Measuring tape** (to measure soil core depth increments)
- ☐ **Meter stick** (to measure the sampling grid and transect)
- ☐ **Flags** (for marking the center of the sampling grid)
- ☐ **Data collection sheet** (CLBL specific data sheet can be found in the *Soil Organic Carbon Monitoring* folder; see Appendix B for an example data sheet)
- ☐ **One-quart plastic bags** (for storing the soil samples)
- ☐ **Sharpies** (for labeling the bags) **and pens** (for recording data)

Delineating sampling regions and subplots

When selecting sampling locations it is important that all soils come from the same uniform soil type (soil type can be determined using the NRCS's Web Soil Survey). The Maples Farm's dominant soil series is Reiff very fine sandy loam – this soil dominates the entire property with the exception of the riparian zone which is dominated by the Riverwash series.

For baseline SOC sampling at The Maples Farm in 2021, we selected eight sites based on current and projected future management. For instance, we separated the front field into two sampling regions – Front North Field and Front South Field – since the southern portion will be converted into an olive grove as of spring 2023 whereas the northern portion is reserved for incubator plots. For baseline sampling, five of the eight sites are agricultural production and/or education fields and the remaining three sites are conservation hedgerows. Future baseline sampling should include the riparian region along Cache Creek and the borders of the front field. The eight baseline regions sampled in 2021 are delineated on the map below.

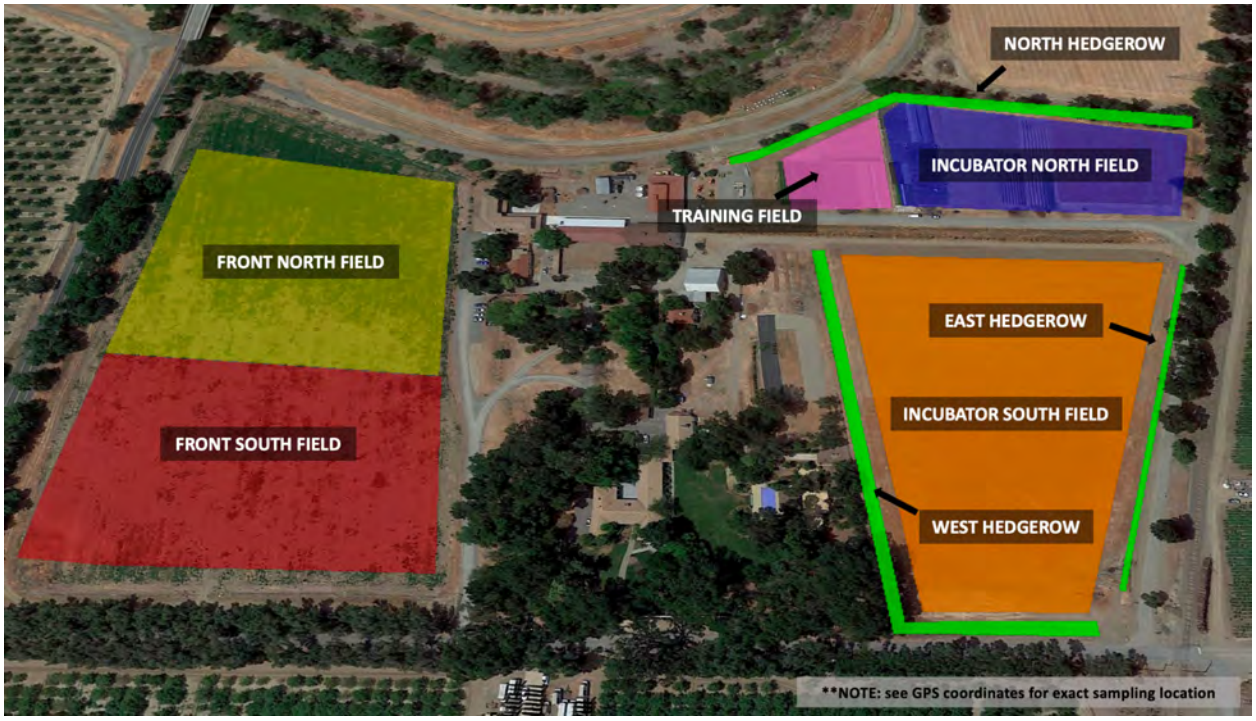

Figure 1. A map of the eight SOC and BD sample collection regions. Each site has a distinctive management history and projected future management plan. Baseline samples collected November 2021.

Since SOC is highly variable across space, we randomly selected a subplot of each of the eight sample collection regions to reduce noise. For the agricultural fields, the subplots were four by four meters and randomly located within each region. For the hedgerows, the subplots consisted of a 24 meter long transect randomly positioned in the hedgerows. The center of the subplots were GPS located. It is important to stress that in order to accurately measure SOC change over time, you must record the GPS coordinate for all your sampling subplots. GPS coordinates for the center of the eight subplots are recorded below (these coordinates are also found in the SOC and BD datasheet).

Table 1. GPS coordinates for SOC and BD sampling subplots. Future resampling endeavors must return to these GPS located subplots.

Region Description	Site Latitude	Site Longitude
Incubator South Field	38.7177769	-121.759823
Incubator North Field	38.7193585	-121.7587538
Training Field	38.7193203	-121.760390
Front North Field	38.7188667	-121.7631359

Front South Field	38.7178015	-121.7631282
West Hedgerow	38.7182614	-121.7603682
North Hedgerow	38.7197893	-121.7588212
East Hedgerow	38.7183629	-121.758602

Timing of SOC and BD sampling

It is common practice to sample soils in the fall. The baseline SOC and BD samples were collected on November 7, 2021. Future resampling of SOC and BD should take place in the fall season, ideally in November. Future resampling should occur once every three years – the next sampling will take place in November 2024, then November 2027, etc. By sampling fields as close to the same time of year for each subsequent resampling events will help reduce noise and ensure the most accurate estimates of SOC change over time.

Additionally, to ensure the most accurate SOC stock estimates, do not sample after a major weather event. For example, do not sample if the soil is wetter than normal after a heavy rainfall. Wait at least three days after a major weather event before sampling.

Do not sample immediately after soil amendments are added (such as compost etc.). Wait at least 1–2 weeks after adding soil amendments.

Choosing SOC and BD sampling depth

Depth increments for SOC sampling vary substantially. SOC change over time tends to be most noticeable at shallow depths; in agricultural fields, the top 15 cm of the soil profile are typically most impacted by management (this soil strata has the greatest root density, microbial activity, and amendment additions). It is therefore highly important to include the 0 cm to 15 cm increment when testing SOC levels. However, carbon dynamics in deeper increments of the soil profile are also important for tracking changes in SOC stocks (but these SOC levels are slower to change with management and more difficult to sample).

For this monitoring protocol, we chose to sample the 0 cm to 15 cm depth increment and the 15 cm to 30 cm depth increment across all regions. In the Front South Field region, we also sampled the 30 cm to 45 cm depth increment because CLBL plans on installing an olive grove in this area. Since olives are

perennials with deep root systems, it is important to test deeper strata in the soil profile to get a more complete picture of SOC storage dynamics.

When using the soil probe, it is critical to carefully separate soil core samples into discrete depths. Carefully measuring and separating the soil core is another way to reduce noise across sampling events.

When measuring BD, the dimensions of the BD core will determine the soil depth increment. For this protocol, we recommend using a core with a 12–15 cm depth.

SOC sampling process in the field

STEP 1:

Assemble all the necessary sampling tools listed on page 2.

STEP 2:

When first taking baseline samples, you must randomly select a subplot in your region of interest. Record the GPS coordinates for the center point in the subplot. When resampling after the baseline sampling event, return to the exact GPS located subplot.

STEP 3:

Once you arrive at the proper GPS located subplot, record your metadata and field data on the data sheet (see Appendix B). Then place a flag at the center point of the subplot.

STEP 4:

For the agricultural fields, **a fixed plot grid** is constructed around this center point. There are 25 possible subsample locations in this grid. Each possible subsample location is exactly one meter apart from neighboring subsample locations. The grid is alway oriented so that if you were to trace a line from subsample location 13 (the center point) to subsample location 3, the line would be pointing due North (see image below).

For hedgerows, **a fixed line transect** is constructed around this central GPS located point. There are 25 possible subsample locations in this transect. Each possible subsample location is exactly one meter apart from the neighboring subsample location. The line is alway oriented with the angle of the hedgerow (see image below).

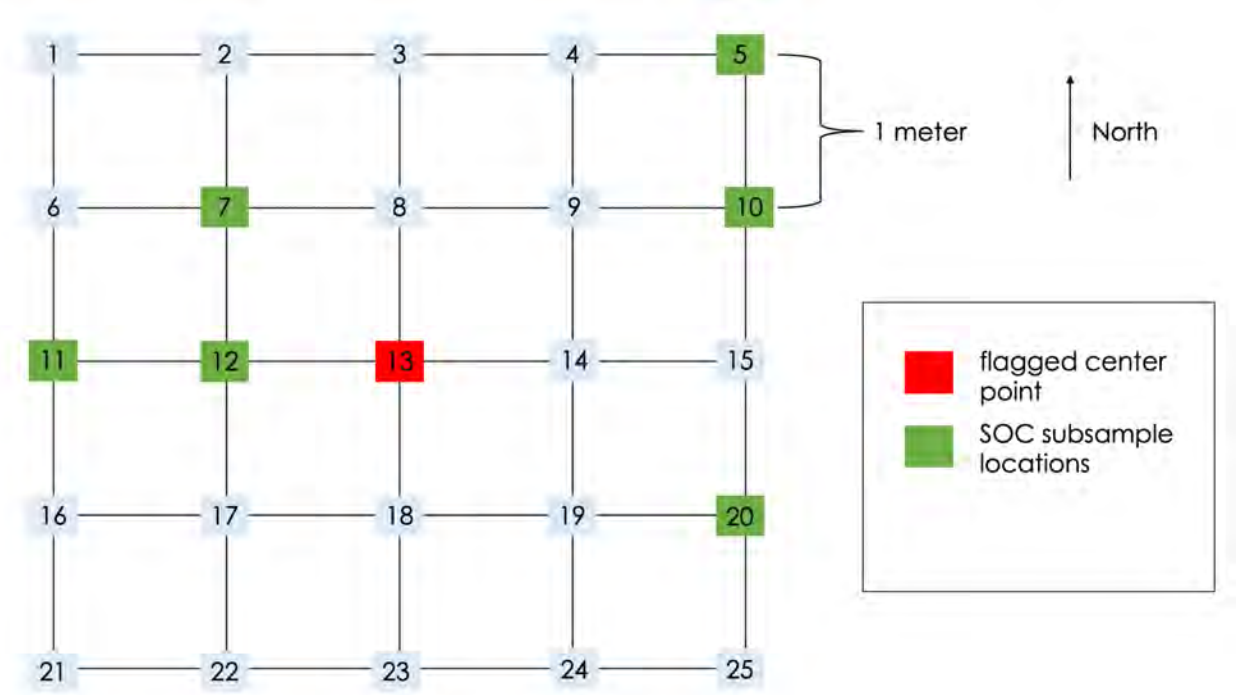

Figure 2. A fixed plot grid layout is used in agricultural fields. SOC sample collection occurs at six random subsample locations within the grid.

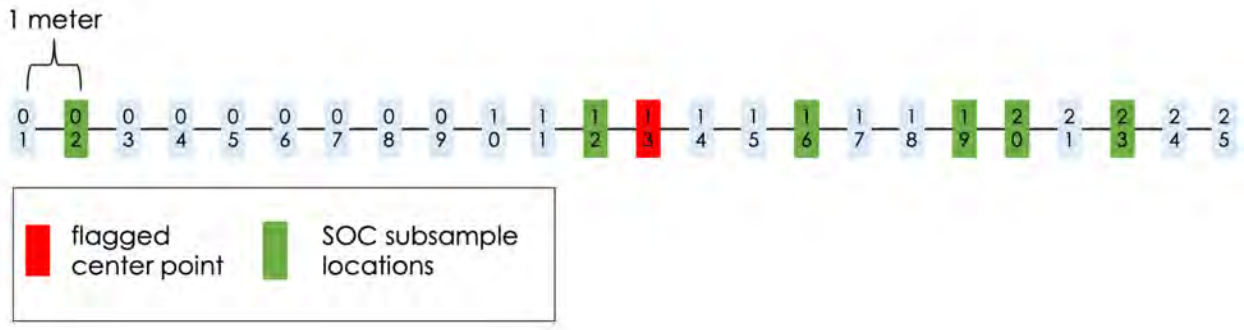

Figure 3. A fixed line transect is used in hedgerows. SOC sample collection occurs at six random subsample locations along the transect.

STEP 5:

Use a random number generator to produce six unique digits between one and twenty-five. Note these numbers on your data sheet. These randomly generated numbers inform the location of your six subsamples. Each number corresponds to a point in your fixed plot grid or line transect. Use the meter stick or measuring tape to arrive at each of the proper subsample locations, always starting at the flagged center point.

STEP 6:

At each of the six subsample locations, expose the bare soil surface without disturbing the soil surface. If necessary, gently remove any vegetation or litter covering the soil surface.

STEP 7:

Once the soil surface is exposed, use the soil probe to take soil cores at your six randomly selected locations within the grid plot or line transect. Use the soil probe to collect a subsample of each depth increment at each of the randomly selected subsample locations.

STEP 8:

At each subsample location, place the 0 cm to 15 cm section of the soil core into a bucket labeled 0–15 cm. Place the 15 cm to 30 cm section of the soil core into a bucket labeled 15–30 cm. For the Front South Field region, place the 30 cm to 45 cm section of the soil core into a bucket labeled 30–45 cm.

STEP 9:

Once you have taken soil cores from all six subsample locations, transfer the soil from the buckets into plastic bags.

STEP 10:

Using a sharpie, label the plastic bags with the date, time of sampling, sampler name(s), type of sampling (SOC), region name (Incubator South Field, Incubator North Field etc.), soil depth increment (0–15 cm, 15–30 cm, or 30–45 cm), and GPS coordinates for the plot or transect center point (latitude, longitude).

BD sampling process in the field

STEP 1:

BD sampling will occur in the same fixed grid plots (for agricultural fields) or fixed line transects (for hedgerows) where you took soil cores for SOC sampling (see above section).

STEP 2:

Use a random number generator to produce a number between one and twenty-five (make sure it is not one of the numbers you used for SOC monitoring above). Note this number on your data sheet. Similar to the SOC protocol above, this randomly generated number informs the location of your BD sampling site. Use the meter stick or measuring tape to arrive at the proper BD sampling location, always starting at the flagged center point.

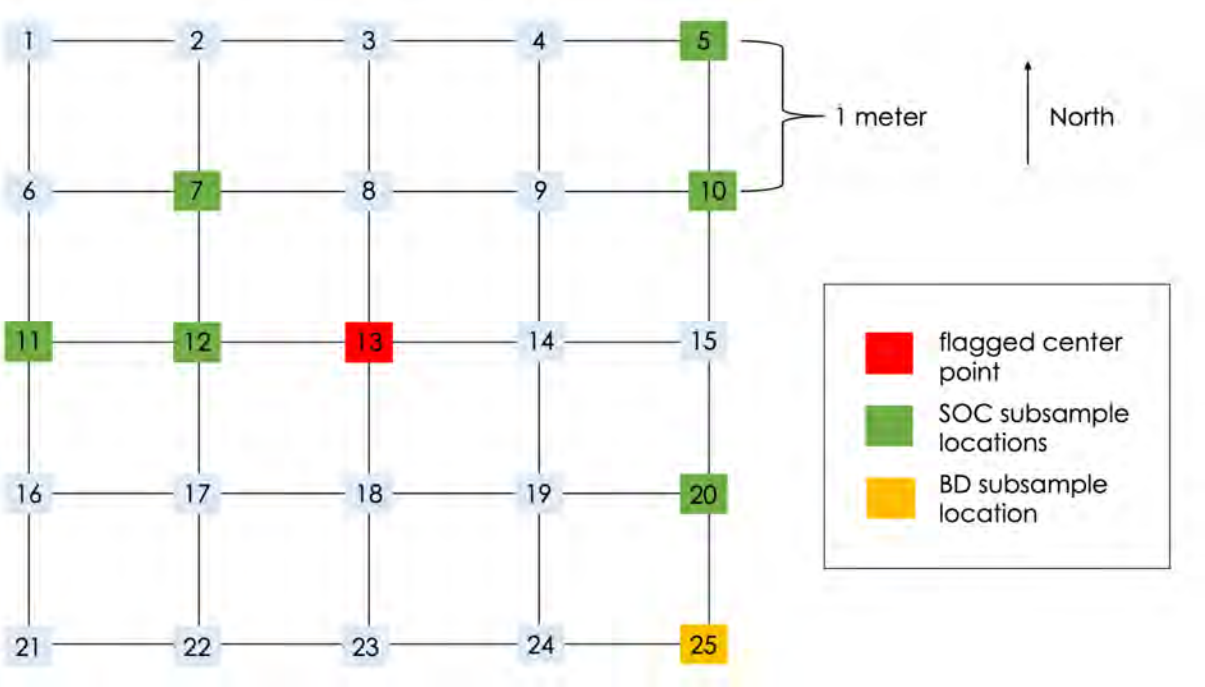

Figure 4. A fixed plot grid layout is used in agricultural fields. BD sample collection occurs at one random subsample location within the grid.

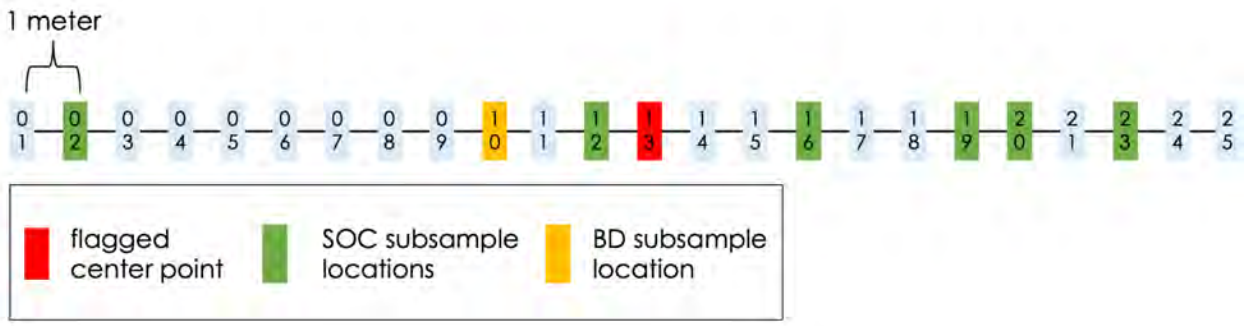

Figure 5. A fixed line transect is used in hedgerows. BD sample collection occurs at one random subsample location along the transect.

STEP 3:

At the sampling location, expose the bare soil surface without disturbing the soil surface. If necessary, gently remove any vegetation or litter covering the soil surface.

STEP 4:

Once the soil surface is exposed, place the BD core on top of the soil surface. Place the wooden block on top of the BD core. Using the hammer, evenly drive the BD core into the soil until the top of the core is level with the ground.

STEP 5:

Use the hand trowel to dig around the edge of the BD core. Carefully lift the BD core out of the soil, making sure not to let any soil escape from the bottom of the BD core when lifting it out of the ground.

STEP 6:

Use the flat blade knife to remove any excess soil on the bottom of the BD core. Ensure that the soil sample is flat with the edges of the BD core.

STEP 7:

Transfer the soil in the BD core into a plastic bag.

STEP 8:

Using a sharpie, label the plastic bag with the date, time of sampling, sampler name(s), type of sampling (BD), region name (Incubator South Field, Incubator

North Field etc.), BD core dimensions (diameter, height), and GPS coordinates for the plot or transect center point (latitude, longitude).

Sending SOC and BD samples to the lab and recording results

STEP 1:

Once you have sampled all the regions for SOC using the soil probe and BD using the BD core, store your labeled bags of soil somewhere safe (room temperature, not in direct sun). For the baseline monitoring that took place in November 2021, there were a total of 25 labeled plastic bags (17 SOC samples and 8 BD samples).

STEP 2:

As soon as possible after you complete sampling, prepare your samples for shipment. Ship soil samples to Ward Laboratories in Kearney, Nebraska. This lab was selected since they offer both tests of interest and have competitive pricing. You need to fill out their soil sample information sheet (see Appendix C). For the SOC samples, select the Total Organic Carbon (Combustion Method) option. For the BD samples, select the Basic Bulk Density option (not the Comprehensive Bulk Density option).

STEP 3:

After filling out necessary paperwork, ship your samples to Ward Laboratories (4007 Cherry Ave, Kearney, Nebraska 68847). You can expect results within 1–4 months.

STEP 4:

Once you receive the results, record the data and metadata in the spreadsheet titled *Data for Soil Organic Carbon and Bulk Density at The Maples Farm* in the *Soil Organic Carbon Monitoring* folder (see Appendix D).

References

** *All references can be found in PDF form in the folder titled References SOC and BD in the Soil Organic Carbon Monitoring folder. References also listed below.*

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Appendix 4. Water Holding Capacity Calculations

Carbon Cycle Institute

NRCS suggests that a 1% increase in SOM (SOM) results in an increase in soil water holding capacity (WHC) of an approximately 1-acre inch, or 27,152 gallons of increased soil WHC per acre. A 1% increase in SOM represents roughly 20,000 pounds (10 short tons) of organic matter or 5 short tons of organic carbon. The WHC table below shows estimated additional WHC associated with soil carbon increases on a landscape resulting from the implementation of the CFP. For simplicity, only practices resulting in WHC increases greater than one-acre foot are shown in the Table.

Add your Carbon Farm Practice from Drop Down Menu. Choose "Blank" as a space filler.	Add the individual carbon farm practice Mg/CO2e 20 year value only from the overall CFP summary table. Remember, COMET will only give you and annual value so you will need to come up with the 20 year value. https://docs.google.com/spreadsheets/d/1GturZTy_o	(20 year Mg CO2e) / (3.67) = Mg Organic Carbon (SOC)	Soil Factor: some practices store 100% of their carbon in the soil, some, such as agroforestry practices, and riparian, store only a percentage below ground. This factor attempts to account for that.	(Mg SOC) x (2) =Mg Soil Organic Matter (SOM)	Conversion: metric ton to short ton 10 short tons = 9.09 metric tons	10 short tons of SOM/ acre inch (AI) increase WHC	Convert acre inch to acre feet (/12)
Carbon Farm Practices (use dropdown)	**Mg CO2e 20 yr**	**Mg SOC**	**Soil Factor**	**Mg SOM**	**Mg SOM/AI**	**Acre Inches (AI)**	**Acre Feet (AF)**
Alley Cropping (CPS 311)	200.00	54.50	0.50	54.50	9.09	5.99	0.50
Compost Application on Cropland	1780.00	485.01	1.00	970.03	9.09	106.70	8.89
Conservation Cover (CPS 327)	27.60	7.52	1.00	15.04	9.09	1.65	0.14
Cover Crops (CPS 340)	80.00	21.80	1.00	43.60	9.09	4.80	0.40
Critical Area Planting (CPS 342)	20.00	5.45	0.50	5.45	9.09	0.60	0.05
Hedgerow Planting (CPS 422)	320.00	87.19	0.50	87.19	9.09	9.59	0.80
Riparian Restoration	280.00	76.29	0.50	76.29	9.09	8.39	0.70
Tree/Shrub Establishment (CPS 612)	1940.00	528.61	0.50	528.61	9.09	58.15	4.85
Mulching (CPS 484)	8.40	2.29	1.00	4.58	9.09	0.50	0.04
	71.00	19.35	1.00	38.69	9.09	4.26	0.35 bioct
Blank							
TOTAL	**4727.00**	**1288.01**		**1823.98**		**200.64**	**16.72**

Appendix 5. Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Yolo County, California

December 7, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


121° 45' 56" W
121° 45' 24" W
38° 43' 16" N
38° 42' 59" N
607330
607410
607490
607570
607650
607730
607810
607890
607970
608050
4286550
4286470
4286390
4286310
4286230
4286150
4286070
LVS
Cache Creek
Rh
LVS
State Highway 113
Ra
113
Best Ranch Rd
Soil Map may not be valid at this scale.
Map Scale: 1:3,590 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 50 100 200 300
Feet
0 150 300 600 900
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yolo County, California
Survey Area Data: Version 19, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 23, 2022—Apr 24, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ra	Reiff very fine sandy loam	36.2	76.4%
Rh	Riverwash	11.2	23.6%
Totals for Area of Interest		**47.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yolo County, California

Ra—Reiff very fine sandy loam

Map Unit Setting

National map unit symbol: hdwt
Elevation: 30 to 70 feet
Mean annual precipitation: 10 to 20 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 240 to 275 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Reiff and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reiff

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed coarse-loamy alluvium

Typical profile

H1 - 0 to 16 inches: very fine sandy loam
H2 - 16 to 60 inches: stratified sandy loam to loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: A
Ecological site: R017XY904CA - Subirrigated Deep Alluvial Fans
Hydric soil rating: No

Minor Components

Yolo

Percent of map unit: 5 percent
Hydric soil rating: No

Sycamore
Percent of map unit: 4 percent
Landform: Alluvial fans
Hydric soil rating: Yes

Tyndall
Percent of map unit: 4 percent
Hydric soil rating: No

Unnamed
Percent of map unit: 2 percent
Hydric soil rating: No

Rh—Riverwash

Map Unit Setting
National map unit symbol: hdwx
Elevation: 0 to 500 feet
Mean annual precipitation: 17 to 20 inches
Frost-free period: 230 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition
Riverwash: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Riverwash

Setting
Landform: Channels on streams
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed sandy and gravelly alluvium

Typical profile
H1 - 0 to 6 inches: gravelly sand
H2 - 6 to 60 inches: stratified gravelly coarse sand to sandy loam

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Ecological site: R017XY903CA - Stream Channels and Floodplains
Hydric soil rating: Yes

Minor Components

Loamy alluvial land
Percent of map unit: 10 percent

Hydric soil rating: No

Soboba

Percent of map unit: 5 percent
Hydric soil rating: No

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Carbon Farm Practice Workbook

Este libro de trabajo se deriva de una red de organizaciones, así como de una serie de actividades de planificación y comentarios de productores a partir de eventos de divulgación centrados en la planificación de Carbon Farm Planning. En particular, Center for Land-Based Learning reconoce el trabajo del Carbon Cycle Institute y Fibershed por su trabajo en la elaboración de estos documentos y por la creación de materiales y recursos de Carbon Farm Planning.

Este libro de trabajo tiene como objetivo ayudar a los productores a dar los primeros pasos hacia carbon farm planning y trabajar hacia la implementación de prácticas para mejorar la función del ecosistema en las tierras que administran. Tenga en cuenta que cada operación, condiciones del sitio, sistemas, productores y planificadores generan un conjunto único de oportunidades de carbon farming! (granjas de carbono)

Este libro de trabajo tiene cuatro objetivos principales:

1) *Haga un inventario de las condiciones de su sitio, las prácticas existentes de gestión de tierras y otros planes pertinentes.*

2) *Delinee las preocupaciones de recursos específicas de su operación*

3) *Establezca objetivos a corto y largo plazo para su operación.*

4) *Prepararlo para una visita al sitio con un asistente técnico que puede ayudarlo a identificar posibles oportunidades en la granja y acercarlo al desarrollo de un Carbon Farm Plan.*

Cómo utilizar este libro de trabajo

Este libro de trabajo ofrecerá lo máximo a los productores cuando se utilice junto con la orientación de un proveedor de servicios técnicos, como un agente del Distrito de Conservación de Recursos (RCD), el Servicio Nacional de Conservación de Recursos (NRCS) u otra persona calificada que trabaje para ayudarlo a comprender el carbono. agricultura, aclarar sus objetivos de agricultura de carbono para su operación e implementar prácticas de Carbon Farming.

> *“La Agricultura de Carbono implica la implementación de prácticas, como el pastoreo prescrito, la restauración riparia y la aplicación de compost, que son conocidas por mejorar la tasa a la que el CO2 se elimina de la atmósfera y se convierte en material*

vegetal y materia orgánica del suelo. Un Carbon Farm Plan (CFP, por sus siglas en inglés) es una evaluación integral de todas las oportunidades para la reducción de GHG y la captura de carbono en una granja o rancho específico. Un conjunto de herramientas en línea (incluido COMET-Planner) permite la cuantificación de los beneficios de GHG asociados con cada práctica de manejo de tierras y el Carbon Farm Plan en su conjunto. El CFP proporciona al productor un portafolio de prácticas de conservación recomendadas para implementar a lo largo del tiempo."

– Carbon Cycle Institute

Los documentos generados al completar este cuaderno de trabajo no están destinados a servir como un Plan de Carbon Farm completo. Estas actividades están destinadas a ayudar a los productores a implementar prácticas de agricultura de carbono que tengan sentido para su operación; y, si lo desean, facilitar la creación de un CFP que describa con precisión la visión del productor para maximizar los potenciales de captura de carbono de las tierras que gestionan.

Introducción y Antecedentes

Nombre de la operación

Persona de contacto

Dirección de correo electrónico

Dirección física de la operación

Superficie total en acres

Acres considerados para la planificación

Cuéntenos sobre la historia de la tierra y su operación.

Cuéntenos sobre su operación actual. Por ejemplo, proporcione el tipo de ganado y el tamaño del rebaño, el tipo de cultivo/producción así como las acres por tipo de producción.

Por favor, detalle cualquier entidad con la que haya trabajado para crear un plan de conservación, pastoreo o manejo de nutrientes o para implementar una práctica de conservación.

Inventario de la Granja

Describa su ciclo de manejo para sus tierras de cultivo.

¿Cuál es su cultivo principal?

¿Planta un cultivo de cobertura y practica la rotación de cultivos?

¿Con qué frecuencia labra?

¿Aplica compost u otras enmiendas?

¿Con qué frecuencia aplica fertilizantes sintéticos?

Condiciones Ambientales

Esta sección nos ayudará a obtener una mejor comprensión de las condiciones y características de su sitio.

<u>Clima</u>

¿Cuál es la precipitación anual?

¿Duración de la temporada de crecimiento?

¿Temperatura máxima/mínima?

Describa cualquier cambio climático reciente observado en la granja o localmente.

Suelos

¿Qué sabe sobre sus suelos en el sitio?

¿Tienen un alto contenido de arcilla/arena/limo?

¿Contienen alta o baja materia orgánica del suelo?

¿Drenan rápidamente o pobremente?

¿Están compactados?

Si tiene experiencia utilizando el Web Soil Survey del NRCS para obtener datos básicos sobre sus suelos, por favor incluya aquí cualquier información que haya aprendido.

Hidrología

¿En qué cuenca hidrográfica se encuentra?

¿Tiene algún arroyo o río importante que pase por sus tierras de trabajo?

Vegetación

¿Cuál era el tipo de vegetación histórica en el sitio?

¿Qué tipos de cobertura vegetal tiene en tierras no labradas en el sitio o localmente?

Establecimiento de Objetivos

Esta sección lo ayudará a través de un proceso de identificación de sus objetivos con respecto a su granja/rancho. Estos objetivos deben reflejar lo que está tratando de lograr o mejorar en su propiedad. Estos objetivos se utilizarán en conjunto con sus preocupaciones específicas sobre los recursos (detalladas en la siguiente sección) para identificar estrategias y prácticas de manejo potenciales.

Los objetivos pueden dividirse en categorías de negocio, calidad de vida y recursos naturales.

Ejemplos de objetivos orientados al negocio podrían incluir:

- aumentar la rentabilidad
- desarrollar una marca ecológica
- planificación de sucesión
- expandir la producción

Ejemplos de objetivos de calidad de vida pueden incluir:

- reducir las horas o los costos dedicados a tareas de mantenimiento (control de malezas, riego, fertilizantes, etc.)
- construir relaciones de apoyo con otros productores/organizaciones
- disminuir el estrés
- ser parte de la solución a nuestra crisis climática

Ejemplos de objetivos de recursos naturales pueden incluir:

- mejorar la capacidad de retención de agua en el suelo
- reducir la erosión
- mejorar la diversidad de especies
- aumentar la materia orgánica del suelo.

¿Por qué está interesado en Carbon Farm Planning?

¿Cuáles son algunos de sus objetivos a corto plazo (1-4 años)?

¿Cuáles son algunos de sus objetivos a largo plazo (más de 5 años)?

¿Qué ajustes a su manejo actual prevé que necesitan cambiar o mejorar para alcanzar sus objetivos?

¿Qué factores están limitándolo para alcanzar sus objetivos?

Identificar Preocupaciones sobre Recursos

En esta sección le pedimos que identifique las preocupaciones sobre los recursos en su terreno. Enumere las limitaciones relacionadas con la función del ecosistema y/o restricciones sociales/culturales.

Las preocupaciones sobre los recursos son elementos identificados que pueden estar inhibiendo el potencial completo del suelo, agua, animales, plantas, aire, humano o energía (SWAPA+HE) de las tierras de la operación. Esas preocupaciones sobre los recursos también pueden evitar que el propietario de la tierra alcance sus objetivos y metas.

Un CFP, por definición, reconoce el carbono en la granja como la principal preocupación sobre los recursos. El plan, por lo tanto, se construye en torno a los potenciales para aumentar la captura o conservación de carbono. Con ese fin, se pueden identificar otras preocupaciones sobre los recursos que, de alguna manera, limitan la captura de carbono en el sitio. Una vez completada, la información en esta tabla ayudará a un asistente técnico a comprender sus preocupaciones y a enfocarse en qué prácticas pueden ser más útiles para alcanzar sus objetivos.

	Preocupaciones sobre los recursos identificadas por el propietario	
	SWAPA+HE	Ejemplos de limitaciones relacionadas con la función del ecosistema y/o restricciones sociales/culturales.
Ejemplo	Suelo	Erosión del suelo a lo largo de una vía fluvial, áreas de compactación, agotamiento de materia orgánica, pérdida o degradación del hábitat de organismos del suelo, concentraciones de sales u otros químicos, e inestabilidad de los agregados.
Ejemplo	Agua	La compactación en los suelos resulta en inundaciones o agua estancada en los campos después de eventos de lluvias intensas. Los suelos no retienen el agua mucho tiempo después del riego.
Ejemplo	Animal	Pérdida de hábitat histórico para la vida silvestre y disminución de insectos beneficiosos para el manejo integrado de plagas.
Ejemplo	Plantas	\ Baja productividad y salud de las plantas en algunas áreas. Alta presión de malezas. Riesgo de incendios forestales por acumulación de biomasa.
Ejemplo	Aire	Pérdida de capacidades de captura de carbono. Los vientos predominantes dañan los cultivos y hacen que el trabajo sea incómodo.
Ejemplo	Humano	Fondos limitados para implementar mejoras vegetativas y estructurales para alcanzar los objetivos. La instalación inicial de prácticas puede aumentar los costos y la gestión a corto plazo.
Ejemplo	Energía	Baja eficiencia energética de equipos e instalaciones, prácticas agrícolas y operaciones en el campo.

	Preocupaciones de Recursos Identificadas por el Propietario o Asistente Técnico	
	SWAPA+HE	Enumera las limitaciones relacionadas con el funcionamiento del ecosistema y/o las restricciones sociales/culturales.
Completar	Suelo	
Completar	Agua	
Completar	Animal	
Completar	Planta	
Completar	Aire	
Completar	Humano	
Completar	Energia	

Evaluación del Sitio

Para esta sección, es mejor organizar una visita al sitio con un proveedor de servicios técnicos, como un Distrito de Conservación de Recursos (RCD), un agente del Servicio de Conservación de Recursos Nacionales (NRCS) o otra persona calificada que te ayude a entender carbon farming, aclarar tus objetivos de carbon farming para tu operación y comenzar a planificar cómo implementar las prácticas de agricultura de carbono.

Contexto Geográfico

¿En qué cuenca hidrográfica te encuentras?

¿En qué dirección fluye el agua?

¿Cuánta lluvia recibe este sitio?

¿Alguna parte se inunda o tiene agua estancada?

¿Los arroyos influyen en el paisaje y de qué manera?

¿En qué dirección está el viento predominante?

¿El viento afecta los cultivos, las personas o el ganado en la finca? Si es así, ¿desde qué dirección y estación?

¿Cuáles son los tipos de uso del suelo en el área de planificación y adyacentes a ella?

¿Cómo se manejan los sitios con ecologías similares?

Información Específica del Sitio

¿Cuáles son los recursos de agua disponibles en la finca?

¿Cómo difiere la gestión en el área de planificación?

¿Cuál ha sido el impacto de la gestión en sitios similares o únicos en la finca?

¿Qué te dicen la vegetación residente y/o el patrón de cultivo sobre el suelo, el agua y la gestión?

Oportunidades

Detalla en un mapa del sitio dónde ves oportunidades para:

- Integrar cultivos de cobertura en lugar de barbecho desnudo
- Diversificar las rotaciones de cultivos
- Cultivar en intercultivo y usar mezclas diversas de cultivos de cobertura
- Integrar sistemas de cultivos y ganado en espacio y tiempo
- Integrar prácticas agroforestales para la diversidad de hábitat y vida silvestre
- Mejorar la salud del suelo
- Reducir insumos sintéticos
- Reducir las emisiones de gases de efecto invernadero
- Capturar más energía solar y carbono atmosférico
- Aumentar la productividad

Identificación de Prácticas

Esta sección ayudará a identificar cómo abordar tus preocupaciones de recursos y comenzar a lograr tus objetivos de planificación de la finca de carbono. Como se mencionó anteriormente, este ejercicio está diseñado para ser completado con un asistente técnico familiarizado con las Prácticas de Conservación del NRCS.

	Preocupaciones de Recursos Identificadas por el Propietario	**Estándar de Práctica de Conservación del NRCS (CPS) y código asociado # (cuando sea aplicable) u otras prácticas de CFP para abordar la preocupación**.

	SWAPA+HE	Ejemplos de limitaciones relacionadas con el funcionamiento del ecosistema y/o las restricciones sociales/culturales.	Ejemplos de Prácticas de Conservación completadas por el asistente técnico
Ejemplo	Suelo	Erosión del suelo a lo largo de un cuerpo de agua, áreas de compactación, agotamiento de materia orgánica, pérdida o degradación del hábitat de organismos del suelo, concentraciones de sales u otros químicos, e inestabilidad de los agregados.	Restauración Ripariana, Plantación de Áreas Críticas (CPS 342), Búfer Forestal Ripariano (CPS 391), Plantación de Biomasa Forrajera (CPS 512) o Plantación de Pastizales (CPS 528) Pastoreo Prescrito (CPS 528) y Cercado (CPS 328) Borde de Campo (CPS 386) o Seto (CPS 422)
Ejemplo	Agua	Compactación del suelo que resulta en inundaciones o agua estancada en campos después de lluvias intensas. Los suelos no retienen agua durante mucho tiempo después de la irrigación.	Aplicación de Compost (CPS TBD); Pastoreo Prescrito (CPS 528); Cercado (CPS 328); Plantación de Biomasa Forrajera (CPS 512); Establecimiento de Árboles/Shrubs (CPS 612)
Ejemplo	Animal	Pérdida del hábitat histórico para la vida silvestre y disminución de insectos beneficiosos para el manejo integrado de plagas.	Plantación de Biomasa Forrajera (CPS 512) o Plantación de Pastizales (CPS 528); Aplicación de Compost (CPS TBD); Pastoreo Prescrito (CPS 528); Cercado (CPS 328); Silvopastura (CPS 381); Establecimiento de Árboles/Shrubs (CPS 612)
Ejemplo	Planta	Baja productividad y salud de las plantas en algunas áreas. Alta presión de malezas. Riesgo de incendio forestal por acumulación de biomasa.	Plantación de Biomasa Forrajera (CPS 512) o Plantación de Pastizales (CPS 528); Aplicación de Compost (CPS TBD); Pastoreo Prescrito (CPS 528); Cercado (CPS 328)
Ejemplo	Aire	Pérdida de capacidades de secuestro de carbono. Los vientos predominantes dañan los cultivos y hacen que el trabajo sea incómodo.	Establecimiento de Árboles/Shrubs (CPS 612); Establecimiento de Rompe Vientos/Seto (CPS 380); Mejora del Sistema de Combustión (CPS 372)
Ejemplo	Humano	Fondos limitados para implementar mejoras vegetativas y estructurales para cumplir con objetivos. La instalación inicial de prácticas puede aumentar los costos y la gestión a corto plazo.	Conservación de costos compartidos, oportunidades de subvenciones

Ejemplo	Energia	Baja eficiencia energética de equipos e instalaciones, prácticas agrícolas y operaciones en campo.	Establecimiento de Rompe Vientos/Seto (CPS 380); Mejora del Sistema de Combustión (CPS 372); Manejo del Agua de Riego (CPS 449); Bomba Solar (CPS 533)

	Preocupaciones de Recursos Identificadas por el Propietario		**Estándar de Práctica de Conservación del NRCS (CPS) y Código Asociado** (cuando sea aplicable) u otras prácticas de CFP para abordar la preocupación**
	SWAPA+HE	Limitaciones relacionadas con el funcionamiento del ecosistema y/o las restricciones sociales/culturales.	Prácticas de Conservación completadas por el asistente técnico
Llenar	Suelo		
Llenar	Agua		
Llenar	Animal		
Llenar	Planta		

Llenar	Aire		
Llenar	Humano		
Llenar	Energia		

Desarrollando un Carbon Farm Plan

Con el trabajo que ya has completado, ya puedes comenzar a solicitar financiamiento o implementar las prácticas identificadas. Sin embargo, si deseas seguir con el desarrollo completo de un Plan de Carbono para tu operación, el paso final es trabajar con un asistente técnico que pueda reunir toda la información que has detallado, tus objetivos, tus preocupaciones sobre los recursos y tus prácticas potenciales en un plan integral.

Carbon Farm Plan for Matchbook Wine Company

January 2025

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1. Introduction

1.1 Why Carbon?

Carbon has recently garnered a lot of attention for its ability to affect global climates as a greenhouse gas. When combined with oxygen, its gaseous form (carbon dioxide or CO_2) can enter the atmosphere and act like a blanket, trapping heat from the sun on the earth's surface. In moderation, this warming effect is what has allowed life to flourish on the planet, but due to recent human activities, the carbon cycle has been thrown out of balance and these levels are rising at dangerous rates.

Carbon enters the landscape from the atmosphere when growing plants absorb or capture carbon dioxide from the air to combine it with water and other nutrients from the soil and create sugars and other structures needed to support life. Above ground, this process allows plants to produce food, fiber, fuel, and flora that humans and other organisms rely on. Below ground, this carbon supplies fungi, bacteria, and other organisms directly with sugar byproducts known as photosynthates. Photosynthates move directly to the soil via plant roots as exudates and indirectly through roots to beneficial soil mycorrhizal fungi.

In addition to the transformation of carbon from the air into agricultural products, carbon can be stored long-term (decades to centuries or more) in soil and woody vegetation through a process known as biological carbon sequestration. Increasing carbon capture has a host of agronomic and environmental benefits that include increased soil water holding capacity, improved soil fertility and mitigating rising levels of atmospheric carbon dioxide (CO_2) and other greenhouse gases (GHG) that currently contribute to climate destabilization through global warming.

The term "carbon farming" refers to proven and measurable practices that increase the rate at which CO_2 and other greenhouse gases (GHG) are removed from the atmosphere and stored over the long term in soil and plant material. Carbon entering the farm from the atmosphere can end up in several locations: in the harvested portion of the crop, in the soil as root exudates and soil organic matter (SOM), in "waste" materials such as compost or manure, in standing carbon stocks such as grassland vegetation or woody perennials (trees, vines, orchards, etc.), or in other permanent vegetation such as windbreaks, vegetated filter strips, or riparian forests and woodlands. While all farming is completely dependent upon atmospheric CO2, different farming practices and different farm systems can lead to very different amounts of on-farm carbon capture and storage.

1.2 The Carbon Farm Planning Process

The Carbon Farm Planning (CFP) process differs from other approaches to land use planning by focusing on increasing the capacity of the farm to capture carbon and to store it beneficially in the crop, as standing carbon stocks in permanent vegetation, and/or as SOM. While agricultural practices often lead to a gradual loss of carbon from the farm system, a CFP is successful when it leads to a net increase in farm-system carbon. By increasing the amount of photosynthetically captured carbon stored, or "sequestered," in long-term carbon pools on the farm, carbon farming results in a direct reduction in the amount of CO2 in the atmosphere, while supporting crop production and farm resilience to environmental stress, including flood and drought.

Carbon Farm Planning is based upon the USDA NRCS Conservation Planning process, but uses carbon and carbon capture as the organizing principle around which the plan is constructed. This simplifies the planning process and connects on-farm practices directly with ecosystem processes, including climate change mitigation, increases in on-farm climate resilience, water holding capacity, soil health, and farm productivity.

Like NRCS Conservation Planning, carbon farm planning begins with an overall inventory of natural resource conditions on the farm or ranch, then proceeds to identify opportunities for reduction of GHG emissions, enhanced carbon capture, and storage by both plants and soils. Building this list of opportunities is a brain-storming process; it should be as extensive as possible, including everything the farmer and planners can think of that could potentially reduce emissions and capture and sequester carbon on the farm. While actions proposed in the plan should reflect the inherent limits of the farm ecosystem, financial considerations should not limit this initial brainstorming process, as one goal of the carbon farm planning process is to identify potential funding, above and beyond existing resources, to realize implementation of the plan.

Finally, practices are prioritized based on the needs and goals of the landowner, choosing high carbon-benefit practices wherever possible. While economic considerations may be used to filter the comprehensive list of options, funding mechanisms may also be identified. Funding sources include cap and trade or other GHG mitigation offset credits, USDA-NRCS and other state and federal programs, and private funding. Projects are implemented as funding, technical assistance, and farm scheduling allow. Over time, the CFP is evaluated, updated, and altered as needed to meet changing land management objectives and implementation opportunities, using the fully implemented plan scenario as a goal. Where plan implementation is linked to carbon markets or other ecosystem service markets, periodic plan evaluation may be tied to those verification schedules.

Additional information about carbon farming can be found online at: www.marincarbonproject.org and www.carboncycle.org

2. Property Overview and Carbon Farm Plan Scope

- Property Name: Matchbook Wine Company
- Owner: John and Lane Giguiere
- Address: 12300 County Rd. 92B, Zamora, CA, 95698
- Acreage (total): 2,768 acres total (1,968 acres of croplands, 800 acres of undeveloped land)

2.1 History

Matchbook Wine Company, founded in 2005, is located between Highway 5 and 505 about 3.25 miles southwest of Zamora, CA. The winery operates about 1,968 acres of total cropland, of which 378 acres (referred to as the estate vineyards), are owned by the Giguiere family. The remaining acreage is owned by an investment group but leased and operated under Matchbook Wine Company. The property is approximately 160-260 feet above sea level, and it is located within the Sacramento River Watershed (Figure 1). Much of the land was developed in 2012, and several blocks, including the estate vineyards, are transitioning towards regenerative/organic certification. Wine grapes are the primary crop in cultivation based on acreage (approximately 1,371 acres), though olives are also grown on the site (about 597 acres). There is also about 800 acres of undeveloped open space, some of which is grazed by sheep. Altogether, Matchbook's acreage is approximately 2,768 acres.

In 2024-2025, Matchbook Wine Company collaborated with the Yolo Carbon Farming Partnership to create a Carbon Farm Plan (CFP) for this property. The Carbon Farming Partnership, developed and led by the Center for Land-Based Learning, was one of several early action projects for Yolo County's Climate Action and Adaptation Plan. The project was funded by the County of Yolo as part of an effort to achieve the County's goal of a net negative carbon footprint by 2030. This project, among others, is aimed at decreasing greenhouse gas emissions and increasing carbon sequestration with a particular focus in the agricultural landscape which makes up much of the county. The partnership consists of the Center for Land-Based Learning, the County of Yolo, Yolo County Resource Conservation District, the Yolo Land Trust, and the Carbon Cycle Institute in collaboration with local agricultural operations. Through this partnership, two other CFPs were developed—one for a 50-acre property which serves largely as a learning space for new and beginning farmers, and another for a 7,000-acre property comprised primarily of annual crops. Matchbook Wine Company, in contrast, operates a perennial cropping system, and thus was prioritized as it provides a third example of the diverse agricultural backdrops to which the carbon farming approach can be applied. As a participant, Matchbook is providing a site-specific framework for the county-wide goal of increasing the pace and scale of carbon sequestration in natural and working lands. This plan will not only identify and quantify the carbon benefits of current on-farm carbon-beneficial practices, but it will also outline and quantify future sequestration potential.

As this carbon farm plan is being written, several parcels on the property are undergoing ownership and operational transition. There are tentative plans to remove several of the vineyard blocks and replace them with olives orchards. These areas will be discussed later in this document.

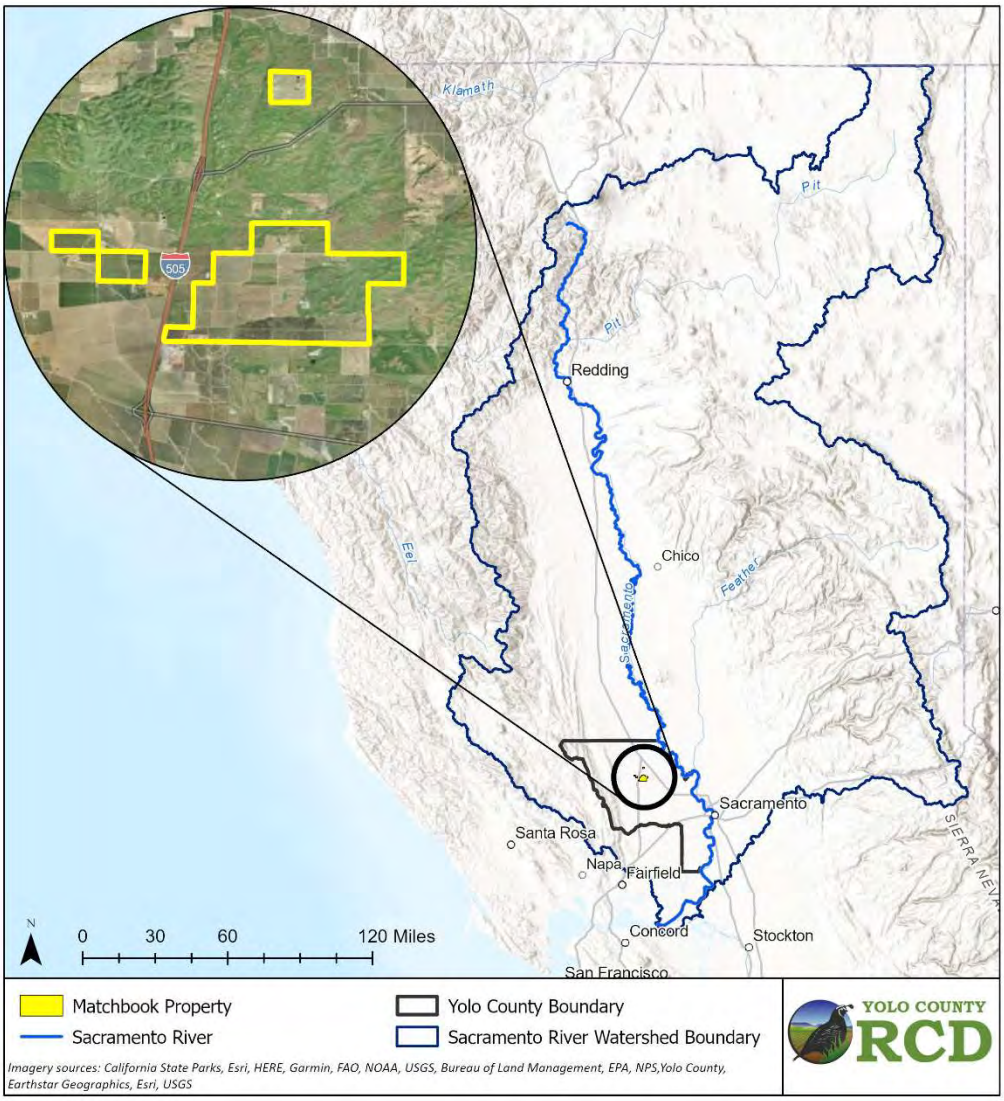

Figure 1. Matchbook Wine Company geographical location and boundaries.

2.2 Landowner Goals and Objectives

Overall, Matchbook's aim is to promote all practices that support regenerative agriculture while maintaining a viable, operational business. Built into their goals of bolstering regenerative agricultural practices are desires to manage resources and crop conditions to promote high quality wines. Stated objectives include the following:

1) Remain operable and ultimately cut costs.
2) Utilize regenerative practices such as composting, cover cropping, reduced tillage, etc.
3) Improve soil aggregation and minimize soil disturbance.

4) Increase soil organic matter to 5%.
5) Minimize additives and reduce the use of synthetics (fertilizers, pesticides, and herbicides).
6) Implement hedgerows and support biological habitat areas.
7) Produce healthier vines with less fertilizer.
8) Increase wine quality through better soil structure and presence of secondary metabolites.
9) Manage wine acidity, a quality that is impacted by heat and soil quality.
10) Decrease water pH. Currently, the district water applied has a pH between 7.5-8.

This Carbon Farm Plan will address a number of these issues directly. Other goals (such as goal #10) will not be the focus of this plan, but are included in the goals to create a holistic document that can be referenced in the future.

3. Site Overview and Carbon Farm Plan Scope

3.1 Environmental Conditions

Matchbook Wine Company is in California's Sacramento Valley which experiences a Mediterranean climate characterized by hot, dry summers and cool, wet winters. Temperatures in the area range from an average low of 39°F in December to an average high of 94°F in July and August. Average precipitation is about 21 inches per year, with most occurring between November to March (temperature and precipitation data come from nearby Woodland, CA; US Climate Data). On average, there are 267 frost-free days at or above 32°F in the area (https://ucanr.edu/sites/gardenweb/files/29030.pdf). Wind is a concern for Matchbook, though there hasn't been a large crop loss associated with it. Northern winds are prevalent and can damage the outer vine on the northern row of some blocks. About 20 miles to the southeast at the Sacramento International airport, wind speeds average between 7-8 mph throughout the year, though they can exceed 20 mph at times (Iowa State University Iowa Environmental Mesonet; https://mesonet.agron.iastate.edu/sites/locate.php?network=CA_ASOS).

3.2 Soils

Soils at Matchbook Wine Company fall into 9 different soil units (Figure 2, Table 1). 71% of the soils are categorized as Corning gravely loam, while about 28% are a Sehorn clay or Sehorn-Balcom complex. The Corning series is "very deep, well or moderately well drained soils formed in gravelly alluvium weathered from mixed rock sources," and it can have high runoff on mounds. (https://soilseries.sc.egov.usda.gov/OSD_Docs/C/CORNING.html). "The Sehorn series consists of moderately deep, well-drained soil on foothills. These soils formed in residuum weathered from calcareous and shale" (https://soilseries.sc.egov.usda.gov/OSD_Docs/S/SEHORN.html). About one percent total is made up of other soil types (Hillgate loam, Marvin silty clay loam, Myers clay, and Willows Clay).

Increasing soil organic matter (SOM) was identified as a goal in this plan. SOM varies by soil type, but in general, it does not exceed 2% on the majority of the property according to site-specific data from NRCS' Web Soil Survey (https://websoilsurvey.nrcs.usda.gov/app/). Several soil analyses were conducted in April 2024 by JMLord, Inc; these reports show that SOM ranges from 0.83-2.4% with most field reports

showing levels around 1.5%. Since soil organic carbon (SOC) comprises 58% of SOM, this equates to a range of 0.5-1.4% SOC.

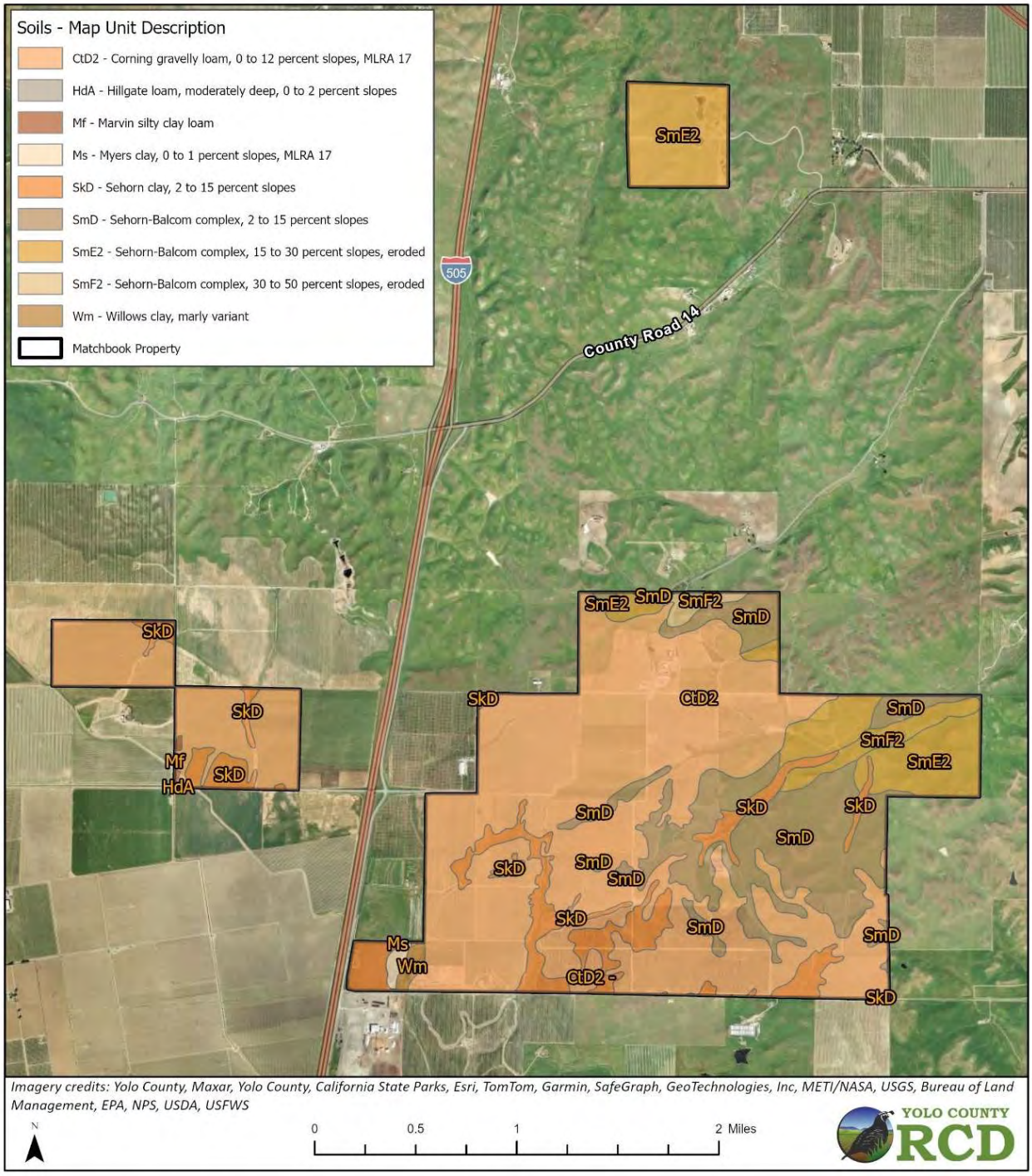

Figure 2. Soil map of Matchbook Wine Company.

Table 1. Matchbook Wine Company Soils (NRCs designations). Bulk density, %SOM, and %SOC are based on NRCS data of the top 30 cm.

Map Unit	Soil Type	Acres (2,450.4 total)	Proportion of Area	Bulk Density (g/cm3)	% Soil Organic Matter (SOM)	% Soil Organic Carbon (SOC)*
CtD2	Corning gravelly loam, 0 to 12 percent slopes, MLRA 17	1,740.7	71.0%	1.45	2.00	1.16
HdA	Hillgate loam, moderately deep, 0 to 2 percent slopes	0.1	0.0%	1.50	0.75	0.44
Mf	Marvin silty clay loam	3.0	0.1%	1.50	2.50	1.45
Ms	Myers clay, 0 to 1 percent slopes, MLRA 17	10.1	0.4%	1.31	1.70	0.99
SkD	Sehorn clay, 2 to 15 percent slopes	253.6	10.3%	1.40	1.50	0.87
SmD	Sehorn-Balcom complex, 2 to 15 percent slopes	213.7	8.7%	1.40	1.50	0.87
SmE2	Sehorn-Balcom complex 15 to 30 percent slopes, eroded	195.3	8.0%	1.40	1.50	0.87
SmF2	Sehorn-Balcom complex, 30 to 50 percent slopes, eroded	21.8	0.9%	1.40	1.50	0.87
Wm	Willows clay, marly variant	12.1	0.5%	1.45	3.00	1.74

**SOC is calculated as 58% of SOM*

3.3 Current Management Practices

Approximately 1,968 acres of the 2,768-acre operation are currently in production. Olive orchards account for about 597 acres and vineyards comprise about 1,371 acres (Figure 3). The remaining approximately 800 acres are open or undeveloped space. In 2024, about 1,800 tons of grapes were processed. Matchbook grows several varietals of grapes which require different management strategies to attain specific flavor and chemical profiles. Trellis heights also vary through the property, with some vines raised higher to allow for easier grazing. Cultivars include cabernet Sauvignon, Chardonay, Touriga Nacional, Petite Sirah, Petit Verdot Syrah, Teroldego, Tannat, Tempranillo, and Verdejo. For the goals of this plan and for the sake of concision, varietal-specific management differences will not be addressed.

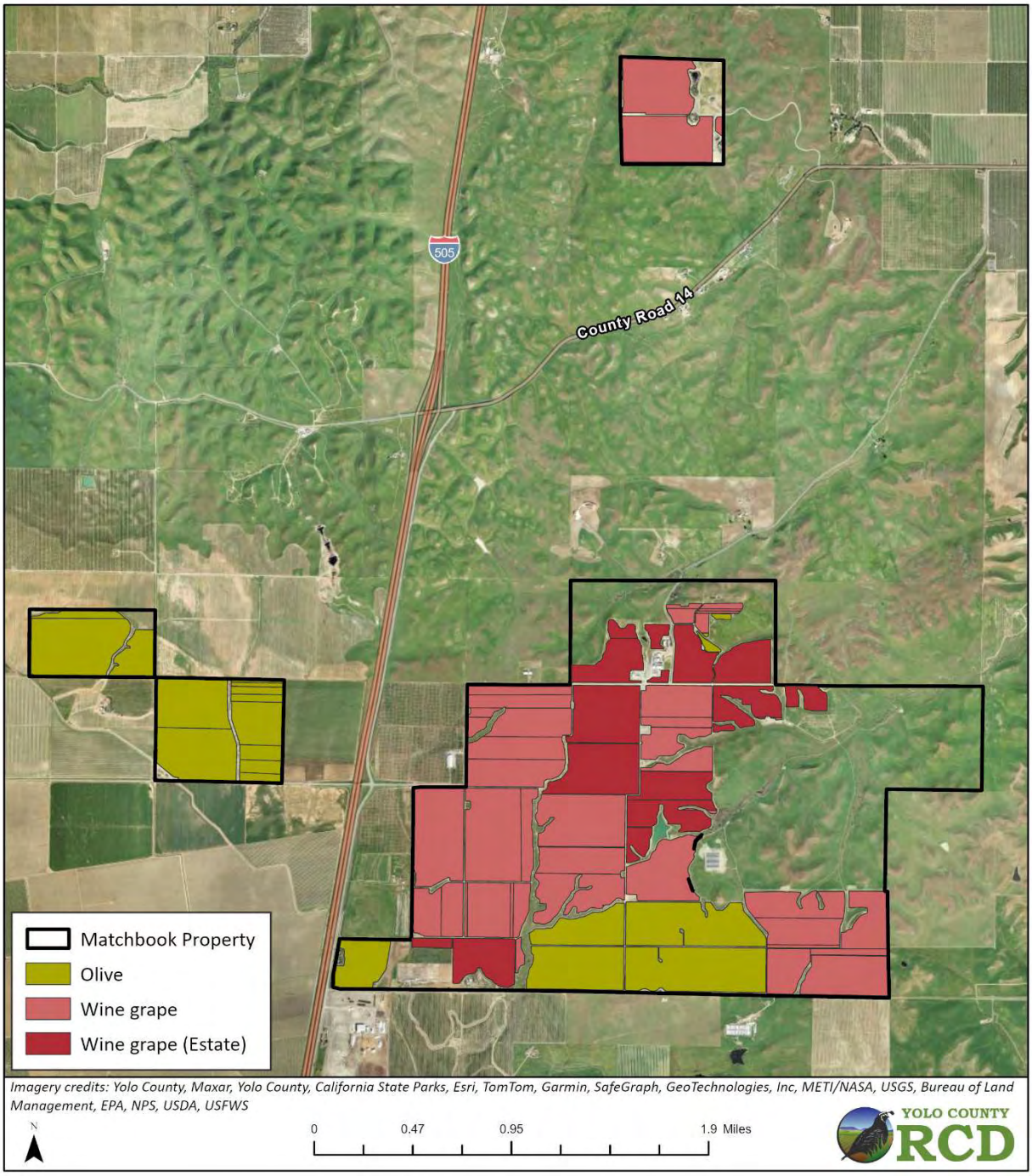

Figure 3. 2024 crop map at Matchbook Wine Company.

Compost has been spread in the vineyards in the past, but the last application was in 2022 due to budget limitations. About 3-3.5 tons per acre of compost with a C:N ratio between 20:1 – 30:1 was spread once per year in the fall (note: this is the rate that compost can be applied by a single tractor pass with the current equipment). Presently, nitrogen and potassium are applied at different times of the year, and there are goals of transitioning all areas to be organic. Urea is used in limited amounts

throughout the property, as well as CAN 17, UN32, potassium fluoride, sulfate of potash, and some micro-amendments. Amendments are added year-round through water treatment, and some foliar sprays are used as well. In the estate vineyards, biological fertilizers are used (Figure 3, indicated by darker red). In order to address mildew issues, sulfur dust is used in organic operations.

In terms of infrastructure, there is a 4-acre solar farm on the property that provides energy for irrigation pumping and the winery itself. Buried driplines are placed in the middle of vineyard alleys, and there is also trellised drip in the crop row, so together, there is drip irrigation about every four feet. There is a no-till drill seeder which is used for cover cropping, though the use of a multispecies mix has made setting the depth and rate difficult (more information on cover cropping later).

3.4 Existing Carbon Beneficial Practices

Matchbook Wine Company already employs several carbon beneficial practices. A row of olives was planted on the eastern side of road 92B, and it in part acts as a windbreak for the vineyards to the east (marked in purple in Figure 4). As mentioned above, compost was used in the recent past, though the last time it was spread was in 2022 on about 1,371 acres of vineyard floor. Budget constraints have limited the ability to spread compost recently. Vineyard and olive orchard floors are also covered with vegetation at times during the year (the estate vineyards have year-round coverage). In some areas, this coverage is natural vegetation consisting of volunteer cereal grains and clovers, and in other areas, it is actively seeded. One of the goals in actively seeding is to fix nitrogen in the soil. Cover cropping was first initiated around 2021, and in the fall of 2023, a 12-species cover crop was planted that consisted of species such as safflower, sunflower, clovers, fiddleneck, fava beans, bell peas, daikon, and wildflower. In 2024, about 378 acres were actively planted in the estate vineyards (indicated in orange in Figure 4), and species included peas, vetch, and barley.

To remove cover crops, sheep are used (in addition to mowing) to adaptively graze the vineyard alleys. The objective is to minimally graze, leaving about 50% of the biomass. Grazing occurs in the fall/winter and stops from spring into early summer; hence, mowing is still needed later in the season to prepare for harvest. Prunings are also flail mowed in alleys to be shredded and left as a green mulch on all vineyard acres except the estate vineyards (about 993 acres total which are mowed). To the east, there is undeveloped land which is grazed when animals are not in the vineyards. The olive orchards have not been grazed, though there is interest in doing so. Throughout the property, tillage is not employed.

A summary of existing practices is provided in Table 2 below, and a summation of the total carbon benefits from these existing practices is provided in Table 3 towards the end of the Recommended Carbon Farm Practices section found later in this document. In total, approximately 3,832 metric tonnes (MT) of CO2e are sequestered each year by the practices listed below (compost application accounts for 3,082 MT or 80% of the total).

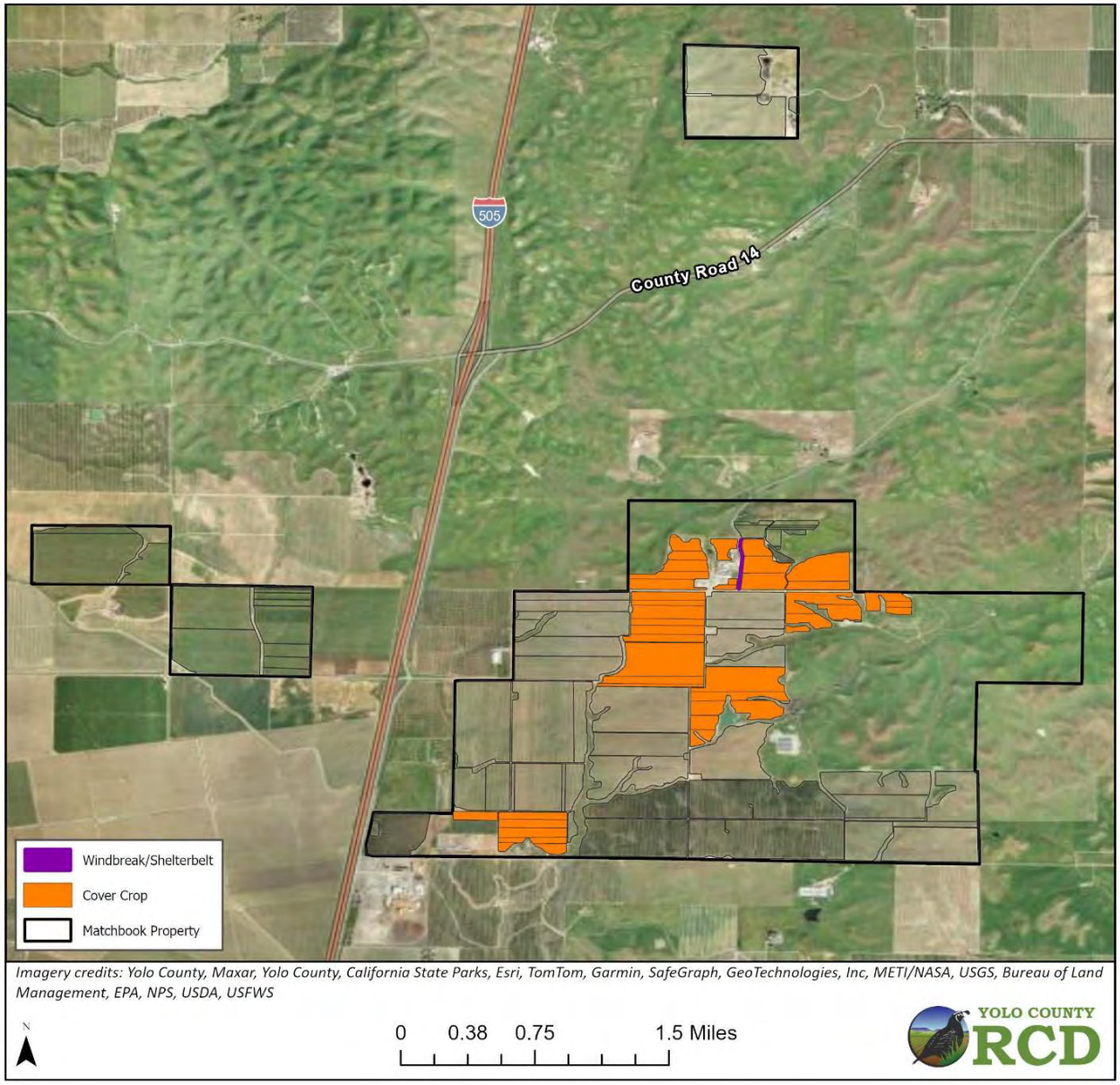

Figure 4. Existing windbreak and cover crop practices at Matchbook Wine Company.

Table 2: Existing carbon-beneficial practices at Matchbook Wine Company.

Current Practice (NRCS CPS #)	*Acreage*	*Description*	*Co-Benefits*
Cover Crop (340)	*378 seeded, 2,390 natural cover*	*Historically, seeded cover included a variety of species including* safflower, sunflower, clovers, fiddleneck, fava beans, bell peas, daikon, wildflowers, peas, vetch, barley etc.)	*Increase nitrogen in soil, suppress weeds, reduce erosion, improve soil moisture, decrease soil compaction, utilize excess soil nutrients.*
Residue and Tillage Management, No-Till (329)	*2,768*	*Tillage is not implemented on the property. Only mowing is done to vegetation and canes in vineyard alleys.*	*Support soil quality and organic matter, reduce soil erosion and particulate emission, decrease energy usage, and increase moisture for plants.*
Prescribed grazing (528)	*2,171*	*Prescribed grazing takes place on about 2,171 acres across the property, except in about 597 acres of olive orchards.*	*Support desired species composition, reduce erosion and promote soil health, improve surface and subsurface water quality.*
Soil Carbon Amendment (336)	*1,371*	*Compost (C:N>11) was applied in the past at a rate of 3-3.5 tons per acre to all vineyard acres. Compost came, in part, from off-site sources. Chicken manure is currently spread on organic fields.*	*Improve soil health habitat and aggregate stability.*
Mulching (484)	*993*	*Vine prunings are placed in the middle of alleys and mulched. This is done on all vineyards except the estate vineyards.*	*Improve soil moisture, improve irrigation efficiency, prevent and reduce erosion, weed suppression, reduce particulate matter emissions.*
Windbreak/ Shelterbelt Establishment and Renovation (380)	*0.66*	*About 1,428 feet of olive trees are planted along the eastern side of road 92B. They provide wind protection to the field just east of the planting. A width of 20 feet was used to calculate acreage.*	*Minimize soil erosion and crop damage due to wind, provide and enhance habitat for wildlife and pollinators, improves air quality from airborne contaminants.*

3.5 Resource concerns

Natural Resource Conservation Services (NRCS) defines a resource concern as "an expected degradation of the soil, water, air plant or animal resource base to an extent the sustainability or intended use of the resource is impaired." Put simply, this refers to any resource associated with an agricultural operation (natural, human, energy, etc.) that faces the possibility of degradation. In the conservation planning process, the goal of addressing and alleviating resource concerns typically guides the planner and producer in creating a plan. A similar strategy can be used when developing a carbon farm plan, with a central focal point being carbon in the system. Overall, a carbon farm plan will outline practices to increase carbon sequestration and decrease greenhouse gas emissions, but at the same time, it can address other associated resource concerns.

At Matchbook Wine Company, low organic matter is one of the widespread concerns across the property. Generally, SOM is below 2%, and according to soil testing reports, some areas have SOM below 1%. SOM will vary with soil type and will depend on the management practices and soil coverage by vegetation, but the producer notes that some hilltops are quite gravelly. SOM in these areas is likely quite low. Additionally, soil is eroded by water running down the sloped vineyards, particularly along the edges of grape blocks and along roads. As a result, several areas experience minor gully erosion. Strong winds, particularly from the north, have caused vine damage to the outermost row and to vines on hilltops. Weed pressure has also been noted; fleabane, prickly oxtail, sow thistle, ripgut brome, and marestail have all been observed. Lastly, crop-damaging frost has been observed in some of the low areas where taller vegetation reduces air flow.

4. Recommended Carbon Farm Practices

While there are various carbon-beneficial practices already implemented at Matchbook Wine Company, additional opportunities are present. Carbon sequestration and greenhouse gas reduction can be achieved through a combination of agricultural management activities and planting installations. Several management practices such as cover cropping, composting, and prescribed grazing can be continued on increased acreage at Matchbook. Installations of new plantings such as hedgerows and windbreaks will further augment carbon capture and sequestration. Beyond the carbon benefits, the practices outlined in this document will promote cropland productivity and increase water infiltration.

The following carbon farming opportunities are categorized into four subsections: agroforestry systems, wetland systems, cropland systems, and miscellaneous. A map of proposed carbon-beneficial plantings is included below (Figure 5). Definitions and general information about the practices described come from Natural Resource Conservation Service's (NRCS) conservation practice standards which can be found in the online field office technical guide (https://www.nrcs.usda.gov/resources/guides-and-instructions/field-office-technical-guides). Specific practice numbers are listed next to the practice name. In some cases, multiple NRCS practices may apply to a proposed action, so discussing these practices with an NRCS conservation planner before implementation is highly recommended to

determine feasibility, strategy, and funding. COMET-Planner[1] was used to calculate potential carbon benefits associated with each proposed practice (Table 4). A summary of carbon benefits, both from existing and recommended practices, can be seen in Table 5 at the end of the Recommended Carbon Farm Practices section.

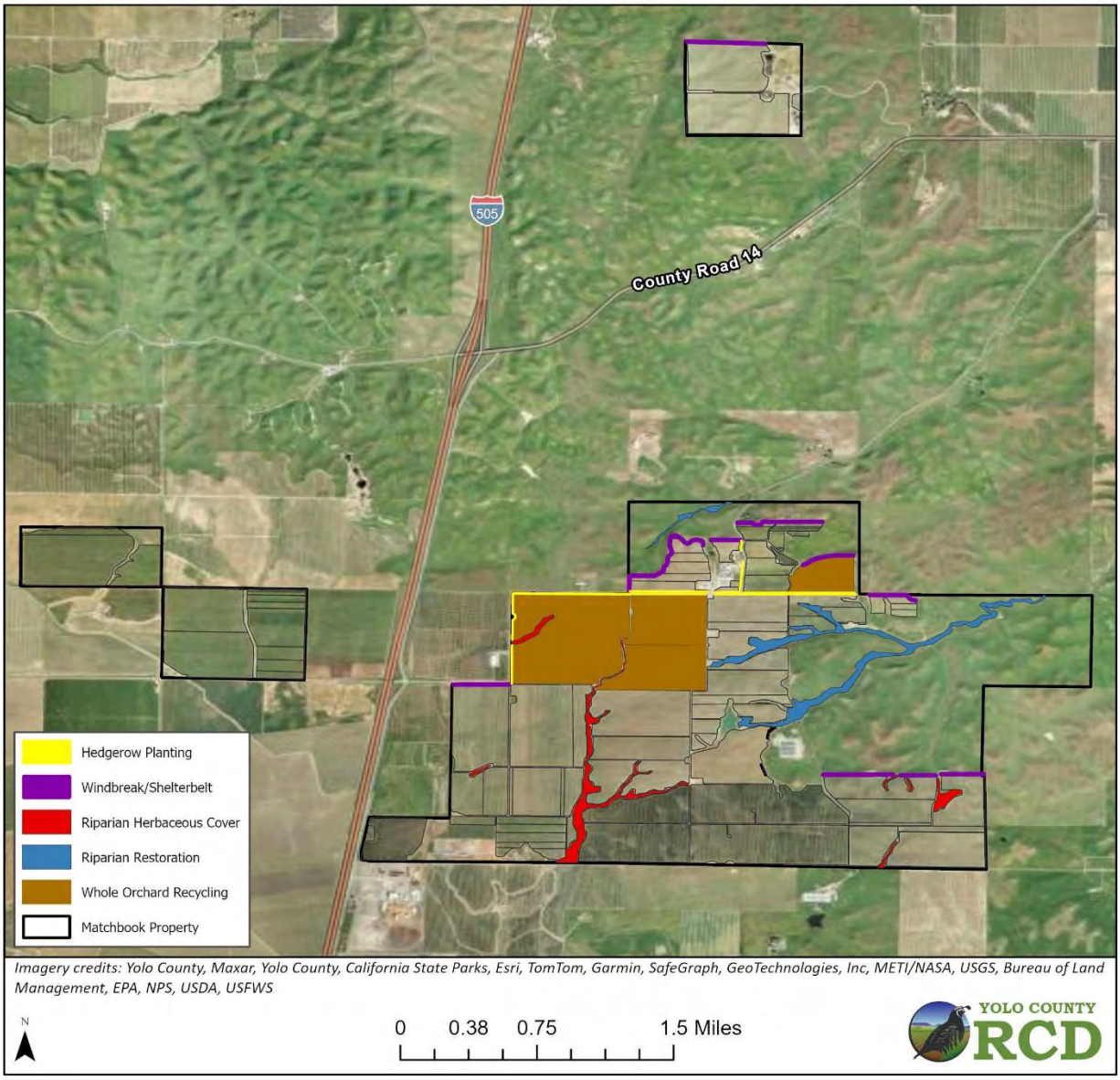

Figure 5: Proposed carbon-beneficial plantings at Matchbook Wine Company.

[1] Two versions were referenced: 1) The general version (http://comet-planner.com) and 2) California Department of Food and Agriculture's Healthy Soil Program version (http://www.comet-planner-cdfahsp.com).

4.1 Agroforestry Systems

Agroforestry refers to the "intentional integration of trees and shrubs into crop and animal production systems" (Patel-Weynand, Bentrup, and Schoeneberger, 2017). Through the "carbon lens," agroforestry is a straightforward means of increasing above-ground living carbon while also creating pathways for soil carbon sequestration. Other benefits of agroforestry can include increasing structural and biological diversity above and below ground, reducing the potential damage to crops and soils from wind, providing habitat for beneficial animals and insects that can reduce pest presence and assist with pollination, and increasing water infiltration potential and reducing risk of flooding or runoff. The following subsections describe agroforestry practices that could be implemented at Matchbook Wine Company.

Hedgerow Planting (CPS 422)

A hedgerow is defined as the establishment of dense woody vegetation in a linear design. Hedgerows can benefit an agricultural operation by sequestering carbon in biomass and soils, increasing the structural and biological diversity of a site, reducing soil erosion from wind and water, and increasing wildlife and pollinator habitat. A local-conducted study found soil carbon under mature hedgerows in Yolo County was 36% higher than in adjacent farm fields (Chiartas, et al, 2022).

One optimal site for a hedgerow is on the west side of road 92B (hedgerows are marked in yellow in Figure 5). Currently the field edge of the Crew Matchbook 2012 block is not planted, so it presents an opportunity to install woody plantings (See Supplementary Figure S1 for field names). If hedgerows are estimated to be 10 feet wide, planting 1,160 linear feet of hedgerow in this area would equate to about 0.27 acres. A hedgerow of this size would result in about 4 MT of CO2e storage annually. The south and north sides of Road 15 B could also be planted as a hedgerow. The southern portion is about 7,509 feet long (1.72 acres using a 10-foot-wide hedgerow) and would result in about 24 MT of CO2e stored annually. The northern portion is about 4,812 linear feet (1.10 acres using a 10-foot width) and would sequester about 15 MT of CO2e annually. One consideration with planting in this area, however, is the powerline that runs along the southern side of the road. Small species would need to be selected so they don't interfere with the powerlines, or one to two rows of vines could be removed to accommodate a hedgerow. If vines were removed, however, the net benefit would be reduced since woody plantings are being removed to plant new woody species. Lastly, on the eastern side of Road 90B, a hedgerow could be planted that extends 2,499 feet. Assuming a width of 10 feet, this equates to about 0.57 acres which could sequester 8 MT of C02e annually.

Of note, some of the existing infrastructure could be incorporated into hedgerow plantings. Trellising and irrigation line, for example, does not necessarily need to be removed if grape rows are removed, and in fact, irrigation line could be reused during hedgerow establishment. On the northern side of road 15B east of 92B, there is a fence with grape stock planted. Both the fence and portions of the grape stock could be kept to reduce labor in removal, and a hedgerow could be interplanted amongst the grape stock. If hedgerow species are used to replace the grape stock, however, the carbon benefit will

be less in this area, again due to the fact that woody plantings are being removed and replaced with new plantings.

WINDBREAK (CPS 380)

Windbreaks are single or multiple rows of trees planted in straight or curved configurations, similar to hedgerows, but oriented perpendicular to the prevailing winds. While they do have many of the same benefits as hedgerows, the primary function is to protect against the negative effects of wind. By impeding wind, windbreaks can reduce soil erosion, protect plants from wind damage, reduce evapotranspirative losses thus improving irrigation efficiency, and improve air quality from airborne contaminants. Beyond that, they serve as another opportunity to sequester carbon in biomass and soils, provide wildlife and beneficial insect habitat, and provide microclimate-ameliorating benefits to the associated farm fields

According to the general version of the Comet Planner tool, every acre of single-row windbreak would result in 14 MT of CO2e of carbon sequestration annually, and a double-row would result in 11 MT of CO2e/year of sequestration. This may seem counterintuitive, but the acreage would be greater with a double row hedgerow since the total width is greater. For the calculations used herein, 20 feet will be used for the width of a single-row windbreak, and 32-feet will be used for a double-row. Where feasible, double-row windbreaks will be prioritized. Winds typically come from the north on this property, so installing windbreaks on the northern side of wind-exposed blocks would help diminish wind speeds (windbreaks are denoted in purple in Figure 5). Matchbook Wine Company noted that across the site, there are about 10.88 acres of wind-exposed northern borders that could be suitable for windbreaks (3,029 linear feet suitable for single-row and 12,902 linear feet suitable for double-row). This has the potential to sequester 126 MT of CO2e annually (19 MT of CO2e/year in single-row areas, 107 MT of CO2e/year in double-row areas). The Matchbook 2024 block north of the tasting room is an area that suffers from particularly strong winds and would be an ideal place to begin installation. A double-row windbreak of about 690 feet installed here would sequester 6 MT of CO2e annually.

TREE-SHRUB ESTABLISHMENT (CPS 612)

Tree shrub establishment refers to the establishment of woody plants by means of planting, direct seeding, or natural regeneration. In addition to sequestering carbon, this practice can also be used to restore native plant communities; improve plant diversity, productivity, and health; support wildlife habitat; and improve water quality. When used around buildings, trees/large shrubs can also help minimize energy consumption through shading and wind protection.

Along the eastern side of the property, there is a large swath of land that is currently undeveloped open space (the area without any clear parcel delineations in Figure 5). There are no crops planted in this area, though there are some blackberries and Goodding's willows in the low-lying area on the eastern side of the Richie parcels, northeast of the solar array. This open space provides the opportunity to plant additional woody species. Example species which would be suitable for this area include cottonwoods, blue oaks, or buckeyes (Supplementary Table S1). Not only would this provide the benefit

of sequestering additional carbon on the property, but it could also serve as shade for animals grazing in the open area. If 1% of the 800 acres were able to be planted (8 acres), 75 MT of CO2e/year could be stored. A major consideration before doing this, however, would be irrigating plants during establishment. Without permanent infrastructure, plants would need to be manually watered for the first three years of establishment, with decreasing frequency and quantity over the timeframe as plants mature.

As this plan is being written, there have been discussions to convert some of the undeveloped land to the east into olive orchard plantings. This would essentially act as a tree/shrub establishment on a much larger scale, but because this is in the early discussion phase, this possibility will not be explored in this document. There have also been discussions of converting some vineyard blocks into olive orchards. This presents an opportunity for whole orchard recycling, which will be discussed later in this document.

4.2 Wetland Systems

Throughout the property, there are areas which have been federally delineated as wetland. In some of these wetlands, there are trees and woody shrubs present, but in general, annual grasses and forbs such as prairie grasses, oats, and star thistle are the dominant form of vegetation. On the eastern side of the property (northeast of the solar array, just east of Richie Parcels), there is large low-lying land which currently has blackberries and several Goodding's black willows. West of Richie Parcels, there is a large wetland strip running north to south currently populated by annuals vegetation described earlier, and scattered throughout the property there are pockets of low-lying wetland zones. To improve these areas while simultaneously increasing carbon storage, intentional woody and herbaceous vegetation can be planted.

Riparian Restoration

Riparian restoration refers to the restoration of degraded streambanks through the planting of woody plants. Though this is not identified in the NRCS FOTG with a specific CPS number, it is identified as a practice in COMET Planner (http://comet-planner.com). Riparian restoration helps to reduce runoff, protect the native plant community, support aquatic avian and insect habitat, and increase carbon storage in biomass and the soil. Though Matchbook Wine Company does not have riparian habitat per se (in the sense that there is no river or stream running through the property), a riparian restoration implementation strategy could be used for the large wetland area near the Richie Parcels and north of the tasting room (indicated in blue in Figure 5).

Since willows and blackberries are already present, these should be suitable species to plant, though incorporating drought tolerant species such as toyon or mule fat is recommended since the area is intermittently dry (see possible species in Supplementary Table S2). The area east of Richie Parcels is about 51 acres, and the area north of the tasting room is about 4 acres. Riparian restoration across the

entirety of this acreage would sequester 55 MT of CO2e annually. It is recommended to start with a subset of the acreage, however, to identify which species fare well.

Riparian herbaceous cover (390)

Riparian herbaceous cover refers to grasses, sedges, rushes, ferns, legumes, and forbs tolerant of intermittent flooding or saturated soils that are established or managed as the dominant vegetation in the transitional zone between upland and aquatic habitats. In terms of direct carbon benefits, this practice provides the opportunity to store carbon in biomass and the soil. It also acts to reduce erosion and improve water quality while at the same time supporting pollinator habitat.

This practice is recommended for the wetland area west of Richie Parcels, as well as the pockets of wetland throughout the property where there are not already woody species present (denoted in red in Figure 5). Together, these areas make up approximately 36 acres, and planting riparian herbaceous cover across that acreage would sequester 12 MT of CO2e/year. This value assumes the species mix consists of grasses and legumes and that it is unfertilized. A possible species mix could include gumplant, yarrow, wildrye, and California redbud (a legume, but note that this plant can get up to 20 feet tall and 15 feet wide, so it may be unsuitable in some areas if it impedes tractor movement). Supplementary Table S3 provides a list of species suitable for this area.

4.3 Cropland Systems

Many of the practices listed below are management changes as opposed to infrastructure changes, so they can be scaled up or back as the needs of the farming operation shift. Because olives and grapes have different nutrient needs, the following practices will be dependent on the plant-specific requirements. There are also currently discussions about converting some areas from vineyard or undeveloped land to orchard. Hence, practices in this section are less specific in terms of exact location. Instead, feasible and/or optimistic acreages are noted in each subsection and management at Matchbook Wine Company would decide annually as to where implementation of a specific practice would make sense.

Cover crop (CPS 340)

Cover cropping refers to the planting of grasses, legumes, and forbs as a form of seasonal cover. The resulting stand of vegetation can provide an array of benefits including reduced erosion, greater organic matter, reduced weed pressure, improved soil moisture, and less soil compaction. In the most basic sense, planting cover crops keeps living roots in the soil which is one of the primary principles for promoting healthy soil.

As noted earlier, some areas on the property are actively seeded while other areas have natural coverage from the seedbank. In 2024, 378 acres of the 1,968 acres of cropland were seeded, meaning

the remaining 1,590 acres have only volunteer cover. If all the crop acreage with volunteer cover could be planted with cover crop, 697 MT of CO2e/year could be sequestered. Even increasing the acreage by only 10% the (i.e. planting an additional 37.8 acres) would result in an added 16 MT of stored CO2e/year. This assumes that the land is untilled, irrigated, and nutrient fertilization decreases by 50%.

Compost Application (CPS 808–Soil Carbon Amendment)

Applying carbon-based amendments derived from plant materials or treated animal byproducts can improve soil organic matter, sequester carbon, improve aggregate stability, reduce the need for synthetic nutrients and improve habitat for soil organisms. Additionally, this practice can help improve soil moisture.

In the past, Matchbook Wine Company applied compost at a rate of about 3-3.5 tons/acre. Budgetary reasons have been stated as a limitation for acquiring and spreading compost. The last application of compost on the property was in the fall of 2022. This was done across the 1,371 acres of vineyard using a compost with a C:N ratio between 20:1 – 30:1. Compost has never been applied to the olive orchards. If compost with a C:N ratio greater than 11 was purchased from a facility and spread across all the vineyards at an increased rate of 6 tons/acre (two passes using the currently available implements), 6,164 MT of CO2e could be sequestered annually. Adding 6 tons/acre in the 597 acres of olive orchards (again C:N>11) would add another 2,684 MT of CO2e/year benefit. In total, there is potential to sequester 8,848 MT of CO2e each year across the vineyards and orchards, so even if only 10 percent of that acreage could receive compost, there would still be a sizeable carbon benefit.

At points in the past, compost has been created onsite using vineyard waste mixed with other off-site components (e.g. almond shells, compost, gypsum, humic chips). If Matchbook could once again acquire material from neighboring operations and create compost on site, operational byproducts could be recycled back into the system. Assuming that half of the volume is lost during the compost process and that 2 cubic yards of mature compost equate to about 1 ton of compost (Biernbaum, 2016), 1 ton of compost could be created with 4 cubic yards of raw material. With an application rate of 6 tons/acre, each acre would require about 24 cubic yards of raw material.

Filter Strip (393), Field Border (386), or Vegetative Barrier (601)

Though there are not pervasive erosion issues throughout the property, there are some roads and vineyard alleys which are experiencing soil erosion (e.g. the west end of Smith Creek). Filter strips, field borders, and vegetative barriers are all NRCS practices that address soil erosion via the planting of vegetation to slow the speed of running water. The focus of filter strips is to minimize the spread of contaminants in runoff to sensitive areas, while the purpose of field borders and vegetative barriers is more explicitly aimed at reducing erosion from water. From an implementation standpoint, these practices will look similar in that they will add vegetation, but the specific requirements of each may

vary slightly. It is recommended to consult with an NRCS conservation planner regarding specific funding and practice requirements before implementing.

From a carbon sequestration and greenhouse gas reduction standpoint, the impact of these practices is minimal, especially at the scale it would be implemented at Matchbook Wine Company. Every 2-4 acres converted from irrigated cropland to permanent unfertilized grass/legume cover sequesters 1 MT of CO2e annually. Given that there are only a few areas where erosion is an issue, the direct carbon benefits of this practice are negligible in relation to the other practices outlined. Still, planting vegetation around areas of high water-flow would be worthwhile in terms of protecting topsoil and preventing contaminants from flowing downstream, particularly into the lower-lying areas which are designated as wetland.

NUTRIENT MANAGEMENT (590)

Nutrient management is grounded in four key principles: ensuring that the right nutrients are applied in the right place, at the right time, and at the right rate. The goal of this practice is to ensure plant health and productivity while at the same time reducing excess nutrient loss, emissions of particulate matter, and release of GHG and ozone precursors. Nutrient management can be incorporated wherever amendments are used. In the most fundamental sense, it helps optimize nitrogen, phosphorus, and potassium by accounting for all significant sources and removal of these nutrients. To properly track nutrient levels, all inputs and removal of nutrients should be considered. Sources include irrigation water, fertilizers/amendments, nutrients within the root zone, and crop residues. Removal includes leaching, erosion, volatilization, and crop harvest.

Matchbook Wine Company primarily adds nitrogen and potassium at different times of the year. As mentioned earlier, products used across the property include CAN 17, UN32, biological fertilizers, urea (20-0-0), sulfur of potash, a potassium fluoride product, and some micro-amendments as needed. Amendments are added year-round through the irrigation system, and foliar sprays are utilized as needed. Eventually, Matchbook hopes to transition everything to organic. If fertilizer application were reduced by 15% on 984 acres, i.e. 50% of the cropland, 1 MT of CO2e emissions could be reduced each year. Because wine taste and quality are so dependent upon the nutrient profile, nutrient management may be difficult without impacting the quality of the wine. Therefore, it would be wise to explore this practice on a small acreage first and assess the impacts before scaling up.

4.4 Miscellaneous

Prescribed Grazing (CPS 528)

Matchbook Wine Company already incorporates this practice across many of the grape parcels, particularly the organic estate vineyards. Sheep also graze the undeveloped open area, and an agreement is currently in place where Matchbook and the grazer are not charging one another for the land or grazing service. Prescribed grazing helps to improve and maintain desired species composition and function, reduce erosion, recycle nutrients, and reduce the amount of fossil fuels usage which would otherwise be required to manage vegetation mechanically or chemically. Over a thousand head of sheep have been used for grazing vineyards, and in doing so, weed species such as fleabane and marestail have been better controlled (though others such as foxtail and ripgut brome have not responded). This practice could be used more extensively on the property by utilizing it in olive orchards.

For every 38 acres of unirrigated land that is grazed, 1 MT of CO2e/year is sequestered. Olive orchards currently make up about 597 acres, and there are tentative plans to increase that acreage. If 50% of the current olive acreage (298.5 acres) were grazed, CO2e emission could be reduced by 4 MT/year.

Whole Orchard Recycling (CPS 376; Old Code CPS 808)

Whole orchard recycling refers to the removal of trees/vineyards and the subsequent chipping of that woody material. The resulting chips are then reincorporated uniformly into the same area as a source of carbon. In orchard systems, this has become a desirable alternative to open pile burning, not only because it replenishes carbon in the soil, but it also minimizes pollutants and greenhouse gases released during burning. Diseased plants are not recommended for this practice, however, as they can reintroduce pathogens into the site.

As of January, 2025, there are currently discussions of converting 290 acres of vineyards to olive orchards (denoted in brown in Figure 5). If a whole orchard strategy were used, up to 11 MT of CO2e could be sequestered annually. This value is likely an overestimate, however, since the COMET Planner calculation is based on the biomass of wood chips that would be generated from a prune or almond orchard rather than a vineyard (Wolf and Guo, 2020). Still, other studies have found positive soil-health benefits when reincorporating vineyard material (Yilmaz et al., 2017), so if vines are not diseased, this practice is worthwhile to consider.

Table 3: Carbon Sequestration benefits of previous/existing practices at Matchbook Wine Company.

Existing practice (NRCS CPS #)	*Acreage*	*Description*	*Annual CO2e sequestration (MT)*	*20-year CO2e sequestration (MT)*	*Co-Benefits*	*Reference*
Cover Crop (340)	*378 seeded*	*Historically, seeded cover included a variety of species including* safflower, sunflower, clovers, fiddleneck, fava beans, bell peas, daikon, wildflowers, peas, vetch, barley etc.	*166* [a]	*3,320*	*Increase nitrogen in soil, suppress weeds, reduce erosion, improve soil moisture, decrease soil compaction, utilize excess soil nutrients.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Residue and Tillage Management, No-Till (329)	*2,768*	*Tillage is not implemented on the property.*	*369 (320 MT in irrigated areas and 49 in non-irrigated areas)* [b]	*7,380*	*Support soil quality and organic matter, reduce soil erosion and particulate emission, decrease energy usage, and increase moisture for plants.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Prescribed grazing (528)	*2,171*	*Prescribed grazing takes place across the property, except in about 597 acres of olive orchards.*	*155 (135 MT in irrigated areas, 20 MT in non-irrigated areas)* [b]	*3,100*	*Support desired species composition, reduce erosion and promote soil health, improve surface and subsurface water quality.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Soil Carbon Amendment (336)	*1,371*	*Compost (C:N>11) was applied in the past at a rate of 3-3.5 tons per acre in all vineyards. Compost came, in part,*	*3,082* [c]	*61,640*	*Improve soil health habitat and aggregate stability.*	*COMET-Planner CDFA HSP version accessed December 2024*

		from off-site sources. Chicken manure is currently spread on organic fields.				
Mulching (484)	*993*	*Vine prunings are placed in the middle of alleys and mulched. Takes place in all vineyards but the estate vineyards.*	*51* [d]	*1,020*	*Improve soil moisture, improve irrigation efficiency, prevent and reduce erosion, weed suppression, reduce particulate matter emissions.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Windbreak/ Shelterbelt Establishment and Renovation (380)	*0.66*	*1,428 feet of olive trees on the eastern side of Road 92B.*	*9*	*180*	*Minimize soil erosion and crop damage due to wind, provide and enhance habitat for wildlife and pollinators, improves air quality from airborne contaminants.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Total			*3,832 MT* [e]	*76,640 MT*		

[a] Accounting only for the 378 acres of seeded cover. This is calculated as leguminous cover added to irrigated, no-till cropland.

[b] Irrigated areas refer to the planted acreage (597 acres of olives and 1,371 acres of vineyard), and non-irrigated areas refer to the 800 acres of undeveloped land on the eastern side of the property.

[c] COMET-Planner's lowest application rate for C:N>11 compost is 6 tons/acre, so the benefit was halved for this calculation.

[d] Because the mulch comes from flail mowing canes, the depth is likely not 2 inches as required by NRCS specifications, so the carbon benefit was divided by 4 to provide a more realistic estimate.

[e] If compost application is not considered since it hasn't been applied since 2022, the total would be 750 MT of CO2e/year.

Table 4: Carbon sequestration benefits associated with implementation of proposed practices at Matchbook Wine Company.

Planned practice (NRCS CPS #)	*Acreage*	*Description*	*Annual CO2e sequestration (MT)*	*20-year CO2e sequestration (MT)*	*Co-Benefits*	*Reference*
Hedgerow Planting (422)	*3.66*	*Woody plantings implemented along road 92B, 90B, and 15B.*	*51*	*1,020*	*Provide and enhance habitat for wildlife and pollinators, reduces airborne particulate matter and chemical drift.*	*COMET-Planner Version 3.0, Build 1, accessed January, 2025*
Windbreak (380)	*10.88 [a]*	*Any wind-exposed northern border in the vineyards could benefit from a windbreak.*	*126*	*2,520*	*Minimize soil erosion and crop damage due to wind, provide and enhance habitat for wildlife and pollinators, improves air quality from airborne contaminants.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Tree-Shrub Establishment (612)	*8*	*Planting trees on 1% of the open space acreage on the eastern side of the property.*	*75*	*1,500*	*Provide shade and wind protection to for grazing sheep; support wildlife habitat; support plant diversity, productivity, and health.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Riparian Restoration (NA)	*54.99*	*Woody plantings throughout the eastern wetland area where some Goodding's willows are already present.*	*55*	*1,100*	*Reduce runoff, protect native plant community and aquatic habitat.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*

Riparian Herbaceous Cover (390)	*36.29*	*Plantings of herbaceous plants in the smaller designated wetland areas where there is already herbaceous vegetation. Plants may include grasses, sedges, rushes, ferns, legumes, and forbs.*	*12*	*240*	*Reduce erosion, improve water quality, stabilize banks, support pollinator habitat.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Cover Crop (340)	*37.80*	*Multispecies mix (with legumes) applied to 10% more land than the 378 acres planted in 2024.*	*16*	*320*	*Reduce erosion, suppress weeds, utilize excess soil nutrients, improve soil moisture, decrease soil compaction.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Soil Carbon Amendment (336)	*1,968 (597 olives; 1,371 vineyards)*	*Compost (C:N > 11) from a composting facility applied at 6 tons/acre across all cropland.*	*2,684 (olives) 6,164 (vineyards) 8,848 (total)*	*53,680 (olives) 123,280 (vineyards) 176,960 (total)*	*Improve soil health, habitat, and aggregate stability, increase SOM, improve soil moisture.*	*COMET-Planner CDFA HSP version accessed December 2024*
Filter Strip (393), Field Border (386), Vegetative Barrier (601)	*<1 acre*	*One of these practices could be applied along roads or block edges where erosion is evident.*	*NA*	*NA*	*Reduce soil erosion, decrease sediment load, decrease water flow.*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Nutrient Management (590)	*984*	*Creating an approach to account for all nutrient input and removal for the*	*1*	*20*	*Support plant health and productivity, reduce excess nutrient loss,*	*COMET-Planner Version 3.0, Build 1, accessed*

		operation. 984 acres represents 50% of the cropland.			*decrease particulate matter emissions, minimize release of GHG and ozone precursors.*	*December 2024*
Prescribed Grazing (328)	*298.5*	*Incorporation of sheep grazing into 50% of the olive orchard acreage.*	*8*	*160*	*Improve and maintain desired species composition and function, reduce erosion, recycle nutrients, reduce fossil fuel usage*	*COMET-Planner Version 3.0, Build 1, accessed December 2024*
Whole Orchard Recycling	*290*	*Removing vineyards, chipping the material, and incorporating it into the soil before planting olive orchards.*	*11*	*220*	*Decreases GHG emissions, dust, and odors associated with open pile burning.*	*COMET-Planner CDFA HSP version accessed January 2025*
Total			9,203 MT	184,060 MT		

[a] *9.48 acres of double-row windbreak; 1.41 acres of single-row.*

Table 5: Summary of carbon benefits from implemented and planned practices at Matchbook Wine Company. See Tables 4-5 for more details on each practice.

Practice	*Acreage*	*CO2e sequestered annually (MT)*	*CO2 sequestered over 20 years (MT)*
Hedgerow Planting	3.66	51	1,020
Windbreak (single-row)	2.07	28	560

Windbreak (double-row)	9.48	107	2,140
Tree-Shrub Establishment	8	75	1,500
Riparian Restoration	54.99	55	1,100
Riparian Herbaceous Cover	36.29	12	240
Residue and Tillage Management; No-Till	2,768	369	7,380
Cover Crop	415.8	182	3,640
Soil Carbon Amendment	1,968	8,848	176,960
Mulching	993	51	1,020
Prescribed Grazing	2,469.5	184	3,680
Nutrient Management	984	1	20
Filter Strip, Field Border, OR Vegetative Barrier	<1	NA	NA
Whole Orchard Recycling	290	11	220
TOTAL		9,974 MT	199,480 MT

5. SOIL WATER HOLDING CAPACITY

By increasing carbon in the soil, water holding capacity is also increased. NRCS indicates that a 1% increase in SOM (about 0.5% increase in SOC) in the topsoil equates to 27,000 gallons of additional water holding capacity per acre (NRCS Soil Health Key Points). If we assume that 1% SOC is equal to 9 MT of SOC per acre (Carbon Cycle Institute), then the proposed practices illustrated in Table 4 above would equate to approximately 903.77 acre feet of soil water holding capacity over a 20 year period (Table 6 and Supplementary Table S4). It is worth noting, however, that compost application (soil carbon amendment) accounts for 884 AF or 98% of the total water holding capacity increase. If only a portion of the total cropland acreage receives compost, the total Soil WHC increase will be much less.

Table 6. Summary of impacts of proposed carbon farming practices on

Practice	*Acres*	*20-year SOM increase*	*Soil WHC increase by year 20 (AF)*
Hedgerow Planting	3.66	1,020	2.55
Windbreak (single-row)	1.41	380	0.95
Windbreak (double-row)	9.48	2,140	5.35
Tree-Shrub Establishment	8	1,500	3.75
Riparian Restoration	54.99	1,100	2.75
Riparian Herbaceous Cover	36.29	240	1.20
Cover Crop	37.8	320	1.60
Soil Carbon Amendment	1,968	176,960	884.00
Filter Strip, Field Border, OR Vegetative Barrier	<1	NA	NA
Nutrient Management	984	20	0.10
Prescribed Grazing	298.5	160	0.80
Whole Orchard Recycling	290	220	0.72 [b]
Totals		*184,060*	*903.77*

[a] *Data for whole orchard recycling was not available as an option, so data for tree/shrub establishment was used in this calculation.*

6. Conclusion

6.1 Quantification of Carbon Benefits

Matchbook Wine Company already employs a number of carbon-beneficial practices, and they have utilized even more historically when resources were available. Through the implementation of additional practices detailed above, the benefits from carbon sequestration and greenhouse gas reduction can be amplified. Tables 4-6 above indicate the historic and potential carbon benefits for each practice as calculated using COMET-Planner (both the general and the CDFA version as indicated in the tables) in December 2024.

If all existing practices were to continue, and if all proposed practices were implemented as described above, the total carbon sequestration potential could be up to 9,974 MT of CO2e annually, or 199,480 MT of CO2e over a 20-year period.

The US EPA Greenhouse Gas Equivalencies Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) is a tool that helps to put greenhouse gas emissions into perspective. The total sequestration potential of 9,974 MT CO2e equates to 2,326 gasoline powered passenger vehicles driven for one year or the annual energy use of 1,339 homes.

6.2 Summary

Current carbon-beneficial practices utilized at Matchbook Wine Company help to sequester 750 MT of CO2e annually. If compost application (which was done in the recent past) is included, the total benefit rises to 3,832 MT of CO2e/year). The operation aims to continue utilizing regenerative practices that build soil health, and where possible, augment these soil-health benefits by employing additional practices or increasing the acreage where existing practices are used. Many of the practices detailed in this document provide co-benefits such as crop protection, wildlife habitat, nutrient supplementation, etc. Intentionally adding practices meant to sequester carbon and reduce CO2 emissions has the potential to amplify the current carbon benefits to over 9,000 MT of CO2e/year.

By 2030, Yolo County aims to achieve a negative carbon footprint, a goal set forth by the county Board of Supervisors in 2020. The Carbon Farming Partnership, which was developed to create this carbon farm plan and two additional plans, is one of seven early action projects meant to begin moving towards that goal. The overarching goal of the Yolo County Carbon Farming Partnership is to increase the pace and scale of carbon farm planning and implementation in Yolo County. Matchbook Wine Company, having gone through the carbon farm planning process, can now serve as a reference for others seeking to develop a plan. As practices are implemented on the property, technical and financial considerations can be shared as well. This plan can be physically shared as a resource for others interested in carbon farming (within the comfort level of Matchbook Wine Company management).

A 2018 GHG inventory for Yolo County indicates that the total GHG emissions for unincorporated Yolo County equated to 1,082,801 MT of CO2e in 2016, and agriculture accounted for 232,569 MT of CO2e of that total (Ascent Environmental, 2018). If all practices outlined in this plan were incorporated, Matchbook Wine Company could optimistically sequester 9,974 MT of CO2e annually, equivalent to 0.92% of the total 2016 emissions and 4.29% of agricultural emission.

Another way to look at GHG emission and carbon sequestration is on a per-acre basis. According to the 2017 census of agriculture (USDA, 2017), Yolo County consisted of 459,662 acres of farmland. Taken in consideration with the GHG inventory, on average, each acre of farmland generates approximately 0.51 MT of CO2e. (Heterogeneity is certainly lost in considering this per-acre average; some acres produce more or less GHG than others based on land use, crop type, soil, etc.) Using this average, Matchbook Wine Company could make a proportional contribution towards total greenhouse gas reductions if enough practices could be implemented to sequester 1,412 MT of CO2e across the property's 2,768 acres (i.e. 2,768 acres x 0.51 MT of CO2/acre). It is important to note that this estimate is based on an average that does not consider fine-scale variability across the landscape; as such, this value is meant more to illustrate a goal within a county-wide context rather than denote a prescriptive stopping point for practice implementation.

This plan should be viewed as a living document. This plan is dynamic in the sense that it may be modified, appended, or refined to meet future goals and needs. This plan should evolve as practices are implemented and new information/feedback, tools and resources become available. Additional carbon-beneficial practices may be considered for inclusion in the long-term plan. GHG values presented here as associated with specific practices are based upon the best available information at the time of this plan's preparation (2024). They likewise may be revised as evaluation techniques are refined or new data becomes available.

6.3 Project Implementation Timeline

Table 7 below depicts a general timeline for implementing various carbon-beneficial practices. As a note, several of the practices discussed above are already implemented onsite, so are not included in this table. Some practices (or expansion of practices) are dependent upon funding acquisition. For the near-term goals of compost application and cover crop planting, CDFA's Healthy Soils Program (HSP) could be pursued if/when the program opens again following recent Proposition 4 funding (estimated as early as 2025-2026). Funding sources may change in the future, but HSP and Natural Resource Conservation Services (NRCS) funding opportunities typically have regular solicitation periods and can be used to support all practices listed below.

Table 7. Implementation timeline of near, medium, and long-term goals.

Objectives	*Short-term goals (currently ongoing or to be initiated in the next 1-2 years)*	*Medium-term goals (to be initiated in the next 2-5 years)*	*Long-term goals (to be initiated in the next 5-10 years)*	*Additional notes (if applicable)*
Apply compost	X			Apply to as many acres as feasibly possible considering funding and resource availability.
Plant cover crops on increased acreage	X			This practice can be expanded to olive orchards and additional vineyard blocks.
Whole Orchard Recycling	X	X		If/when vineyards are converted to olive orchards, woody material can be chipped and reincorporated.
Install wind break		X		The northern border of the Matchbook 2024 block was identified as a feasible starting point.
Install hedgerows		X		In some cases, this may require removal of 1-2 rows of vines.
Begin riparian plantings			X	
Plant trees in undeveloped area			X	It will likely be most feasible from an infrastructure standpoint (e.g. providing water) to plant trees in small blocks.

6.4 MONITORING AND RECORD KEEPING

Monitoring the initial application, implementation, and establishment of practices (e.g., compost application, cover crop establishment, hedgerow/windbreak plantings survival, etc.) should be carried out in coordination with annual inspections or at key moments by Matchbook Wine Company staff or any organizations involved in project implementation. For assessing longer-term goals, soil organic carbon or soil organic matter should be measured where practices are implemented in accordance with market or voluntary protocol requirements (if applicable). Ideally, soil samples or other data will be taken prior to implementation of a practice to provide a baseline. Subsequent collections can then occur at appropriate intervals after implementation. As a note, some funding sources such as CDFA Healthy Soils Program require yearly soil monitoring to track organic matter over time. Monitoring data and records of implementation activities, including locations, extent of project(s), dates of implementation, etc., should all be included in plan implementation documentation. If funding or partnerships are available, monitoring the impacts of these practices on other ecosystem services and co-benefits would be of value to verify and quantify impacts and to adjust management strategies. Such activities may include biological surveys (animal and plants, soil macrobiota or microorganisms) and assessments of water quality and agricultural productivity.

6.5 FUNDING STRATEGY FOR CARBON FARM PLAN IMPLEMENTATION

This section describes potential funding opportunities that include grants and direct contributions from regional, state, and federal agencies to implement the practices outlined for Matchbook Wine Company. This list is by no means meant to be exhaustive. In some cases, opportunities also exist for obtaining technical assistance in applying for funding. The goal and scope of these resources vary widely, but funding opportunities can be maximized by leveraging these resources strategically. There are several programs aimed at supporting pollinators, for example, which could be applied towards hedgerow plantings at Matchbook Wine Company. Other funding sources could be utilized to support riparian plantings, cover cropping, or the wildlife community in general. Framing a project in the wetland areas in such a way that it emphasizes the benefit to wildlife may broaden the pool of funding opportunities to include some which may seem less directly related to carbon capture.

FEDERAL

U.S. Fish and Wildlife Service- Partners for Fish and Wildlife Program: "The Partners for Fish and Wildlife Program provides technical and financial assistance to landowners interested in restoring and enhancing wildlife habitat on their land." Provides up to $750,000 per award.

https://www.fws.gov/program/partners-fish-and-wildlife

Central Valley Project Improvement Act- Habitat Restoration Program: The U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service's Central Valley Project Improvement Act grant provides funding

for the “protection, restoration and enhancement of fish and wildlife.”. This program typically receives $1.5 million annually and funds five or more projects.

https://www.usbr.gov/mp/cvpia/

Natural Resources Conservation Service (NRCS)- Environmental Quality Incentives Program (EQIP): The “Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, increased soil health and reduced soil erosion and sedimentation, improved or created wildlife habitat, and mitigation against drought and increasing weather volatility.” This program typically assists agricultural producers with cost share related to many of the practices listed in this carbon farm plan (e.g. hedgerow planting, soil carbon amendment, cover crop).

https://www.nrcs.usda.gov/sites/default/files/2022-10/EQIP-fact-sheet.pdf

Natural Resources Conservation Service (NRCS)- Conservation Stewardship Program (CSP): CSP results in a “plan that outlines and enhances existing efforts, using new conservation practices or activities, based on management objectives” for an operation. These contracts are for five years and involve maintaining existing levels of conservation and implementing additional conservation activities. There are multiple payments available including annual contract payments, supplemental payments, and minimum contract payments.

https://www.nrcs.usda.gov/sites/default/files/2023-11/is-csp-right-for-me-11062023.pdf

STATE

California Department of Food and Agriculture (CDFA)- Office of Environmental Farming and Innovation (OEFI)- Healthy Soils Program (HSP): “The HSP Incentives Program provides financial incentives to California growers and ranchers to implement conservation management practices that sequester carbon, reduce atmospheric greenhouse gases (GHGs), and improve soil health.” Supported practices would include compost application, cover cropping, no-till, reduced-till, mulching, windbreak and hedgerow planting, tree/shrub establishment, nutrient management, whole orchard recycling, etc.

https://www.cdfa.ca.gov/oefi/healthysoils/IncentivesProgram.html

California Department of Food and Agriculture (CDFA)- Office of Environmental Farming and Innovation (OEFI)- State Water Efficiency & Enhancement Program (SWEEP): SWEEP provides financial assistance in the form of grants to implement irrigation systems that reduce greenhouse gases and save water on California agricultural operations. Eligible system components include soil moisture monitoring, drip systems, switching to low pressure irrigation systems, pump retrofits, variable frequency drives, and installation of renewable energy to reduce on-farm water use and energy.” If additional solar panels are incorporated on site, this grant would be relevant.

https://www.cdfa.ca.gov/oefi/sweep/

California Department of Fish and Wildlife (CDFW)- California Waterfowl Habitat Program (CWHP): "The CWHP provides economic incentives to private landowners who agree to manage their properties in accordance with a wetland management plan developed cooperatively by California Department of Fish and Wildlife (CDFW) biologists and the participating landowner." Landowners can receive an incentive of $30-$60/acre annually depending on the lands being managed.

https://wildlife.ca.gov/Lands/WCP/Private-Lands-Programs

California Wildlife Conservation Board: Provides funding to support a variety of habitat enhancement programs including the California Riparian Habitat Conservation Program (CRHCP) which aims at "protecting and restoring California's riparian systems." The Ecosystem Restoration on Agricultural Lands (ERAL) program "collaborates with the agricultural community to identify and implement projects that provide long-term habitat benefits for wildlife", and the Monarch Butterfly and Pollinator Rescue Program provides grant funding to restore or enhance monarch breeding habitat on private and public lands. Depending on the goals and/or outcomes of a proposed practice, various programs may be utilized.

https://wcb.ca.gov/Programs

USDA Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants (REAP): The program provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses for renewable energy systems or to make energy efficiency improvements. Agricultural producers may also apply for new energy efficient equipment and new system loans for agricultural production and processing.

PRIVATE/NON-PROFIT

National Fish and Wildlife Foundation (NFWF)- Monarch Butterfly and Pollinators Conservation Fund: Grants are awarded to projects that "create and sustain interconnected monarch and pollinator habitats" to support annual life cycle needs. In 2023, grants ranged from $200,00-$250,000 for projects up to two years.

https://www.nfwf.org/programs/monarch-butterfly-and-pollinators-conservation-fund

Project Apis m.- Seeds for Bees: This cost share program provides cover crop seed with the goal to "increase the density, diversity, and duration of bee forage in California orchards, farms, and vineyards, while improving soil health. The seed mixes available through Seeds for Bees are designed to bloom at critical times of the year when natural forage is scarce but managed and native bees are active. Seeds for Bees serves the needs of bees, beekeepers, and growers, increasing sustainability of pollination and agriculture."

https://www.projectapism.org/seeds-for-bees.html

The Xerces Society- Monarch and Pollinator Habitat Kits: Provides habitat plant kits that contain climate-smart native plants with the goal to support monarchs and other local pollinators in California whose populations are in decline. This cost share opportunity could support the planned hedgerow components of this carbon farm plan but also riparian areas through a different kit specifically for riparian wildflower plantings.

https://xerces.org/pollinator-conservation/habitat-kits/california

Zero Foodprint Restore Grant: Provides funding for adopting practices aimed at sequestering atmospheric carbon in the soil. Maximum funding is $25,000 per round, with a lifetime maximum of $75,000 across multiple rounds.

https://www.zerofoodprint.org/

7. REFERENCES

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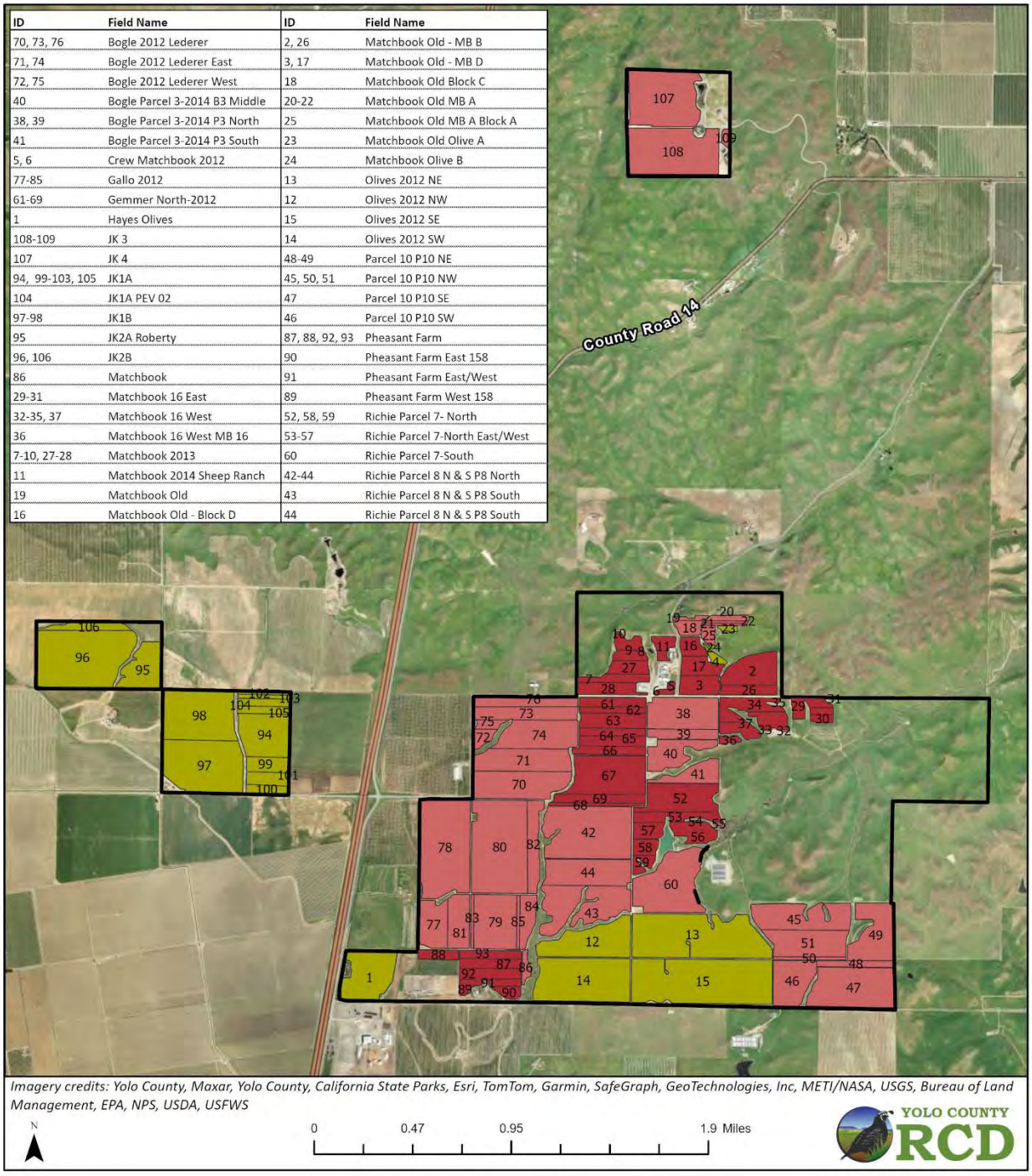
8. APPENDIX



Supplementary Figure S1. Matchbook Wine Company Field Names

Supplementary Table S1. NRCS eVegGuide native tree species. These tree species are acceptable species for Tree/Shrub Establishment (CPS 612) for this area and soil type. (https://www.calflora.org/nrcs/).

Common Name	Scientific Name	Bloom
White fir	Abies concolor	May-Jun
California buckeye	Aesculus californica	May-Jul
Incense cedar	Calocedrus decurrens	May-Jun
western dogwood	Cornus sericea	Jun-Aug
Oregon ash	Fraxinus latifolia	Apr-May
California wax myrtle	Morella californica	Jun-Jul
Coulter pine	Pinus coulteri	May-Jun
Jeffrey pine	Pinus jeffreyi	May-Jun
Ponderosa pine	Pinus ponderosa	Apr-May
California Foothill pine (aka Gray pine	Pinus sabiniana	Feb-Mar
California sycamore	Platanus racemosa	Feb-May
Chokecherry	Prunus virginiana	Apr-May
California live oak	Quercus agrifolia ssp. agrifolia	Feb-Apr
Scrub oak	Quercus berberidifolia	Feb-Mar
Blue oak	Quercus douglasii	May-Jun
Oregon white oak	Quercus garryana	Apr-May
California black oak	Quercus kelloggii	Feb-May
Valley oak or California white oak	Quercus lobata	Feb-Mar
Interior live oak	Quercus wislizeni	Mar-May
Red willow	Salix laevigata	Feb-May
Arroyo willow	Salix lasiolepis	Feb-May
Coast redwood	Sequoia sempervirens	Sep-Nov
California laurel	Umbellularia californica	Mar-May
California red fir	Abies magnifica	May-Jun
Noble fir	Abies procera	May-Jun
Bigleaf maple	Acer macrophyllum	Apr-May
Box elder	Acer negundo	Feb-Mar
Pacific madrone	Arbutus menziesii	Apr-May
Brown dogwood	Cornus glabrata	May-Jun
Sargent's cypress	Hesperocyparis sargentii	Mar-May
Sugar pine	Pinus lambertiana	Mar-May

Fremont cottonwood	Populus fremontii ssp. fremontii	Feb-Mar
Bitter cherry	Prunus emarginata	Apr-May
Douglas-fir or Douglas fir	Pseudotsuga menziesii var. menziesii	Apr-May
Canyon live oak	Quercus chrysolepis	May-Jun
Sandbar willow	Salix exigua	Feb-Mar
Sitka willow	Salix sitchensis	Mar
White alder	Alnus rhombifolia	Sep-Nov
Sugarberry (hackberry)	Celtis laevigata	Feb-Mar
Giant chinquapin	Chrysolepis chrysophylla	Apr-May
Redosier dogwood	Cornus sericea ssp. sericea	Mar-May
Wavyleaf silktassel	Garrya elliptica	Dec-Jan
MacNab Cypress	Hesperocyparis macnabiana	
Monterey cypress	Hesperocyparis macrocarpa	
California black walnut	Juglans hindsii	Apr-May
Monterey pine	Pinus radiata	Jan-Feb
Black cottonwood	Populus balsamifera ssp. trichocarpa	Feb-Apr
Western chokecherry	Prunus virginiana var. demissa	Mar-May
Goodding's willow	Salix gooddingii	Feb-Mar
Pacific willow	Salix lucida ssp. lasiandra	Mar-Apr
Scouler's willow	Salix scouleriana	Feb-Mar

Note: Consider toxicity of plants to certain livestock before selecting.

Supplementary Table S2. NRCS eVegGuide native riparian trees/shrubs. These tree and shrub species are acceptable species for Riparian Forest Buffer (CPS 391) for this area and soil type. (https://www.calflora.org/nrcs/).

Common Name	**Scientific Name**	**Plant Type**	**Bloom**
California buckeye	Aesculus californica	Tree	May-Jul
California Dutchman's pipe	Aristolochia californica	Shrub	Jan-Apr

Fourwing saltbush	Atriplex canescens	Shrub	May-Jun
Coyotebrush	Baccharis pilularis	Shrub	Sep-Jan
Mule-fat	Baccharis salicifolia	Shrub	Jan-Dec
Ceanothus	Ceanothus spp.	Shrub	Mar-May
Common buttonbush (California buttonwillow)	Cephalanthus occidentalis	Shrub	Aug-Oct
California buckthorn or coffeeberry	Frangula californica	Shrub	Jun-Aug
Oregon ash	Fraxinus latifolia	Tree	Apr-May
Toyon	Heteromeles arbutifolia	Shrub	Jun-Aug
Oceanspray	Holodiscus discolor	Shrub	May-Jul
Pink honeysuckle	Lonicera hispidula	Shrub	Apr-Jul
twinberry	Lonicera involucrata	Shrub	Jun-Aug
Ninebark	Physocarpus capitatus	Shrub	May-Jun
California sycamore	Platanus racemosa	Tree	Feb-May
California live oak	Quercus agrifolia ssp. agrifolia	Tree	Feb-Apr
Oregon white oak	Quercus garryana	Tree	Apr-May
California black oak	Quercus kelloggii	Tree	Feb-May
Valley oak or California white oak	Quercus lobata	Tree	Feb-Mar
Interior live oak	Quercus wislizeni	Tree	Mar-May
Western azalea	Rhododendron occidentale	Shrub	May-Jun
California gooseberry	Ribes californicum	Shrub	Jan-Mar
chaparral currant	Ribes malvaceum	Shrub	Dec-Mar
Redflower currant	Ribes sanguineum	Shrub	Jan-May

California wildrose	Rosa californica	Shrub	May-Aug
Thimbleberry	Rubus parviflorus	Shrub	Mar-May
California blackberry	Rubus ursinus	Shrub	Feb-May
Red willow	Salix laevigata	Tree	Feb-May
Arroyo willow	Salix lasiolepis	Tree	Feb-May
Blue elderberry	Sambucus nigra ssp. cerulea	Shrub	Mar-Jul
Coast redwood	Sequoia sempervirens	Tree	Sep-Nov
California laurel	Umbellularia californica	Tree	Mar-May
California wild grape	Vitis californica	Shrub	May-Jun
Bigleaf maple	Acer macrophyllum	Tree	Apr-May
Box elder	Acer negundo	Tree	Feb-Mar
Pacific madrone	Arbutus menziesii	Tree	Apr-May
Western sweetshrub (spicebush)	Calycanthus occidentalis	Shrub	May-Aug
Blueblossom ceanothus	Ceanothus thyrsiflorus	Shrub	Mar-May
Birchleaf mountain mahogany	Cercocarpus betuloides	Shrub	Mar-Jun
Brown dogwood	Cornus glabrata	Tree	May-Jun
Pacific dogwood	Cornus nuttallii	Tree	Apr-May
Beaked hazelnut	Corylus cornuta ssp. cornuta	Shrub	Feb-Mar
Flannelbush	Fremontodendron californicum	Shrub	May-Jun
Fremont cottonwood	Populus fremontii ssp. fremontii	Tree	Feb-Mar
Douglas-fir or Douglas fir	Pseudotsuga menziesii var. menziesii	Tree	Apr-May
Canyon live oak	Quercus chrysolepis	Tree	May-Jun

Sandbar willow	Salix exigua	Tree	Feb-Mar
California huckleberry	Vaccinium ovatum	Shrub	Feb-Jun
White alder	Alnus rhombifolia	Tree	Sep-Nov
Saskatoon serviceberry	Amelanchier alnifolia	Shrub	Jun-Jul
Utah serviceberry	Amelanchier utahensis	Shrub	May-Jun
Redosier dogwood	Cornus sericea ssp. sericea	Tree	Mar-May
Wavyleaf silktassel	Garrya elliptica	Tree	Dec-Jan
California black walnut	Juglans hindsii	Tree	Apr-May
Black cottonwood	Populus balsamifera ssp. trichocarpa	Tree	Feb-Apr
Goodding's willow	Salix gooddingii	Tree	Feb-Mar
European black elderberry	Sambucus nigra ssp. nigra	Shrub	Mar-Jul
Common snowberry	Symphoricarpos albus var. laevigatus	Shrub	May-Jul
Western poison oak	Toxicodendron diversilobum	Shrub	Mar-Jun

Supplementary Table S3. NRCS eVegGuide native riparian herbaceous plants. These forb, grass, and legume species are acceptable species for Riparian Herbaceous Cover (CPS 390) for this area and soil type. (https://www.calflora.org/nrcs/).

Common Name	**Scientific Name**	**Growth Cycle**	**Plant Type**	**Bloom**
Common yarrow	Achillea millefolium	Perennial	Forb	Apr-Aug
California brome	Bromus carinatus	Perennial	Grass	Feb-Apr
California (Western) redbud	Cercis orbiculata	Perennial	Legume	Feb-Apr
Blue wildrye	Elymus glaucus	Perennial	Grass	May-Jul
Yellow monkey flower	Erythranthe guttatus	Annual	Forb	Apr-Jun
Great Valley gumweed	Grindelia camporum	Perennial	Forb	Apr-Oct
Creeping wildrye or Beardless wildrye	Leymus triticoides	Perennial	Grass	Jun-Jul

Alkali sacaton	Sporobolus airoides	Perennial	Grass	Jul-Aug
River bulrush	Bolboschoenus fluviatilis	Perennial	Grass	May-Aug
Santa Barbara sedge	Carex barbarae	Perennial	Grass	Jun-Aug
Common spikerush	Eleocharis macrostachya	Perennial	Grass	May-Jun
Western goldenrod	Euthamia occidentalis	Perennial	Forb	Aug-Oct
Meadow barley	Hordeum brachyantherum ssp. brachyantherum	Perennial	Grass	Jun-Jul
California barley	Hordeum brachyantherum ssp. californicum	Perennial	Grass	May-Jul
Mountain (Baltic) rush	Juncus arcticus	Perennial	Grass	May-Jun
Nodding needlegrass	Nassella cernua	Perennial	Grass	Feb-Jul
Three-square bulrush	Schoenoplectus pungens	Perennial	Grass	

Supplementary Table S4. Soil water holding capacity impacts of carbon farm practices.

Carbon Cycle Institute

NRCS suggests that a 1% increase in SOM (SOM) results in an increase in soil water holding capacity (WHC) of an approximately 1-acre inch, or 27,152 gallons of increased soil water storage capacity per acre. A 1% increase in SOM represents roughly 20,000 pounds (10 short tons) of organic matter or 5 short tons of organic carbon. The WHC table shows estimated additional water storage capacity associated with soil carbon increases at Matchbook Wine Company resulting from the implementation of the CFP.

Instructions and Descriptions:
The basic concept here is that an increase of 1% SOM is equivalent to a 1 acre-inch increase in soil water holding capacity (Emerson 1995).

1. Gather all potential carbon farm practices from your plan and select from the dropdown menu.
2. In the second column enter you practice data for 20 year CO2e. These values are obtained from you overall CFP summary table (linked). These are the values you calculated with the use of a model such as COMET-Planner.
3. Column 3 will AUTO POPULATE! This column is where the 20 year CO2 metric tons is converted to C. This is done by dividing the value from column 2 by 3.67, This value gives you your metric tons of soil organic carbon.
4. Column 4 VALUES (Soil Factor) ARE DEPENDENT ON PRACTICE TYPE! Because not all CO2 captured on farm is stored in soil (some is stored in above-ground vegetation), a "soil factor" is included to adjust accordingly. Use values here appropriate for the practice.
5. Column 5 will AUTO POPULATE! Metric tons of SOC is converted to Metric tons of SOM by multiplying SOC (from column 3) by 2 (Pribyl 2010).
6. Column 6 STAYS CONSTANT! Because CO2 is expressed in metric tons, and NRCS assumes short tons, we need to convert to short tons to derive acre inches. Assuming a 1% increase in SOM in the plow layer weighs 10 short tons per acre (ballpark number based on a commonly accepted acre furrow slice of soil weight of 2 million lbs),
7. Column 7 will AUTO POPULATE! This column converts 10 short tons of SOM to one acre inch (AI) of WHC. Each 1% increase in SOM weighs about 9.09 metric tons and represents one acre inch (AI) of WHC.
8. Column 8 will AUTO POPULATE! This column converts AI to acre feet (AF) by dividing AI by 12.

Carbon Farm Practices(use dropdown)	Mg CO2e 20 yr	Mg SOC	Soil Factor	Mg SOM	Mg SOM/AI	Acre Inches (AI)	Acre Feet (AF)
Hedgerow Planting (CPS 422)	1,020.00	277.93	0.50	277.93	9.09	30.57	2.55
Windbreak/Shelterbelt Establishment (CPS 380)	380.00	103.54	0.50	103.54	9.09	11.39	0.95
Windbreak/Shelterbelt Establishment (CPS 380)	2,140.00	583.11	0.50	583.11	9.09	64.14	5.35
Tree/Shrub Establishment (CPS 612)	1,500.00	408.72	0.50	408.72	9.09	44.96	3.75
Riparian Restoration	1,100.00	299.73	0.50	299.73	9.09	32.97	2.75
Riparian Herbaceous Cover (CPS 390)	240.00	65.40	1.00	130.79	9.09	14.39	1.20

Conventional Tillage to Reduced Till (CPS 345)	5,920.00	1,613.08	1.00	3226.16	9.09	354.88	29.57
Cover Crops (CPS 340)	320.00	87.19	1.00	174.39	9.09	19.18	1.60
Compost Application on Cropland	176,960.00	48,217.98	1.00	96,435.97	9.09	10,607.96	884.00
Mulching (CPS 484)	950.00	258.86	1.00	517.71	9.09	56.95	4.75
Prescribed Grazing (CPS 528)	160.00	43.60	1.00	87.19	9.09	9.59	0.80
Nutrient Management (CPS 590)	20.00	5.45	1.00	10.90	9.09	1.20	0.10
Filter Strip (CPS 393)	0.00	0.00	1.00	0.00	9.09	0.00	0.00
Tree/Shrub Establishment (CPS 612)	290.00	79.02	0.50	79.02	9.09	8.69	0.72
TOTAL	**191,000.00**	**52,043.60**		**102,335.15**		**11,256.87**	**938.07**

NOTES

20 year $MgCO_2e/3.67$ = C x SF = MgSOC x 2 = MgSOM/9.09 Mg/AI/12 = Acre feet

20 year $MgCO_2e/3.67$ = MgSOC x 2 = MgSOM x 1.1 = short tons SOM/10 = Acre inches/12 = Acre feet

1 AF = 325,829 gallons

Carbon Farm Plan for Fair Ranch of River Garden Farms

December 2023

Prepared in collaboration with the Yolo Carbon Farming Partnership by:

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Introduction

Why Carbon?

Carbon has recently garnered a lot of attention for its ability to affect global climates as a greenhouse gas. When combined with oxygen, its gaseous form (carbon dioxide or CO_2) can enter the atmosphere and act like a blanket, trapping heat from the sun on the earth's surface. In moderation, this warming effect is what has allowed life to flourish on the planet, but due to recent human activities, the carbon cycle has been thrown out of balance and these levels are rising at dangerous rates.

Carbon enters the landscape from the atmosphere when growing plants absorb or capture carbon dioxide from the air to combine it with water and other nutrients from the soil and create sugars and other structures needed to support life. Above ground, this process allows plants to produce food, fiber, fuel, and flora that humans and other organisms rely on. Below ground, this carbon supplies fungi, bacteria, and other organisms directly with sugar byproducts known as photosynthates. Photosynthates move directly to the soil via plant roots as exudates and indirectly through roots to beneficial soil mycorrhizal fungi.

In addition to the transformation of carbon from the air into agricultural products, carbon can be stored long-term (decades to centuries or more) in soil and woody vegetation through a process known as biological carbon sequestration. Increasing carbon capture has a host of agronomic and environmental benefits that include increased soil water holding capacity, improved soil fertility and mitigating rising levels of atmospheric carbon dioxide (CO_2) and other greenhouse gases (GHG) that currently contribute to climate destabilization through global warming.

The term "carbon farming" refers to proven and measurable practices that increase the rate at which CO_2 and other greenhouse gases (GHG) are removed from the atmosphere and stored over the long term in soil and plant material. Carbon entering the farm from the atmosphere can end up in several locations: in the harvested portion of the crop, in the soil as root exudates and soil organic matter (SOM), in "waste" materials such as compost or manure, in standing carbon stocks such as grassland vegetation or woody perennials (trees, vines, orchards, etc.), or in other permanent vegetation such as windbreaks, vegetated filter strips, or riparian forests and woodlands. While all farming is completely dependent upon atmospheric CO2, different farming practices and different farm systems can lead to very different amounts of on-farm carbon capture and storage.

The Carbon Farm Planning Process

The Carbon Farm Planning (CFP) process differs from other approaches to land use planning by focusing on increasing the capacity of the farm to capture carbon and to store it beneficially in the crop, as standing carbon stocks in permanent vegetation, and/or as SOM. While agricultural practices often lead to a gradual loss of carbon from the farm system, a CFP is successful when it leads to a net increase in farm-system carbon. By increasing the amount of photosynthetically captured carbon stored, or "sequestered," in long-term carbon pools on the farm, carbon farming results in a direct reduction in the amount of CO2 in the atmosphere, while supporting crop production and farm resilience to environmental stress, including flood and drought.

Carbon Farm Planning is based upon the USDA NRCS Conservation Planning process, but uses carbon and carbon capture as the organizing principle around which the plan is constructed. This simplifies the planning process and connects on-farm practices directly with ecosystem processes, including climate change mitigation, increases in on-farm climate resilience, water holding capacity, soil health, and farm productivity.

Like NRCS Conservation Planning, carbon farm planning begins with an overall inventory of natural resource conditions on the farm or ranch, then proceeds to identify opportunities for reduction of GHG emissions, enhanced carbon capture, and storage by both plants and soils. Building this list of opportunities is a brain-storming process; it should be as extensive as possible, including everything the farmer and planners can think of that could potentially reduce emissions and capture and sequester carbon on the farm. While actions proposed in the plan should reflect the inherent limits of the farm ecosystem, financial considerations should not limit this initial brainstorming process, as one goal of the carbon farm planning process is to identify potential funding, above and beyond existing resources, to realize implementation of the plan.

Finally, practices are prioritized based on needs and goals of the landowner, choosing high carbon-benefit practices wherever possible. While economic considerations may be used to filter the comprehensive list of options, funding mechanisms may also be identified. Funding sources include cap and trade or other GHG mitigation offset credits, USDA-NRCS and other state and federal programs, and private funding. Projects are implemented as funding, technical assistance and farm scheduling allow. Over time, the CFP is evaluated, updated, and altered as needed to meet changing land management objectives and implementation opportunities, using the fully implemented plan scenario as a goal. Where plan implementation is linked to carbon markets or other ecosystem service markets, periodic plan evaluation may be tied to those verification schedules.

Additional information about carbon farming can be found online at: www.marincarbonproject.org and www.carboncycle.org

Fair Ranch Overview and Carbon Farm Plan Scope

Figure 1. Fair Ranch geographical location and boundaries.

Fair Ranch, part of River Garden Farms, is a 7,000-acre farm that is situated northwest of the city of Knights Landing, in the northeastern corner of Yolo County, California. It is intersected by state route 45 which connects Highways 113 and 20. Fair Ranch is approximately 20-50 feet above sea level and located within the Sacramento River Watershed. The property is bordered by the Sacramento River to the north and east, and it is bisected by Sycamore Slough.

In 2022, River Garden Farms and Yolo County Resource Conservation District (Yolo RCD), as part of the Yolo Carbon Farming Partnership, collaborated to create a Carbon Farm Plan (CFP) for this property. As a participant in the Yolo Carbon Farming Partnership, River Garden Farms has agreed to an ongoing partnership throughout the Carbon Farm Planning process and beyond, focusing on the potential to

quantify on-farm carbon sequestration potential. This effort seeks to provide a site-specific framework for the county-wide goal of increasing the pace and scale of carbon sequestration in natural and working lands.

The Carbon Farm Plan includes the entire 7,000-acre Fair Ranch portion of River Garden Farms, which comprises 6,527 acres of agricultural fields and approximately 41 acres along the property edges.

From the outset of this plan, the overarching goals and objectives include the following:

1) Implement a variety of carbon-beneficial practices
2) Quantify the benefits of existing and recommended carbon-beneficial practices
3) Understand opportunities for emissions reduction and/or carbon storage that allow the farm to adapt to market changes as needed, while simultaneously providing conservation/habitat and production benefits.

Ranch History

Fair Ranch lies directly adjacent to Knights Landing in Yolo County, CA which was first established as a city in 1843. Before European colonization, the area was an important location for trade among Native Californians due to its convenient location at the historical confluence of Cache Creek and the Sacramento River. During the gold rush and the early settlement of California, Knights Landing played an important role in shipping materials up and down the Sacramento River. As the area continued to be settled and converted to farmland, Reclamation Districts formed by local farmers in the 1870s and '80s began changing local hydrology by creating levees and weirs to allow agriculture to expand in the area.

River Garden Farms began as a family farm in 1964 just north of Knights Landing, a product of this conversion of riparian habitat to agriculture. Before downsizing to 7,000 acres, the property spanned 15,000 acres and included orchard crops in addition to the cereal and specialty row crops that it currently produces. In 2022, the farm was purchased by Renewable Resources Group, the current owner of River Garden Farms and Fair Ranch. Since its establishment, the farm has participated in several conservation practices and local research efforts aimed at bolstering both wildlife and farm productivity/soil health. To support wildlife conservation efforts, the farm has participated in California Waterfowl's Duck Egg Rescue program, USGS giant garter snake research, CalTrout Fish Food, and multi-benefit shorebird/groundwater recharge among others. As part of its effort to support on-farm conservation goals, Fair Ranch has planted two hedgerows along approximately 3.75 miles of roads and levees in the last five years, and implemented cover cropping on approximately 10 percent of farm fields (funded by the California Department of Food And Agriculture's (CDFA) Healthy Soils Incentive Program).

Environmental Conditions

The approximately 7,000-acre property is situated between the Sacramento River and Colusa Basin Drain and is intersected by Sycamore Slough. This places it in the Sacramento River Watershed, which extends

from the Klamath Mountains in northern California and eventually leads into the Sacramento-San-Joaquin River Delta and San Francisco Bay, draining about 19 California counties throughout its extent (Figure 1).

Fair Ranch is in California's Sacramento Valley, which experiences a Mediterranean climate characterized by hot dry summers and cool wet winters. The average annual precipitation in this area is 21 inches, occurring mostly from November to March. Average annual temperatures range from 50 to 75 degrees. High temperatures in the summer can reach over 90 degrees and low temperatures in the winter can fall below 40 degrees (US Climate Data). The average number of frost-free days at 32 degrees F or higher for the area is 267 days (https://ucanr.edu/sites/gardenweb/files/29030.pdf). NNW winds are predominant around October, and SSE winds prevail starting around May (Iowa State University Iowa Environmental Mesonet; https://mesonet.agron.iastate.edu/sites/locate.php?network=CA_ASOS). Wind speeds average between 7-8 mph throughout the year, but seasonal high winds can exceed 20 mph (Figure 2). Because the topography is flat, these winds can impact farm productivity (e.g. crop loss in rice due to strong winds has been noted).

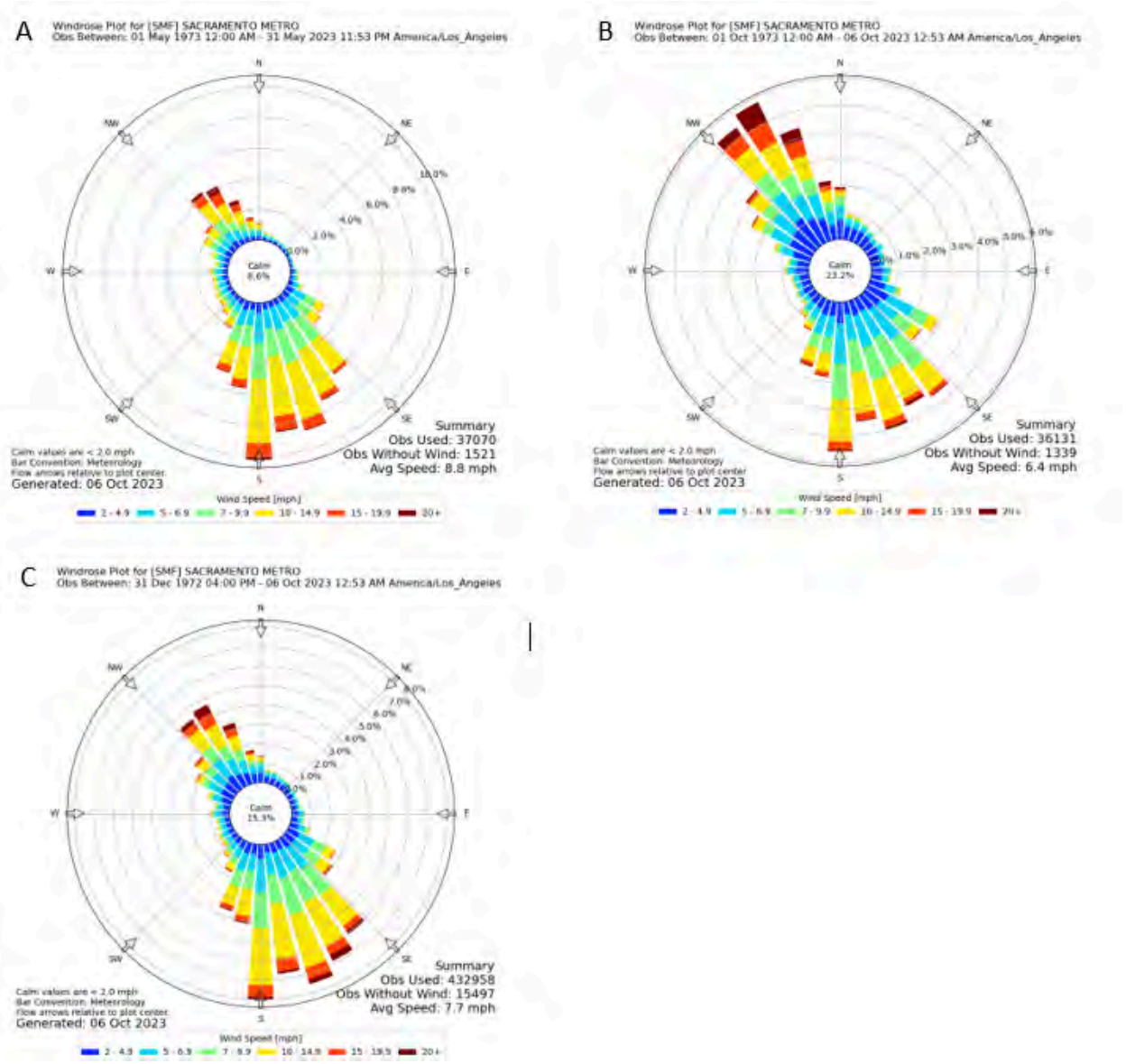

Figure 2. Wind measurements taken at Sacramento International Airport, located approximately 13 miles southeast of Fair Ranch. For each rose, wind speed is indicated by bar color and direction is indicated by bar orientation. The size of bars indicates the proportion of measurements taken between 1973-2023 with a given wind speed and direction. May and October-specific data are presented in panels A and B respectively; prevailing winds tend to shift during those months. A) Wind data for the month of May. B) Wind data for the month of October. C) Yearly wind data (December 31 1972 - October 2023).

Soils

Soil type classification within the 7,000-acre ranch includes 8 different soil units (Table 1). Over 75% of the farm, approximately 6,000 acres, is made up of Sacramento clay. The Sacramento series is characterized by very deep, poorly drained soils that formed in alluvium from mixed rocks, a result of being part of a river bed that receives waters and sediments from the Klamath Mountains, the Sierra

Nevada Range, and part of California's Coast Range. The Sycamore soil series makes up about 10% of the farm, predominantly in areas along Sycamore Slough and the Sacramento River. This soil series is predominantly a fine sandy loam, silty clay loam, or clay loam and can support many crops, though notably, rice is not grown in it as it is a lighter soil type which requires more water (it is also typically found along the river and slough which has higher and steeper slopes that make managing water for rice difficult). Natural vegetation usually includes annual grasses and oaks. The Willows clay series, which is located on the southwestern edge of the farm (Figure 3), is very similar to Sacramento clay except it tends to have sodium in the 10-to-40-inch zone where Sacramento clay soils do not, and it would have originally supported more saline-sodic tolerant plants.

Soil organic matter (SOM) varies throughout the property. According to site-specific data from NRCS' Web Soil Survey, SOM ranges from 2.20%-3.30%. Several analyses of soil samples from various fields in February/March 2023 indicate that SOM ranges from 2.2%- 5.4% across the fields tested (analyses shared by River Garden Farms were conducted by DellaValle Laboratory Inc.). Assuming SOM is composed of 58% soil organic carbon (SOC), these analyses indicate that there is approximately 1.3%-3.1% SOC. Soils are high in magnesium, and some areas (specifically fields 65 and 69 towards the southwest of the property, Figure 4) are noted as being hard-clodded.

Table 1. Fair Ranch Soils (NRCs designations). Bulk density, %SOM, and %SOC are based on NRCS data of the top 30 cm

Map Unit	*Soil Type*	*Acres*	*Ranch Area*	*Bulk Density (g/cm3)*	*% Soil Organic Matter (SOM)*	*% Soil Organic Carbon (SOC)**
Mp	*Merrit complex, saline-alkali*	*88*	*1.10%*	*1.43*	*2.50*	*1.45*
Sc	*Sacramento clay, 0 to 2 percent slopes, MLRA 17*	*6082.8*	*77.00%*	*1.24*	*3.00*	*1.74*
Ss	*Sycamore silty clay loam, 0 to 1 percent slopes, MLRA17*	*455.5*	*5.80%*	*1.36*	*2.20*	*1.28*
St	*Sycamore silty clay loam, drained, 0 percent slopes, MLRA 17*	*298.1*	*3.80%*	*1.36*	*2.20*	*1.28*
Sv	*Sycamore complex, drained*	*199.3*	*2.50%*	*1.50*	*2.00*	*1.16*
Tb	*Tyndall very fine sandy loam*	*58.8*	*0.70%*	*1.50*	*1.50*	*0.87*
Wb	*Willows clay, 0 percent slopes, MLRA 17*	*24.5*	*0.30%*	*1.30*	*3.30*	*1.91*
Wc	*Willows clay, 0 percent slopes, sodic, MLRA 17*	*650.9*	*8.20%*	*1.30*	*3.30*	*1.91*

**SOC is calculated as 58% of SOM*

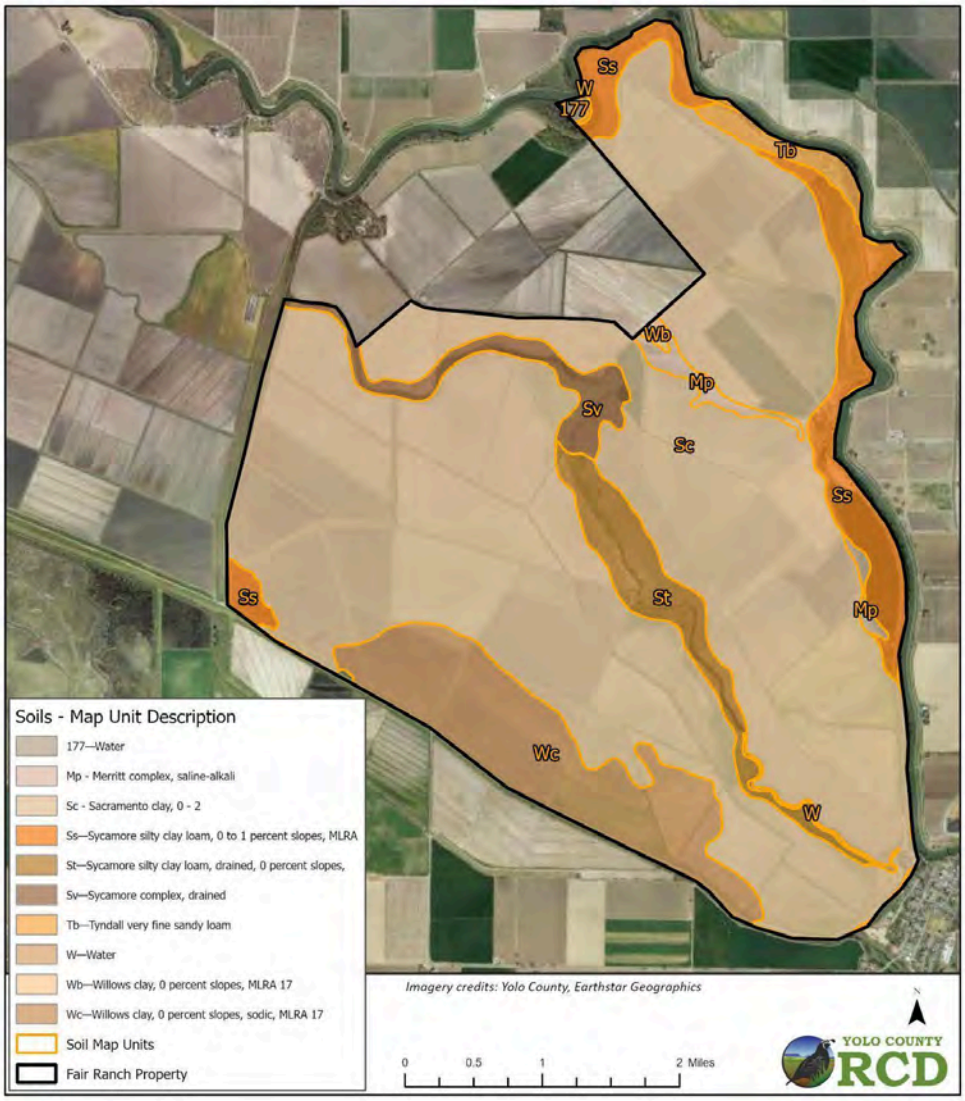

Figure 3. Soil map of Fair Ranch.

Current Management Practices

Fair Ranch is currently being cultivated with annual crops such as rice, melons, tomatoes, sunflowers, wheat, and safflower (Figure 4). Typically, there is a four to five-year rice rotation, then a four to five-year row crop rotation. Generally, some land is left fallow depending on drought and water availability, but fallow acreage can vary greatly from year to year. In 2023, for example, only 16 acres were proposed to be fallow, but in 2021, there were about 2,500 acres fallowed. Typical factors impacting fallowing decisions include: 1) too much water and high river levels which can prevent timely access to the field, 2) reduced water availability due to drought, and 3) water transfers by crop idling. Though there are currently no legumes consistently in rotation, an alfalfa trial totaling approximately 196 acres was planted in 2023 in fields near the office headquarters. Of the roughly 7,000 acres in cultivation, about 500 are certified organic, producing crops such as safflower, tomato, milo, watermelon, and wheat.

Across the farming operation, there are no major crop yield trends to note, though production changes somewhat due to commodity pricing, water availability, and water sales.

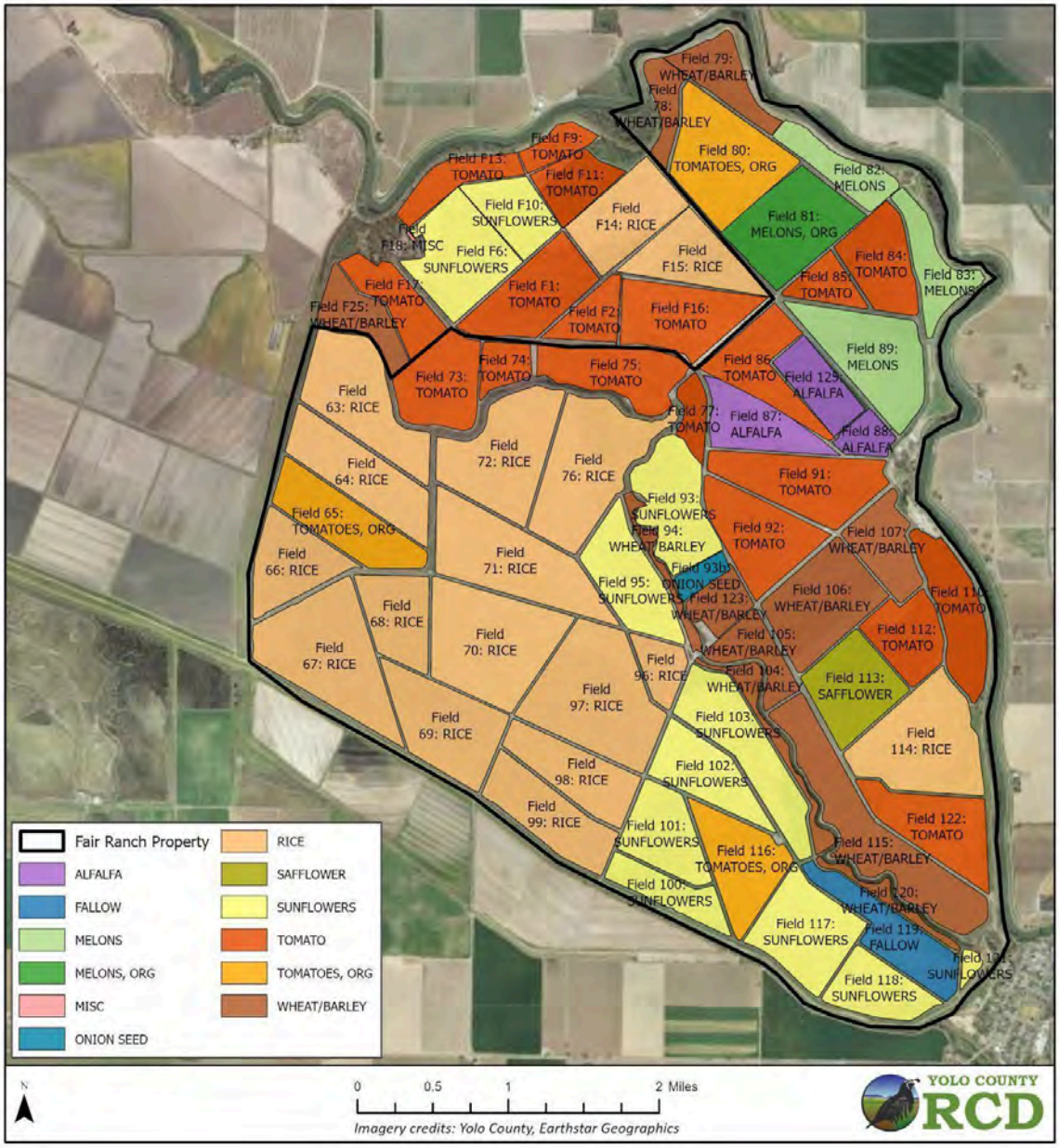

Figure 4. 2023 crop map at Fair Ranch.

Flora and Fauna

Before levees allowed farmers to drain this area, it likely would have been covered in tules, marsh grass, and other water-loving plants. Today, the uncultivated edges of the farm support stands of willows, cottonwoods, and valley oaks with understories of grasses and forbs. Because it is located along the Pacific Flyway, it serves as a stopover point for migrating waterfowl including various species of ducks and geese. The farm already participates in shorebird habitat programs and duck egg-saving initiatives,

and as such, these programs should be accounted for when integrating alternative carbon and/or wildlife practices. The property also provides critical habitat for fish that come to the area to spawn.

With the presence of wildlife comes the concern of possible yield reductions. Bird species present a threat not only in the form of foraging pressure on crops, but they can also spread mold through their feet. Hence, when considering practices in this carbon farm plan that incorporate large woody plantings, the benefits should be weighed against the potential threats to crops associated with increased bird pressure as a result of the added habitat.

Existing Carbon Beneficial Practices

Even before the creation of this carbon farm plan, several carbon beneficial practices have been incorporated at Fair Ranch, though records for certain management practices are limited. Compost from a municipal composting source/green waste has been used in the past, though the last time it was spread was in 2018 on about 700-750 acres (5-6 tons per acre, very low N with a C:N ratio likely greater than 11). Currently, organic fields receive chicken manure, though there is no set frequency and rates vary by crop and availability. Both warm and cool season cover crops are also utilized each year with the majority being a cool season planting (in 2023, 700 acres were planted; more details provided in the Cover Crop section). In the past, mulch was spread along some of the canals, but further details are not available.

In 2019, a hedgerow was installed along Road 112 extending from highway 45 to the headquarters. This planting was completed as part of a high school outreach program (Student and Landowner Education and Watershed Stewardship; SLEWS), and consisted of various trees, shrubs, forbs, and grasses (e.g. coyote brush, wild rose, deergrass, etc.). In 2022, another planting designed to include riparian forest, thicket, and willow scrub communities was established as part of the SLEWS program along County Road 98A. Species included ash, sycamore, oak, cottonwood, rose, blackberry, willows and sedge. The northwest portion extends east along the northern border of Field 63 to create a native grassland understory, and it consists mostly of deergrass and wild rye with some trees and shrubs interspersed (Figure 5).

For the rice production at Fair Ranch, a reduced form of alternate wetting and drying (AWD) is currently being trialed on 123 acres, and the remaining rice acreage (about 2,140 acres) is continuously flooded. AWD entails flooding a rice field, then allowing that standing water to go below the surface level (through seepage, percolation, or evapotranspiration) rather than remaining continuously flooded. After water levels drop to a specific point, fields are flooded again. The timing of flooding changes somewhat depending on the rice growth stage. At Fair Ranch, one dry-down is occurring midseason, so it will be referred to as a "midseason dry" (MSD). AWD acts not only to reduce water usage, but it can also decrease methane production by reducing anaerobic soil conditions that would otherwise occur if the field remained flooded. Though nitrous oxide emissions may increase, one study suggests that global warming potential decreases by 13-17% (Pramono et al. 2022).

A summary of existing practices is provided in Table 2 below, and a summation of the total carbon benefits from these existing practices is provided in Table 4 towards the end of the Recommended

Carbon Farm Practices section found later in this document. In total, approximately 3,800 MT of CO2e are sequestered annually by the practices listed below. Of note, however, is that soil carbon amendment in the form of composting accounts for 3,325 MT of that total value.

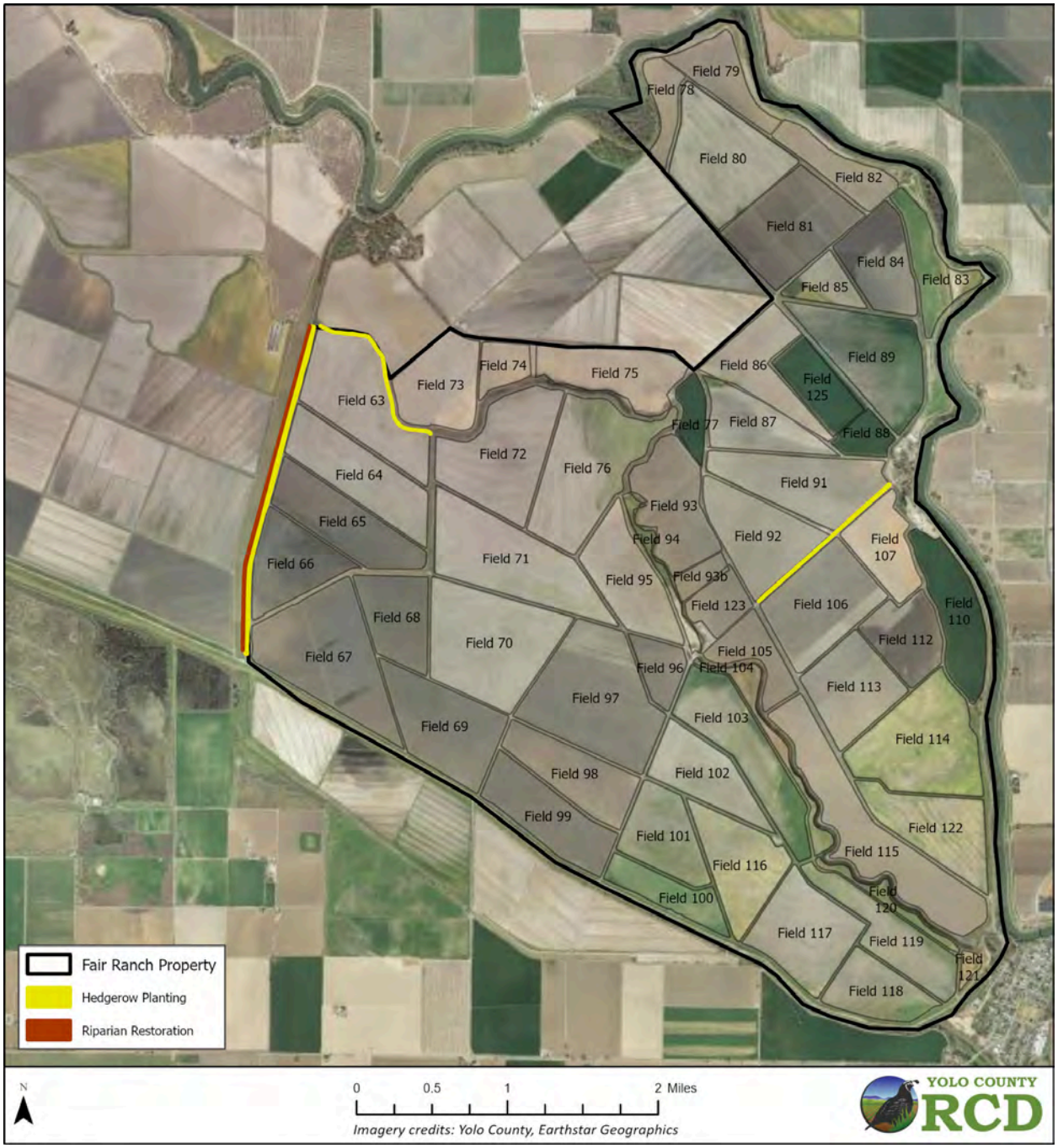

Figure 5. Existing hedgerow and riparian restoration practices at Fair Ranch.

Table 2: Existing carbon-beneficial practices at Fair Ranch.

Current Practice (NRCS CPS #)	*Acreage*	*Description*	*Co-Benefits*
Hedgerow Planting (422)	*17.4*	*Hedgerows consisting largely of deer grass and a few woody shrubs planted along the western border, north of field 63, and along road 112.*	*Provide and enhance habitat for wildlife and pollinators, reduces airborne particulate matter and chemical drift.*
Riparian Restoration (NA)	*2.1*	*Improvement of riparian vegetation along the western edge of the property.*	*reduce runoff, protects waterway structure, preserves waterway function, protects native plant community and aquatic habitat.*
Soil Carbon Amendment (336)	*750*	*Compost was applied in the past at a rate of 5-6 tons per acre. Chicken manure is spread on organic fields currently.*	*Improve soil health habitat and aggregate stability.*
Cover Crop (340)	*700*	*Primarily cool season cover crops used: traditional mix of bell beans, vetch, and grains.*	*Reduce erosion, suppress weeds, utilize excess soil nutrients, improve soil moisture, decrease soil compaction.*
Mulching (484)	*Data unavailable*	*Spread along several canals.*	*Improve soil moisture, improve irrigation efficiency, prevent and reduce erosion, weed suppression, reduce particulate matter emissions.*
MSD: Midseason Drying (NA)	*123*	*Currently being trialed; one dry period during the middle of the irrigation season.*	*Reduces water usage and methane emission.*

Resource concerns:

Soil organic carbon (SOC) levels vary throughout the property, though soil reports generally show soil organic matter (SOM) in the 3-4% range (about 1.7-2.3% SOC). The producer notes that he has not seen values below 2% SOM (1.2% SOC), though carbon levels tend to be lower near the river as the soil gets lighter. There are a few alkali spots and areas prone to seepage in high water; these areas are limited in size, and currently there are no practices being done to address that concern. Wind and water availability are other considerations at this site. Wind not only has the ability to cause soil erosion, but it has caused crop loss at Fair Ranch, particularly in rice. Water availability has also impacted operations–thousands of acres of cropland have been left fallow depending on water availability and crop idling. With the high variability of rainfall in California coupled with warming conditions and drought, water access and quality will be important to plan for in the future. Lastly, wildlife presents pressure both directly through damage to crops and indirectly through the introduction of mold.

Recommended Carbon Farm Practices

Carbon Capture Potential

Fair Ranch offers many opportunities for increased capture of atmospheric carbon consistent with both improvements to agricultural management activities and wildlife habitat enhancement. There are several opportunities for crop-beneficial practices including compost application, cover crops, conversion to reduced tillage and windbreaks. These practices, among others, will all assist in sequestering carbon via increased vegetation cover and soil organic matter, promote enhanced net primary cropland productivity, and increase water holding capacity. Opportunities also exist to enhance unused farm edges with wildlife habitat through riparian restoration and installation of hedgerows. The carbon beneficial practices identified for implementation in this plan will contribute to enhanced water infiltration and water quality, increase agricultural productivity on the property, and improve aquatic and terrestrial wildlife habitat.

The following carbon farming opportunities are categorized into three subsections: agroforestry systems, riparian systems, and cropland systems. A map of proposed carbon-beneficial plantings is included below (Figure 6). Definitions and general information about the practices described come from Natural Resource Conservation Service's (NRCS) conservation practice standards which can be found in the online field office technical guide (FOTG). Specific practice numbers are listed next to the practice name. In some cases, multiple NRCS practices may apply to a proposed action, so discussing these practices with an NRCS conservation planner before implementation is highly recommended to determine feasibility, strategy, and funding. COMET-Planner[1] was used to calculate potential carbon benefits associated with each proposed practice (Table 5). A summary of carbon benefits, both from existing and recommended practices, can be seen in Table 6 at the end of the Recommended Carbon Farm Practices section.

[1] Two versions were referenced: 1. The general version (http://comet-planner.com) and 2. California Department of Food and Agriculture's Healthy Soil Program version (http://www.comet-planner-cdfahsp.com).

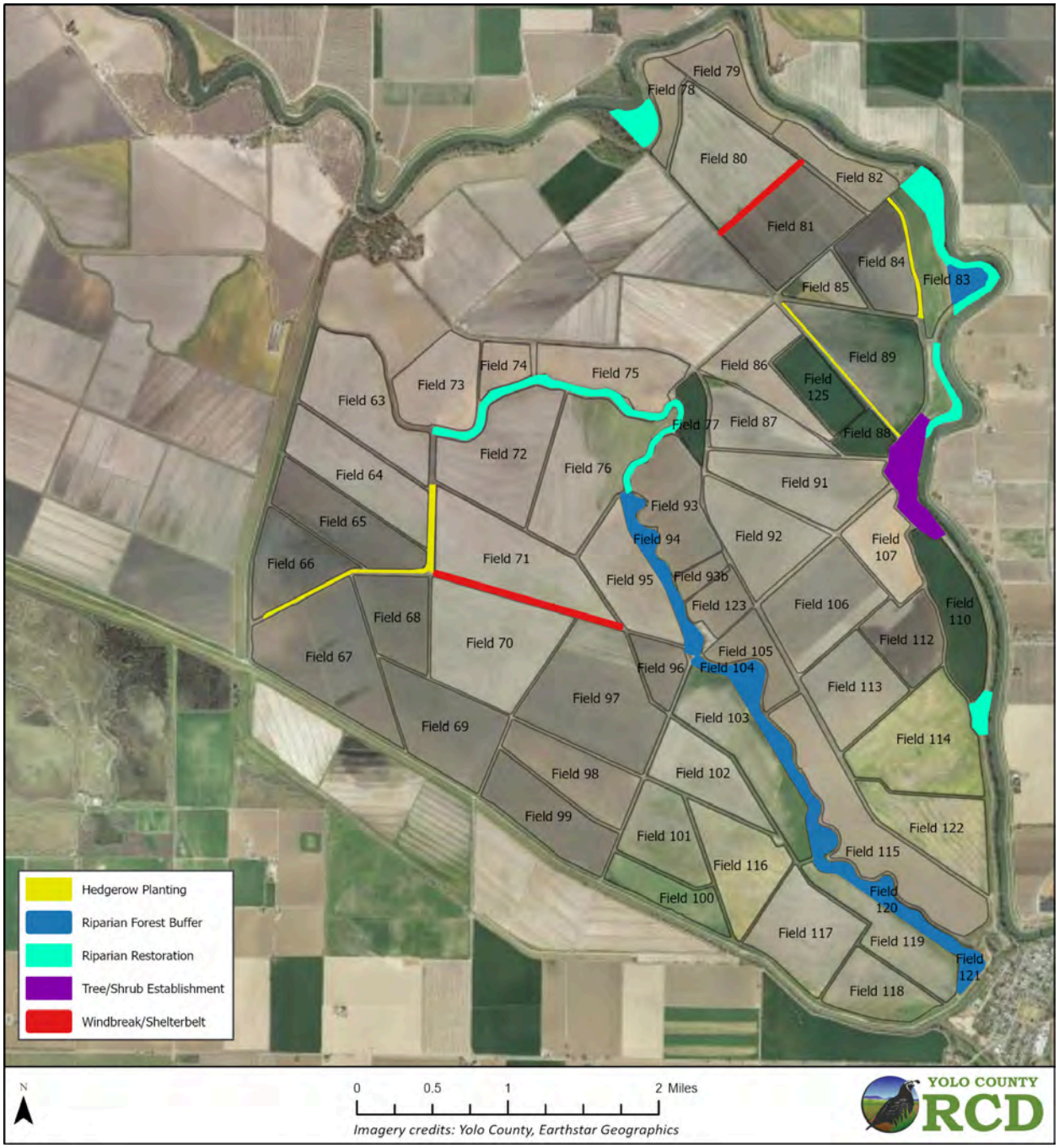

Figure 6: Proposed carbon-beneficial plantings at Fair Ranch.

A. Agroforestry Systems

Agroforestry refers to the "intentional integration of trees and shrubs into crop and animal production systems" (Patel-Weynand, Bentrup, and Schoeneberger, 2017). Through the "carbon lens," agroforestry is a straightforward means of increasing above-ground living carbon while also creating pathways for soil carbon sequestration. Other benefits of agroforestry can include increasing structural and biological diversity above and below ground; reducing the potential damage to crops and soils from wind;

providing habitat for beneficial animals and insects that can reduce pest presence and assist with pollination; and increasing water infiltration potential and reducing risk of flooding or runoff. The following subsections describe agroforestry practices that could be implemented at Fair Ranch.

Hedgerow Planting (CPS 422)

A hedgerow is defined as the establishment of dense woody vegetation in a linear design. Hedgerows can benefit a farm by sequestering carbon in biomass and soils, increasing the structural and biological diversity of a site, reducing soil erosion from wind and water, and increasing wildlife and pollinator habitat. A recent study found soil carbon under mature hedgerows in Yolo County was 36% higher than in adjacent farm fields (Chiartas et al. 2022). While this practice has already been utilized to some extent on Fair Ranch along roads and waterways, more opportunities exist.

Hedgerow plantings vary in width and species composition depending on site-specific characteristics. For this property, low-statured hedgerows are preferable because 1) compared to large trees, they are less likely to serve as habitat for black birds which can damage crops and 2) they are easier to maneuver around with tractors and implements. Suitable native hedgerow species used previously on this property are listed in the appendix (Supplementary Table S1).

In theory, hedgerows could be implemented along most field edges, though it would require taking some land out of production to accommodate the new plantings. Several areas totaling 4.14 acres were identified as good sites to establish trial hedgerows–these sites are indicated by yellow lines in Figure 6. Planting 4.14 acres of hedgerows would result in about 34 metric tons (MT) of CO2e storage annually. If this practice could be scaled up to include an additional 10 acres (14.14 acres total), an additional 82-84 MT of CO2e/year could be sequestered depending on whether grassland or cropland is replaced. If hedgerows were estimated to be 10 feet wide, this would mean installing about 8.25 miles of single row hedgerow (which, according to remotely sensed imagery, is possible if plants are added alongside just a portion of all driving paths within the property).

Windbreak (CPS 380)

Windbreaks are single or multiple rows of trees planted in straight or curved configurations, similar to hedgerows, but oriented perpendicular to the prevailing winds. While they do have overlapping benefits with hedgerows, the primary function is to protect against the negative effects of wind. By impeding wind, windbreaks can reduce soil erosion, protect plants from wind damage, reduce evapotranspirative losses thus improving irrigation efficiency, and improve air quality from airborne contaminants. Beyond that, they serve as another opportunity to sequester carbon in biomass and soils, provide wildlife and beneficial insect habitat, and provide microclimate-ameliorating benefits to the associated farm fields

Due to the relatively flat topography, wind has caused damage to some crops in the past, particularly rice. Positioning windbreaks near rice paddies in such a way that they are perpendicular to prevailing winds could offer protection. After 20 years, windbreaks offer protection up to 10 times the designed maximum height of the planting. In theory, they could be established strategically along various field

edges, but wind protection will likely not be provided to entire blocks due to the larger block sizes. Installing several experimental sites is a reasonable strategy to assess the results. In doing so, the farm could weigh the benefits windbreaks provide to crop yield against the loss in production which is required to install the planting. For example, if the equivalent of 1 ton of potential crop was taken out of production, but the remaining crop produced an additional 1.5 tons as a result of the wind protection, this could be an economically feasible practice to implement on more acreage. Two proposed trial windbreaks are indicated in Figure 6. Together, these comprise approximately 2.54 acres if the windbreaks are 12 feet wide and single-row. This length of single-row windbreak has the potential to store 21 MT of CO2e annually. Supplementary table S2 lists several native tree species around Knights Landing with a stature between 16-25 feet tall. This shorter stature was used to filter the species search in order to prevent adding significant bird habitat, but larger statured trees would offer more wind protection.

As an additional reference point, if 0.1% of the land (7 acres) was converted to single-row windbreaks, this would equate to 58 MT of CO2e storage per year. In areas that are more distant from rice plantings, more major windbreaks could be added where there are multiple rows, taller species, and a windbreak width greater than 12 feet. In areas that are closer to rice, however, minor windbreaks that are single-row, 12 feet wide, and composed of smaller species could be implemented.

Tree-Shrub establishment (CPS 612)

Tree shrub establishment refers to the establishment of woody plants by means of planting, direct seeding, or natural regeneration. In addition to sequestering carbon, this practice can also be used to restore native plant communities; improve plant diversity, productivity, and health; support wildlife habitat; and improve water quality. When used around buildings, trees/large shrubs can also help minimize energy consumption through shading and wind protection.

Near the office buildings at the headquarters, there is currently a mix of older oaks and landscape trees present which could be replaced or supplemented with native plantings. If a replacement strategy is chosen, old and non-native trees that are removed could be chipped and reapplied as mulch. However, because there are already trees at this location, the subsequent planting would have to be denser than the current planting to achieve any sort of carbon sequestration. In essence, these stacked practices would function similarly to a whole-orchard recycling project. Not only does the mulch function as another source of organic matter, but it will also reduce evaporative losses and erosion. If a whole orchard recycling strategy is employed, NRCS CPS 384 Woody Residue Treatment and NRCS CPS 336 Soil Carbon Amendment are other practices that may apply concomitantly.

A more efficient strategy would be to plant new stands that are denser than the current arrangement (especially around edges of the developed area), thus allowing for greater carbon storage. If approximately 5% of the area near the headquarters can be planted (2.5 acres), then the GHG equivalent would be 47 MT per year of CO2e sequestration.

In addition to the headquarters, there are several other areas where woody vegetation could be planted, though many are along waterways. For example, some of the "lobed" insets along Sycamore Slough could be planted with larger woody plantings. Because of their proximity to waterways, these areas will be discussed below in the section Riparian Forest Buffer (NRCS CPS 391).

B. Riparian Systems

Fair Ranch has riparian habitat potential on the eastern and northern edges which are adjacent to the Sacramento River, and along Sycamore Slough which bisects the property. To date, no large-scale riparian restoration activities have been completed on site. Currently, most waterways within the property's perimeter (i.e. not the property edges) have cattails and tule inside of them and species such as wild carrot and ox tongue along the edges. The farm edges adjacent to the Sacramento River have intermittent stands of old woody vegetation. To improve these riparian areas while simultaneously increasing carbon storage, young riparian woody and herbaceous vegetation could be planted selectively along waterways where riparian vegetation is lacking and/or where non-natives and shallow rooted annual plants are present.

Riparian Forest Buffer (CPS 391) - Sycamore Slough

A riparian forest buffer is an area that is primarily covered by trees and/or shrubs located adjacent to and up-gradient from a watercourse or water body. In practice, it involves replacing a strip of cropland or grassland near water features with woody plants. This practice can reduce transport of sediment or other materials, improve water quality and habitat, lower water temperatures, and store carbon in the soil and biomass.

Much of the area around Sycamore Slough would be a prime site to remove cropland and improve the riparian system. Currently, several of the fields south of the slough are often left as bare fallow from year to year, so there is opportunity to take those fields out of production and replace crops with woody plantings. Altogether, there are about 95 acres of land around the slough that could be taken out of production for this purpose (Figure 7 shows a snapshot of a portion of this area). For the purposes of this plan, we'll assume that 50% of that acreage will be used for riparian forest buffer, and the other 50% will become riparian herbaceous cover (see section below). In this scenario, 47.5 acres of riparian forest buffer equates to 91 MT of CO_2e sequestration per year. If the riparian planting were extended along the slough to the hedgerow north of field 63, there would be another 14 MT of CO_2e sequestration (assuming 2 miles are planted at a width of 30 feet, equating to 7.3 total acres; Figure 6).

Figure 7: Riparian forest buffer around Sycamore Slough.

Another site where this practice could be implemented is on the eastern side of the property near field 83 (Figure 8). Currently there is a setback levee that does not have any woody plantings, but would be a suitable location for a backwater habitat. 11.75 acres here could be converted from cropland to riparian land resulting in 23 MT of CO2e storage per year.

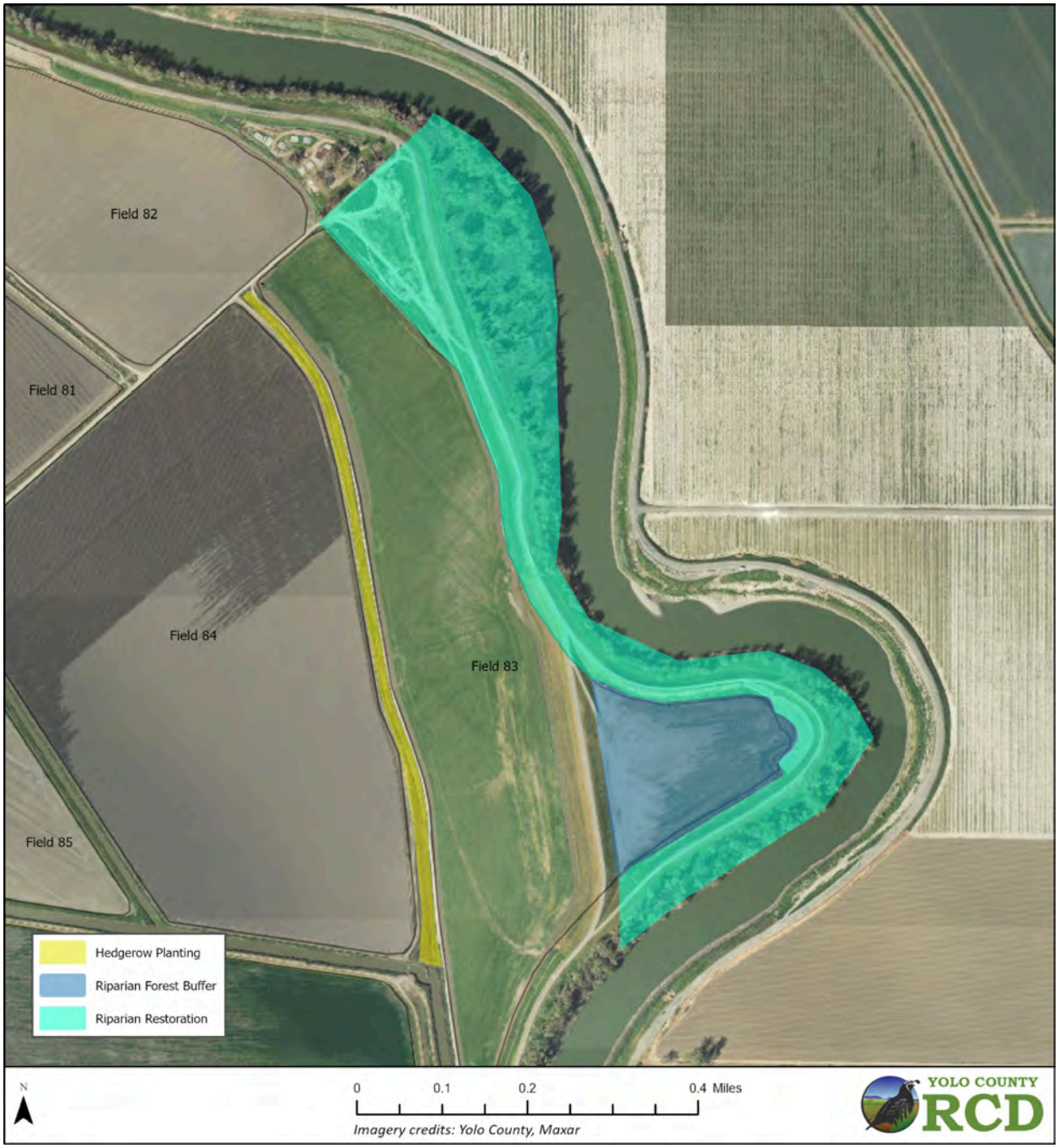

Figure 8: Riparian forest buffer and riparian restoration along the Sacramento River.

Riparian herbaceous cover (390) - all riparian areas

Riparian herbaceous cover refers to grasses, sedges, rushes, ferns, legumes, and forbs tolerant of intermittent flooding or saturated soils that are established or managed as the dominant vegetation in the transitional zone between upland and aquatic habitats. In terms of direct carbon benefits, this

practice provides the opportunity to store carbon in biomass and the soil. It also acts to reduce erosion and improve water quality, stabilize and protect banks along waterways, and support pollinator habitat.

As mentioned above, Sycamore Slough is a suitable site for implementing this practice. If 47.5 acres were planted with a mix of grass and leguminous riparian herbaceous cover, 17 MT of CO2e would be stored annually. The extension towards field 63 mentioned above offers the opportunity for another 1 MT of storage (assuming 2 miles are planted and the width of the planting is 10 feet; 2.4 acres). If only unfertilized grass were planted, the 47.5 acres would sequester 10 MT of CO2e and the 2.4 acres would sequester 1 MT. This practice could also be stacked with riparian restoration, a practice where already-present riparian areas are improved (described in the next section; see below). Several suitable locations for initial plantings are present along the eastern and northern edges of the property. Together they total 85.5 acres and are denoted in turquoise on the map (Figure 6). Again, if only 50% of the land, or 43.8 acres, were allocated toward riparian herbaceous cover it would sequester 16 MT of CO2e annually with a grass/legume mix and 8 MT with an unfertilized grass planting. When planting herbaceous cover, species should be selected for their ability to promote soil stabilization, reduce erosion, and support pollinators.

If the entire property border with the Sacramento River (about 6.75 miles) is considered as an opportunity to install grass/leguminous riparian herbaceous cover at a width of 10 feet, there is an opportunity for another 8.2 acres of planting resulting in 3 MT of CO2e sequestration annually (1 MT with only unfertilized grass). It could also be treated as a riparian restoration in some areas, but that will be discussed in the next section. Much of the border is already vegetated, however, so the carbon sequestration potential is likely less than 3 MT. Canals on the property could also receive riparian herbaceous cover. There are about 24.5 miles of canals; planting herbaceous cover at a 10-foot width in these canals would provide another 296 acres of land which could sequester 108 MT of CO2e annually if planted with a legume/grass mix and 60 MT of CO2e annually if planted with only unfertilized grasses.

Riparian Restoration - Sacramento River

Riparian restoration refers to the restoration of degraded streambanks through the planting of woody plants. Though this is not identified in the NRCS FOTG with a specific CPS number, it is identified as a practice in COMET Planner (http://comet-planner.com). The main distinction between this practice and a Riparian Forest Buffer is that the Riparian Forest Buffer is meant to replace cropland; this practice does not specifically do so. Riparian restoration helps to reduce runoff, therefore protecting waterway structure and services, it protects the native plant community and aquatic avian and insect habitat, and it increases carbon storage in biomass and the soil.

Many of the riparian areas along the farm edges present an opportunity for riparian restoration. For example, the eastern side of the property along the Sacramento River has several areas where additional trees could be added. Currently, large stretches are covered with old stands of blackberries, wild grapes,

and larger trees, but these plants could be removed and replaced, or interplanted with additional native trees and other plants. As mentioned above, several optimal sites to trial riparian restoration are noted in turquoise on the map (totaling 85.5 acres). Riparian restoration along these 85.5 acres would sequester approximately 85 MT of CO2e annually.

C. Cropland Systems

Maintaining the ability to adapt to changing markets is a priority at Fair Ranch, so proposed practices will have to balance economic feasibility with carbon benefits. Many of the practices listed below are management changes as opposed to infrastructure changes, so they can be scaled up or back as the needs of the farming operation shift. Because crops rotate throughout the property, and because crops have different nutrient management needs, the following practices are not illustrated on the map. Instead, feasible and/or optimistic potential acreages are noted in each subsection, and management at Fair Ranch would decide annually as to where implementation of a specific practice would make sense.

Reduced tillage (CPS 345)

Currently, there are attempts to minimize tillage on site, though this practice is limited in the sense that there is no maximum number of passes established. By minimizing tillage, either through reducing passes or the depth of tillage, soil structure can be better maintained while simultaneously reducing the amount of fossil fuel needed by equipment. This practice also serves to reduce the amount of particulate matter released while tilling, and it minimizes sediment lost to erosion.

In theory, this practice could be applied throughout the property by reducing passes. Depending on the residues that are left behind after harvest and the next crop to be planted, some areas may be more suitable for this practice one year and other areas may be more suitable the next year. Deep tillage could also be reduced to help maintain soil structure. Currently, River Garden Farms does not own any no-till equipment, but if these are obtained, carbon benefits could be even greater. River Garden Farms has expressed interest in reduced tillage equipment such as 1) a rip lister which acts as a subsoiler to break up compacted soil without inverting it, thus minimizing soil disruption or 2) a performer which can perform several functions at once such as ripping, listing, and shaping, thus reducing the number of overall passes.

If 10% (approximately 700 acres) of the cropland was converted from intensive tilling to reduced tilling, the CO2e reduction would be about 79 MT/year. If taken a step further, converting 700 acres of intensive tilling to no-till (CPS 329) would result in 179 tons of CO2e/year sequestered. If it were 700 acres of *reduced-till* cropland that was converted to no-till, the savings would be 114 tons annually.

Cover crop (CPS 340)

By planting grasses, legumes, and forbs as a form of seasonal cover, cover crops can present a host of benefits. In the most fundamental sense, cover crops provide an opportunity to maintain living roots in the ground–a key principle in promoting soil health. As such, it can result in reduced erosion, greater organic matter, reduced weed pressure, improved soil moisture, and less soil compaction.

Currently River Garden Farms has about 700 acres of its land in cover crops, sequestering approximately 333 MT of CO2e annually. Cover cropping has been tried in all soil types, though most efforts have been done in areas with rice and organics. The yearly acreage planted depends on funding and organic crop plans. Some warm season cover cropping has been done, but predominantly cool season cover crops have been planted. The current mix is a traditional one consisting of bell beans, vetch, and grains. If another 100 acres were planted with a multi-species cover crop mix, 48 MT of CO2e could be sequestered. One key area where this practice could be incorporated is in fields that would otherwise be left as bare fallow (in some years, over 2,000 acres). If this practice were scaled up to plant 2,000 acres of fallowed land with cover crop, that would result in 951 MT of annual CO2e sequestration.

Nutrient Management (CPS 590)

Nutrient management is grounded in four key principles: ensuring that the right nutrients are applied in the right place, at the right time, and at the right rate. The goal of this practice is to ensure plant health and productivity while at the same time reducing excess nutrient loss, emissions of particulate matter, and release of GHG and ozone precursors. Nutrient management can be incorporated wherever amendments are used. In the most fundamental sense, it helps optimize nitrogen, phosphorus, and potassium by accounting for all significant sources and removal of these nutrients. To properly track nutrient levels, all inputs and removal of nutrients should be considered. Sources include irrigation water, fertilizers/amendments, nutrients within the root zone, and crop residues. Removal includes leaching, erosion, volatilization and crop harvest.

All conventional fields currently receive a standard traditional nitrogen fertilizer, and organic fields receive chicken manure (rates vary by crop; Table 3). Where cover cropping is practiced, additional nitrogen is added via leguminous plants. There have been considerations of using alfalfa as an additional source of nitrogen, but that has only been implemented as a trial so far. Soil tests have been conducted on various fields and levels of nitrogen, phosphorus, and potassium can be found in those reports. If fertilizer application were reduced by 15% on 700 acres, i.e., 10% of the property, 1 MT of CO2e emission could be reduced annually.

Table 3. Typical fertilizer source and rate by crop.

Crop	Source	Rate
Alfalfa	NA	Leguminous crop; very little added
Rice	Aqua 20-0-0; top dress with ammonia sulfate	89 gallons per acre
Sunflowers and row crops	UN32	30-40 gallons per acre
Tomato	UN32 and CAN17	200 pounds per acre

Compost Application (CPS 808–soil carbon amendment)

Applying carbon-based amendments derived from plant materials or treated animal byproducts can improve soil organic matter, sequester carbon, improve aggregate stability, reduce the need for synthetic nutrients and improve habitat for soil organisms. Additionally, this practice can help improve soil moisture. River Garden Farms historically incorporated this practice in orchards and some row crop fields at a rate of about 5-6 tons per acre, however, this practice was not regularly practiced and depended upon availability and cost of material. The last time compost was applied was in 2018 on about 700-750 acres. In order to be implemented again, access to free compost would be necessary. Assuming acquisition is possible from a certified composting facility, applying 6 tons/acre of compost ($C/N > 11$) to 700 acres would sequester 3,103 MT of CO_2e annually. Applying 5 tons/acre of compost ($C/N \leq 11$) would sequester 1,478 MT of CO_2e annually.

Conservation Crop Rotation (328)

Conservation crop rotation, in its simplest sense, refers to the incorporation of multiple plant species into the annual crop rotation cycle. By rotating at least two crops and reducing or eliminating bare fallow, soil health and organic matter can be improved; erosion can be minimized; soil moisture can be increased; plant pests, synthetic fertilizer needs, and salt/chemical buildup can be reduced; and wildlife can be supported.

At Fair Ranch, there were 2,666 acres of fields that were left in bare fallow at least one time in the last ten years. Of this acreage, 2,260 acres was left fallow only one season, 226 acres was fallowed for two seasons, and 130 acres was left fallow for more time (for clarity, this portion will be referred to as “frequently fallowed”). Considering that 97 acres of the frequently fallowed land was already addressed above as part of the riparian planting, there remains 33 acres which could be addressed by this practice. Utilizing conservation crop rotation on this acreage would equate to 9 MT of CO_2e storage per year.

D. Miscellaneous Practices

Prescribed grazing (CPS 528)

River Garden Farms already incorporates this practice along some farm edges. By allowing sheep to graze along hedgerow plantings, weed pressure has been reduced. This practice can be used more extensively and in conjunction with future hedgerow plantings to improve and maintain desired species compositions, maintain hedgerow function, reduce erosion, recycle nutrients, and reduce the amount of fossil fuels required to manage these same areas mechanically or chemically. Grazers could also be used along riparian areas in such a way that promotes native/desired species.

This practice will depend upon availability of animals and labor. Sheep have been used in the past, so they may be an excellent option to begin with since contacts are already established. For every 38 acres that utilize prescribed grazing, 1 MT of CO2e/year is sequestered. Since this practice will most likely be used primarily on hedgerows (and possibly riparian areas), the carbon benefits will be minimal on this property, but it is still worth considering for its myriad of co-benefits, including weed reduction and nutrient recycling.

Table 4: Carbon Sequestration benefits of previous/existing practices at Fair Ranch.

Existing practice (NRCS CPS #)	*Acreage*	*Description*	*Annual CO2e sequestration (MT)*	*20-year CO2e sequestration (MT)*	*Co-Benefits*	*Reference*
Hedgerow Planting (422)	*17.4*	*Hedgerows consisting largely of deer grass and a few woody shrubs planted along the western border, north of field 63, and along road 112*	*143*	*2,860*	*Provide and enhance habitat for wildlife and pollinators, reduces airborne particulate matter and chemical drift*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Riparian Restoration (NA)	*2.1*	*Deergrass and small woody shrubs planted along the western border*	*2*	*40*	*reduce runoff, protects waterway structure, preserves waterway function, protects native plant community and aquatic habitat*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Soil Carbon Amendment (336)	*750*	*Compost (C:N > 11) from a composting facility applied to annual crops at 6 tons/acre*	*3,325*	*66,500*	*Improve soil health habitat and aggregate stability*	*COMET-Planner CDFA HSP version accessed October 2023*
Cover Crop (340)	*700*	*Traditional mix of bell beans, vetch, and grains applied to various fields*	*333*	*6,660*	*Reduce erosion, suppress weeds, utilize excess soil nutrients, improve soil moisture, decrease soil compaction*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Mulching (484)	*1*	*Spread along several canals*	*0.2*	*4*	*Improve soil moisture, improve irrigation efficiency, prevent and reduce erosion, weed suppression, reduce particulate matter emissions*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Midseason Drying (NA)	*123*	*Allowing standing water in irrigated rice paddies to drain before irrigating again*	*193**	*3,860*	*Provides intermittent habitat for migratory birds, reduces methane reductions*	*Enriquez et al. 2021*

Total			*3,996.2 MT*	*79,924 MT*		

*This value was derived using a conservative estimate based on a rice model in Filipino rice paddies (Kraus et al. 2022).

Table 5: Carbon sequestration benefits associated with implementation of proposed practices at Fair Ranch.

Planned practice (NRCS CPS #)	*Acreage*	*Description*	*Annual CO2e sequestration (MT)*	*20-year CO2e sequestration (MT)*	*Co-Benefits*	*Reference*
Hedgerow Planting (422)	*4.14*	*Woody plantings implemented in several trial sites and along driving paths on the property*	*34*	*680*	*Provide and enhance habitat for wildlife and pollinators, reduces airborne particulate matter and chemical drift*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Windbreak (380)	*2.54*	*Low statured plantings are preferred so as not to invite additional avian crop pressure*	*21*	*420*	*Minimize soil erosion and crop damage due to wind, provide and enhance habitat for wildlife and pollinators, improves air quality from airborne contaminants*	*COMET-Planner Version 3.0, Build 1, accessed October 2024*
Tree-Shrub Establishment (612)	*2.5*	*Young native tree plantings around the headquarters*	*47*	*940*	*Provide shade and wind protection to minimize energy consumption; support wildlife habitat; support plant diversity, productivity, and health*	*COMET-Planner Version 3.0, Build 1, accessed October 2025*
Riparian Forest Buffer (391)	*59.25 - 66.55*	*Woody plantings around Sycamore Slough and in the setback levee on the eastern side of the property. Additional planting could extend the planting along Sycamore Slough by 7.3 acres*	*113-128*	*2,260 - 2,560*	*Reduce sediment transport, improve water quality and habitat, lower water temperatures*	*COMET-Planner Version 3.0, Build 1, accessed October 2026*

Riparian Herbaceous Cover (390)	*91.3 - 395.5*	*Plantings of herbaceous plants near water bodies. Plants may include grasses, sedges, rushes, ferns, legumes, and forbs*	*34 - 145*	*680 - 2,900*	*Reduce erosion, improve water quality, stabilize banks, support pollinator habitat*	*COMET-Planner Version 3.0, Build 1, accessed October 2027*
Riparian Restoration (NA)	*85.5*	*Woody plantings located primarily along the Sacramento River*	*85*	*1,700*	*Reduce runoff, protects waterway structure, preserves waterway function, protects native plant community and aquatic, avian and insect habitat*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Reduced Tillage: conversion from intensive to reduced tillage (345) or no-till (329)	*700*	*Minimizing the number of tillage passes or the depth of tillage*	*79 -179*	*1,580 - 3,580*	*Minimize sediment lost to erosion, reduce particulate matter released, improve soil structure*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Cover Crop (340)	*100*	*Traditional mix of bell beans, vetch, and grains applied to various fields*	*48*	*960*	*Reduce erosion, suppress weeds, utilize excess soil nutrients, improve soil moisture, decrease soil compaction*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Nutrient Management (590)	*700*	*Creating an approach to account for all nutrient input and removal for the operation*	*1.0*	*20*	*Support plant health and productivity, reduce excess nutrient loss, decrease particulate matter emissions, minimize release of GHG and ozone precursors.*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*

Soil Carbon Amendment (336)	*700*	*Compost (C:N ≤ 11) from a composting facility applied to annual crops at 5 tons/acre OR Compost (C:N > 11) from a composting facility applied to annual crops at 6 tons/acre*	*1,478- 3,103*	*29,560-62,060*	*Improve soil health, habitat, and aggregate stability, increase SOM, improve soil moisture*	*COMET-Planner CDFA HSP version accessed October 2023*
Conservation Crop Rotation (328)	*33*	*Incorporation of plant species into an annual crop rotation to avoid bare fallow*	*9.0*	*180.0*	*Improve soil health and organic matter, minimize erosion, increase soil moisture, reduce inputs, support wildlife*	*COMET-Planner Version 3.0, Build 1, accessed October 2023*
Total			1,949 - 3,800 MT	38,980 - 76,000 MT		

Table 6: Summary of carbon benefits from implemented and planned practices. See Tables 3-4 for more details on each practice.

Practice	*Acreage*	*CO2e sequestered annually (MT)*	*CO2 sequestered over 20 years (MT)*
Hedgerow Planting	21.54	180	3,600
Windbreak	2.54	21	420
Tree-Shrub Establishment	2.5	4.7	940
Riparian Forest Buffer	59.25 - 66.55	113 - 128	2,260 - 2,560
Riparian Herbaceous Cover	91.3 - 395.5	34 - 145	680 - 2,900

Riparian Restoration	87.6	87	1,740
Reduced Tillage: conversion from intensive to reduced tillage or no-till	700	79 - 179	1,580 - 3,580
Cover Crop	800	381	7620
Nutrient Management	700	1	20.0
Soil Carbon Amendment	1,450	4,803 - 6,428	96,060 - 128,560
Conservation Crop Rotation	33	9	180
Mulching	1	.2	4.2
Alternate Wetting and Drying	123	193	3,860
TOTAL		5,905.9 - 7,756.9 MT	118,118 - 155,138 MT

Soil water holding capacity section needs to be added

By increasing carbon in the soil, water holding capacity is also increased. NRCS indicates that a 1% increase in SOM (about 0.5% increase in SOC) in the topsoil equates to 27,000 gallons of additional water holding capacity per acre (NRCS Soil Health Key Points). If we assume that 1% SOC is equal to 9 MT of SOC per acre (Carbon Cycle Institute), then the proposed practices illustrated in Table 5 above would equate to approximately 369.36 acre feet of additional soil water holding capacity over a 20 year period (Table 7 and Supplementary Table S3).

Table 7. Summary of impacts of proposed carbon farming practices on

Practice	*Acres*	*20-year SOM increase*	*Soil WHC increase by year 20 (AF)*
Hedgerow Planting	*17.4*	*2,860*	*7.14*
Windbreak	*2.54*	*420*	*1.05*
Tree-Shrub Establishment	*2.5*	*940*	*2.35*
Riparian Forest Buffer	*66.55*	*2,560*	*6.39*
Riparian Herbaceous Cover	*395.5*	*2,900*	*14.49*
Riparian Restoration	*85.5*	*1,700*	*4.25*
Reduced Tillage: conversion from intensive to no-till (329)	*700*	*3,580*	*17.88*
Cover Crop	*100*	*960*	*4.8*
Nutrient Management	*700*	*20*	*0.1*
Soil Carbon Amendment	*700*	*62,060*	*310.02*
Conservation Crop Rotation	*33*	*180*	*0.9*
Totals		*78200*	*369.36*

Conclusion

Quantification of Carbon Benefits

Fair Ranch has already implemented several carbon-beneficial practices, and through the implementation of additional practice detailed above, the carbon capture/reduction benefits can be amplified. Tables 4-6 above indicate the historic and potential carbon benefits for each practice as calculated using COMET-Planner (both the general and the CDFA version as indicated in the tables) in October 2023.

If all existing practices were to continue, and if all proposed practices were implemented as described above, the total carbon sequestration potential could be up to 7,756.9 MT of CO2e annually, or 155,138 MT of CO2e over a 20-year period.

The US EPA Greenhouse Gas Equivalencies Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) is a tool that helps to put greenhouse gas emissions into perspective. The total sequestration potential of 7,756.9 MT CO2e equates to 1,726 gasoline powered passenger vehicles driven for one year or the annual energy use of 978 homes.

Summary

Fair Ranch aims to continue operating in a manner that accounts for the practical considerations of maintaining a viable business while at the same time conserving the environment and species found there. Various practices have already been implemented on portions of the property, but there are opportunities for incorporating new practices and implementing more acres of existing practices. Adding intentional practices meant to sequester carbon and reduce CO2 emissions is a practical next step for expanding beneficial practices on this property.

This plan should be viewed as a living document. This plan is dynamic in the sense that it may be modified, appended, or refined to meet future goals and needs. This plan should evolve as practices are implemented and new information/feedback, tools and resources become available. Additional carbon-beneficial practices may be considered for inclusion in the long-term plan. GHG values presented here as associated with specific practices are based upon the best available information at the time of this plan's preparation (2023). They likewise may be revised as evaluation techniques are refined or new data becomes available.

Project Implementation Timeline

Below is a general timeline for implementing various carbon-beneficial practices. As a note, several of these practices are currently taking place or have recently begun implementation. Some practices (or

expansion of a practice) are dependent upon funding acquisition. For the near-term goals of compost application and cover crop planting, CDFA's Healthy Soils Program could be applied for this winter (2024) to begin implementation as early as the fall of 2024.

Table 8. Implementation timeline of near, medium, and long-term goals.

Objectives	*Short-term goals (currently ongoing or to be initiated in the next 1-2 years)*	*Medium-term goals (to be initiated in the next 2-5 years)*	*Long-term goals (to be initiated in the next 5-10 years)*	*Additional notes (if applicable)*
Install Hedgerow	X			Implementation is currently taking place Winter 2024.
Reduce tillage on property	X			Management practices are currently taking place to reduce the number of passes. Funding is being sought for reduced tillage equipment.
Apply compost	X			CDFA Healthy Soils Program (HSP) funding is available Winter 2024.
Plant cover crops	X			This practice is currently taking place on site. CDFA HSP funding is available Winter 2024 which could be used to supplement this practice, though compost acquisition takes priority for that funding.
Install wind break		X		
Implement conservation crop rotation		X		

Begin riparian plantings			X	

MONITORING AND RECORD KEEPING

Monitoring the initial application, implementation, and establishment of practices (e.g., compost application, hedgerow plantings survival, cropland management via tilling and crop rotation, cover crop establishment, etc.) should be carried out in coordination with annual inspections or at key moments by River Garden Farms staff or any organizations involved in project implementation. For assessing longer-term goals, soil organic carbon or soil organic matter should be measured where practices are implemented in accordance with market or voluntary protocol requirements (if applicable). Ideally, soil samples or other data will be taken prior to implementation of a practice to provide a baseline. Subsequent collections can then occur at appropriate intervals after implementation. Monitoring data and records of implementation activities, including locations, extent of project(s), dates of implementation, etc., should all be included in plan implementation documentation. If funding or partnerships are available, monitoring the impacts of these practices on other ecosystem services and co-benefits would be of value to verify and quantify impacts and to adjust management strategies. Such activities may include biological surveys (animal and plants, soil macrobiota or microorganisms) and assessments of water quality and agricultural productivity.

FUNDING STRATEGY FOR CARBON FARM PLAN IMPLEMENTATION

This section describes potential funding opportunities that include grants and direct contributions from regional, state, and federal agencies to implement the practices outlined for Fair Ranch. This list is by no means meant to be exhaustive. In some cases, opportunities also exist for obtaining technical assistance in applying for funding. The goal and scope of these resources vary widely, but funding opportunities can be maximized by leveraging these resources strategically. There are several programs aimed at supporting pollinators, for example, which could be applied towards hedgerow plantings at Fair Ranch. Other funding sources could be utilized to support riparian plantings, cover cropping, or the wildlife community in general. Framing a project along Sycamore Slough or the Sacramento River in such a way that it emphasizes the benefit to wildlife may open up the possibility for more funding opportunities that may seem less directly related to carbon capture.

FEDERAL

Natural Resources Conservation Service (NRCS)- Environmental Quality Incentives Program (EQIP): The "Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to

agricultural producers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, increased soil health and reduced soil erosion and sedimentation, improved or created wildlife habitat, and mitigation against drought and increasing weather volatility.". This program typically assists agricultural producers with cost share related to many of the practices listed in this carbon farm plan (e.g. hedgerow planting, soil carbon amendment, cover crop).

https://www.nrcs.usda.gov/sites/default/files/2022-10/EQIP-fact-sheet.pdf

USDA Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants (REAP): The program provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses for renewable energy systems or to make energy efficiency improvements. Agricultural producers may also apply for new energy efficient equipment and new system loans for agricultural production and processing.

https://www.rd.usda.gov/programs-services/energy-programs/rural-energy-america-program-renewable-energy-systems-energy-efficiency-improvement-guaranteed-loans

U.S. Fish and Wildlife Service- Partners for Fish and Wildlife Program: "The Partners for Fish and Wildlife Program provides technical and financial assistance to landowners interested in restoring and enhancing wildlife habitat on their land." Provides up to $750,000 per award.

https://www.fws.gov/program/partners-fish-and-wildlife

Central Valley Project Improvement Act and Habitat Restoration Program: The U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service's Central Valley Project Improvement Act grant provides funding for the "protection, restoration and enhancement of fish and wildlife.". This program typically receives $1.5 million annually and funds five or more projects.

https://www.usbr.gov/mp/cvpia/

STATE

California Department of Food and Agriculture (CDFA)- Office of Environmental Farming and Innovation (OEFI)- Healthy Soils Program (HSP): "The HSP Incentives Program provides financial incentives to California growers and ranchers to implement conservation management practices that sequester carbon, reduce atmospheric greenhouse gases (GHGs), and improve soil health." Supported practices would include compost application, cover cropping, no-till, reduced-till, mulching, and hedgerow practices.

https://www.cdfa.ca.gov/oefi/healthysoils/IncentivesProgram.html

California Department of Food and Agriculture (CDFA)- Office of Environmental Farming and Innovation (OEFI)- State Water Efficiency & Enhancement Program (SWEEP): SWEEP provides financial assistance in the form of grants to implement irrigation systems that reduce greenhouse gases and save water on California agricultural operations. Eligible system components include soil moisture

monitoring, drip systems, switching to low pressure irrigation systems, pump retrofits, variable frequency drives, and installation of renewable energy to reduce on-farm water use and energy." If solar panels are incorporated on site, this grant would be relevant.

https://www.cdfa.ca.gov/oefi/sweep/

California Department of Fish and Wildlife (CDFW)- California Waterfowl Habitat Program (CWHP): "The CWHP provides economic incentives to private landowners who agree to manage their properties in accordance with a wetland management plan developed cooperatively by California Department of Fish and Wildlife (CDFW) biologists and the participating landowner." Landowners can receive an incentive of $30-$60/acre annually depending on the lands being managed.

https://wildlife.ca.gov/Lands/WCP/Private-Lands-Programs

California Wildlife Conservation Board: Provides funding to support a variety of habitat enhancement programs including the California Riparian Habitat Conservation Program (CRHCP) which aims at "protecting and restoring California's riparian systems." The Ecosystem Restoration on Agricultural Lands (ERAL) program "collaborates with the agricultural community to identify and implement projects that provide long-term habitat benefits for wildlife", and the Monarch Butterfly and Pollinator Rescue Program provides grant funding to restore or enhance monarch breeding habitat on private and public lands. Depending on the goals and/or outcomes of a proposed practice, various programs may be utilized.

https://wcb.ca.gov/Programs

PRIVATE/NON-PROFIT

National Fish and Wildlife Foundation (NFWF)- Monarch Butterfly and Pollinators Conservation Fund: Grants are awarded to projects that "create and sustain interconnected monarch and pollinator habitats" to support annual life cycle needs. In 2023, grants ranged from $200,00-$250,000 for projects up to two years.

https://www.nfwf.org/programs/monarch-butterfly-and-pollinators-conservation-fund

Project Apis m.- Seeds for Bees: This cost share program provides cover crop seed with the goal to "increase the density, diversity, and duration of bee forage in California orchards, farms, and vineyards, while improving soil health. The seed mixes available through Seeds for Bees are designed to bloom at critical times of the year when natural forage is scarce but managed and native bees are active. Seeds for Bees serves the needs of bees, beekeepers, and growers, increasing sustainability of pollination and agriculture."

https://www.projectapism.org/seeds-for-bees.html

The Xerces Society- Monarch and Pollinator Habitat Kits: Provides habitat plant kits that contain climate-smart native plants with the goal to support monarchs and other local pollinators in California whose populations are in decline. This cost share opportunity could support the planned hedgerow components of this carbon farm plan but also riparian areas through a different kit specifically for riparian wildflower plantings.

https://xerces.org/pollinator-conservation/habitat-kits/california

Zero Foodprint Restore Grant: Provides funding for adopting practices aimed at sequestering atmospheric carbon in the soil. Maximum funding is $25,000 per round, with a lifetime maximum of $75,000 across multiple rounds.

https://www.zerofoodprint.org/

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Appendix

Supplementary Table S1. Hedgerow species at Fair Ranch

Common Name	Scientific Name	Taxon
Coyote brush	*Baccharis pilularisi*	tree/shrub
Valley oak	*Quercus lobate*	tree/shrub
Cottonwood	*Populus fremotii*	tree/shrub
Toyon	*Heteromeles arbitufolia*	tree/shrub
California wild rose	*Rosa californica*	tree/shrub
Red bud	*Cercis occidentalis*	tree/shrub
California Buckwheat	*Erogonum grande var. rubescens*	tree/shrub
Buckbrush	*Ceanothus cuneatus*	tree/shrub
Coffeeberry	*Frangula californica*	tree/shrub
Julia Phelps Ceanothus	*Ceanothus spp.*	tree/shrub
Mulefat	*Baccharis salicifolia*	tree/shrub
California Fuchsia	*Epilobium canum*	tree/shrub
Cleveland Sage “Winnifred Gilman”	*Salvia clevelandii*	tree/shrub
Elderberry	*Sambucus mexicana*	tree/shrub
Bladderpod	*Isomeris arborea*	tree/shrub
Flannelbush	*Fremontodendron californicum*	tree/shrub
California Aster	Symphyotrichum chilense	forb/grass
Gumplant	Grindelia camporum	forb/grass
Yarrow	Archillea millefolium	forb/grass

Western goldenrod	Euthamia occidentalis	forb/grass
Deergrass	Muhlenbergia rigens	forb/grass
Narrow-leaf milkweed	Asclepias fascicularis	forb/grass
Mugwort	Artemisia douglasiana	forb/grass

Supplementary Table S2. NRCS eVegGuide native tree species. These tree species are short statured (16-25 feet) and acceptable species for Windbreak/Shelterbelt Establishment (CPS 380) for this area.

Common Name	Scientific Name	Bloom	Spacing (ft)	Height (feet)
Arroyo willow	Salix lasiolepis	Feb-May	10	7-35
Western dogwood	Cornus sericea	Jun-Aug	10	4-13.1
California hoptree	Ptelea crenulata	Apr-Jun	8	16
Goodding's willow	Salix gooddingii	Feb-Mar	20	15-40

Information from NRCS' EvegGuide, and height data from California Native Plant Society's Calscape

Supplementary Table S3.

Carbon Cycle Institute
NRCS suggests that a 1% increase in SOM (SOM) results in an increase in soil water holding capacity (WHC) of an approximately 1-acre inch, or 27,152 gallons of increased soil water storage capacity per acre. A 1% increase in SOM represents roughly 20,000 pounds (10 short tons) of organic matter or 5 short tons of organic carbon. The WHC table shows estimated additional water storage capacity associated with soil carbon increases on Frog Hollow Ranch resulting from the implementation of the CFP. Practices from Table resulting in WHC increases greater than one-acre foot are shown in Table.
Instructions and Descriptions: **The basic concept here is that an increase of 1% SOM is equivalent to a 1 acre-inch increase in soil water holding capacity (Emerson 1995).** **1. Gather all potential carbon farm practices from your plan and select from the dropdown menu.** **2. In the second column enter you practice data for 20 year CO2e. These values are obtained from you overall CFP summary table (linked). These are the values you calculated with the use of a model such as COMET-Planner.** **3. Column 3 will AUTO POPULATE! This column is where the 20 year CO2 metric tons is converted to C. This is done by dividing the value from column 2 by 3.67, This value gives you your metric tons of soil organic carbon.** **4. Column 4 VALUES (Soil Factor) ARE DEPENDENT ON PRACTICE TYPE! Because not all CO2 captured on farm is stored in soil (some is stored in above-ground vegetation), a "soil factor" is included to adjust accordingly. Use values here appropriate for the practice.** **5. Column 5 will AUTO POPULATE! Metric tons of SOC is converted to Metric tons of SOM by multiplying SOC (from column 3) by 2 (Pribyl 2010).** **6. Column 6 STAYS CONSTANT! Because CO2 is expressed in metric tons, and NRCS assumes short tons, we need to convert to short tons to derive acre inches. Assuming a 1% increase in SOM in the plow layer weighs 10 short tons per acre (ballpark number based on a commonly accepted acre furrow slice of soil weight of 2 million lbs),** **7. Column 7 will AUTO POPULATE! This column converts 10 short tons of SOM to one acre inch (AI) of WHC. Each 1% increase in SOM weighs about 9.09 metric tons and represents one acre inch (AI) of WHC.** **8. Column 8 will AUTO POPULATE! This column converts AI to acre feet (AF) by dividing AI by 12.**

Carbon Farm Practices(use dropdown)	Mg CO2e 20 yr	Mg SOC	Soil Factor	Mg SOM	Mg SOM/AI	Acre Inches (AI)	Acre Feet (AF)
Hedgerow Planting (CPS 422)	2860	779.29	0.5	779.29	9.09	85.72	7.14
Windbreak/Shelterbelt Establishment (CPS 380)	420	114.44	0.5	114.44	9.09	12.59	1.05
Tree/Shrub Establishment (CPS 612)	940	256.13	0.5	256.13	9.09	28.17	2.35
Riparian Forest Buffer (CPS 391)	2560	697.55	0.5	697.55	9.09	76.73	6.39
Riparian Herbaceous Cover (CPS 390)	2900	790.19	1	1580.38	9.09	173.84	14.49
Riparian Restoration	1700	463.22	0.5	463.22	9.09	50.95	4.25
Conventional Tillage to No-Till (CPS 329)	3580	975.48	1	1950.95	9.09	214.6	17.88
Cover Crops (CPS 340)	960	261.58	1	523.16	9.09	57.55	4.8

Nutrient Management (CPS 590)	20	5.45	1	10.9	9.09	1.2	0.1
Compost Application on Cropland	62060	16910.08	1	33820.16	9.09	3720.22	310.02
Conservation Crop Rotation (CPS 328)	180	49.05	1	98.09	9.09	10.79	0.9
TOTAL	**78180**	**21302.45**		**40294.28**		**4432.37**	**369.36**
Riparian Restoration WHC ONLY IF YOU ARE USING LOCAL DATA FROM LEWIS ET AL 2015 CREEK RESTORATION STUDY.							
Riparian Soil C	acres	m2/acre		kg SOC/m2/yr	Mg/C/20yr	Mg OM tot	AI
via Lewis et al 2015	94	4046.85642		0.2	1521.618014	3043.236028	334.789442

NOTES
20 year MgCO2e/3.67 = C x SF = MgSOC x 2 = MgSOM/9.09 Mg/AI/12 = Acre feet
20 year MgCO2e/3.67 = MgSOC x 2 = MgSOM x 1.1 = short tons SOM/10 = Acre inches/12 = Acre feet
1 AF = 325,829 gallons