

REGENERATIVE AGRICULTURE NEEDS ASSESSMENT REPORT AND ACTION PLAN

FOR 2026-2030

UCCE REGENERATIVE AGRICULTURE PROGRAM



Abstract

This report is an internal document to support the development of the UCCE
Regenerative Agriculture Program

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Forward

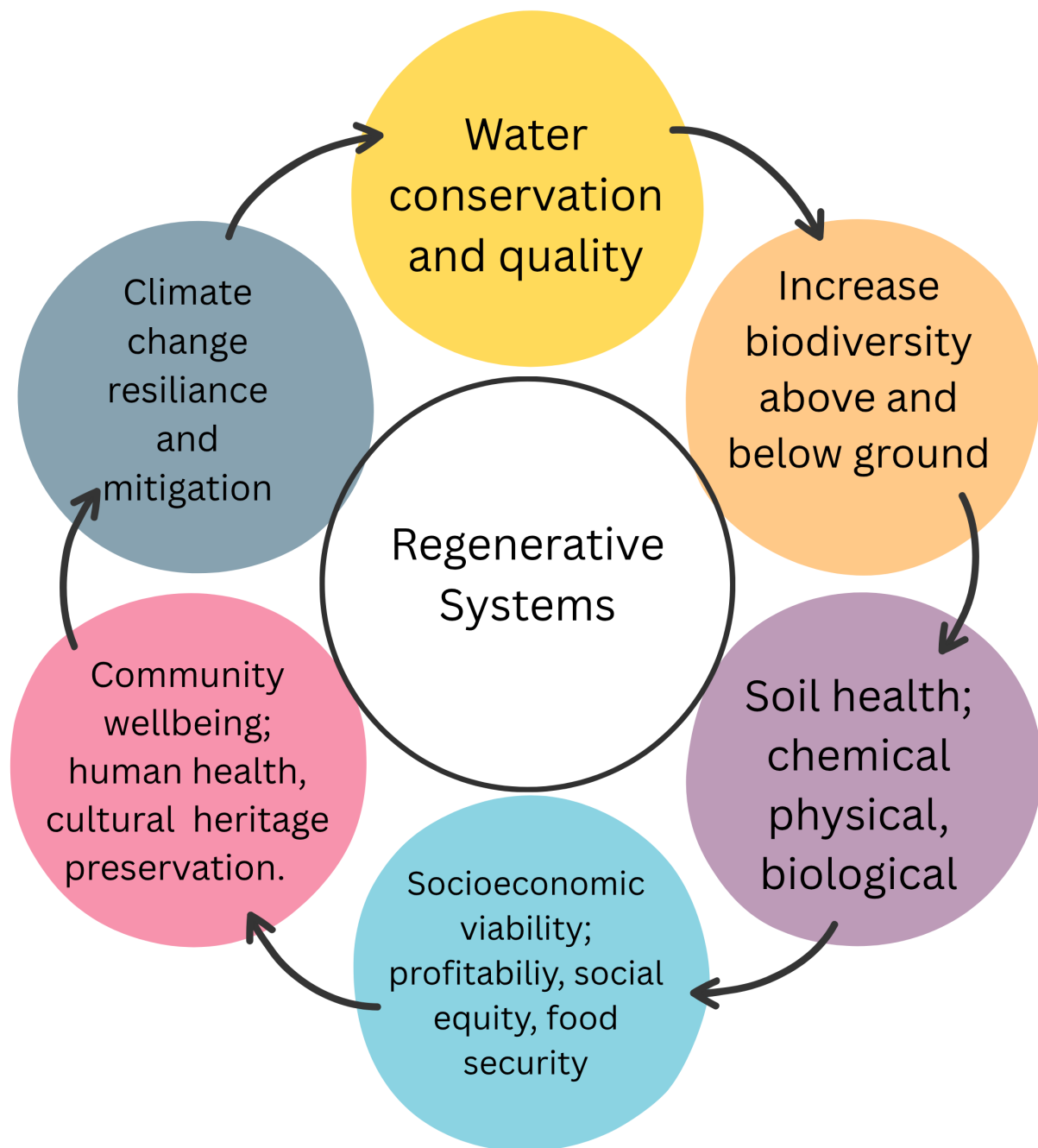
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Defining Regenerative Agriculture

Regenerative Agriculture as a term is currently getting a lot of attention in respect to sustainable solutions to complex problems our societies are facing. However, a clear definition of regenerative agriculture is still up for debate. For this document, we will use the California Department of Food and Agriculture (CDFA) definition, which was developed in 2024 for programmatic purposes. Regenerative agriculture is “an integrated approach to farming and ranching rooted in principles of soil health leading to improved targeted outcomes. This approach is informed by the traditions and innovations from the original Indigenous stewards of the land.” The Definition reflects that “Regenerative agriculture is not an endpoint, but a continuous implementation of practices that over time minimize inputs and environmental impacts and further enhances the ecosystem while maintaining or improving productivity, economic contributions and community benefits” (CDFA, 2024).



Regenerative agriculture follows five basic principles mirrored from ecological theory: Reduced disturbance, optimize photosynthesis and living roots, maximize biodiversity, Support animal integration and wellbeing, and know your context. These principles are used in practice to achieve five interrelated goals: Climate mitigation, soil restoration, biodiversity enhancement, water resource protection, and socio-economic viability, and community wellbeing. Evidence has shown that when promoting nature-based management practices which can be adapted to different cropping systems and environments, agriculture can provide win-win scenarios for agronomic, environmental and economic goals.



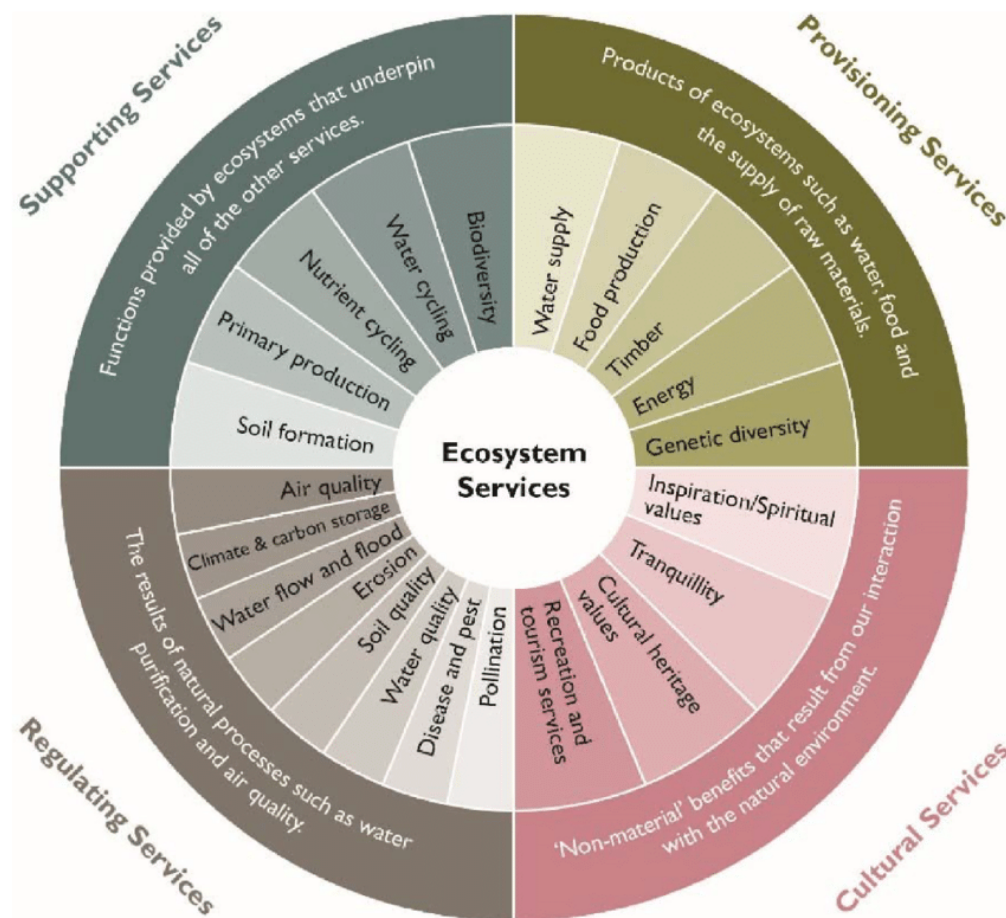
Regenerative system sustainability goals try to manage for a holistic approach to farming which achieves both natural resource conservation and increases capacity for ecosystem services to support agronomic needs. Management practices are chosen for their ability to improving soil health, as it related to chemical, physical and biological properties; increase biodiversity both above ground and below ground, restoring habitat restoration, supporting water quality enhancement as well as water conservation techniques, and increasing the capacity for the farm to be resilient to climate change while also playing a role in mitigating climate greenhouse gas emissions. Furthermore, regenerative agriculture reflects the need to maintain socio-economic viability. Economic benefits can be experienced by cost savings, increased or stable yields, and can extend beyond the market value of agricultural commodities, such as supporting rural economies and creating jobs, providing food security, or diversifying on-farm income. Importantly regenerative agriculture stives to understand economic potential beyond yield and looks at all aspects

of direct and indirect costs and benefits effecting short term and long-term profitability. Finally, regenerative systems are mindful of how they are providing or hindering socio-cultural functions, such as maintaining the social cohesion and capital among communities, offering agritourism, educational activities, preserving cultural heritage, traditions, and traditional food systems, and a sense of regional identity.

Multifunctionality

Multifunctionality is the concept that agriculture can provide multiple services beyond producing food and fiber, including broader environmental functions, as well as contributions to socioeconomic and socio-cultural welfare. Multifunctionality is the lens in which we measure and understand how agricultural systems are achieving the five interrelated goals. Concepts of multifunctionality are key for evaluating regenerative agriculture and measuring outcomes of success that go beyond yield. These frameworks often delineate four categories, Provisioning, Supporting, Regulating, and Cultural services. Provisioning services are understood as products of ecosystems that provide water, food and raw materials. Supporting ecosystem services are services that maintain fundamental ecosystem processes, such as habitat for plants and wildlife. These services underpin all other services such as soil formation, nutrient cycling, water cycling and biodiversity. Regulating services are benefits obtained through moderation or control of ecosystem processes, including regulation of climate, air, or soil quality; carbon sequestration; flood, erosion, or disease control; and pollination, and cultural services are non-material benefits that result from our interaction with the natural environment.

While literature differs in the exact services under each category, these frameworks allow us to decipher different ways to monitor outcomes, changes, and measure resilience at the farm level and landscape level. Furthermore, these assessments can reveal correlations and synergies among different indicators, which can help us finetune strategies to achieve win-win scenarios.



Helmer et al, 2020. Ecosystem service framework, functions provided by ecosystems organized Under each ES category (Supporting, Provisioning, Cultural, Regulating) Functions.

The importance of advancing regenerative farming systems in California

Wicked challenges are encroaching on producers including water scarcity, soil degradation, increased costs of production and a need to comply with state regulations. The state's agricultural sector, a major contributor to the economy, faces significant risks from these issues. According to recent analyses, between 500,000 and 900,000 acres of irrigated farmland in California's Central Valley could be permanently taken out of production due to long-term water scarcity. The state's Sustainable Groundwater Management Act (SGMA) is a major driver of this decline. The California Farm Water Coalition estimates that the ongoing "land retirement" under SGMA could cost the state over \$2.5 billion in lost annual farm revenue and up to 50,000 lost jobs in the Central Valley. A 2025 UC Davis report projected up to 67,000 jobs lost, and 3 million acres of potential fallowing in a "worse future" scenario. For California, aggregate statistics on fertilizer costs show prices soared between 2020 and 2022, and stabilized at higher- than-average levels in 2024. Specific figures on price changes

for nitrogen, phosphorus, and potash illustrate the volatility farmers face for high dependency on external inputs. The American Farm Bureau reported that some fertilizer prices increased by as much as 300% in certain areas. For example, the price of nitrogen- based fertilizer UN 32 tripled in California. At the same time, commodity prices are subject to volatility based on production yields, inventory levels, and global market dynamics.

By advancing regenerative agriculture, California can build resilience, enhance ecosystems, and ensure the long-term viability of its farmlands and farming communities in an equitable and just way.

UCCE Regenerative Agriculture Action Plan

We know regenerative practices are critical for safeguarding communities and building resilient food systems. Yet, adoption of practices considered regenerative remains low across California's complex agroecosystems. Regional climatic, and cultural differences, and the diversity among types of crops and operations across the state, makes transitions towards integrated systems challenging. Successful adoption requires targeted approaches with regional distinctions in mind. Successful transitions, also require involvement from communities of practice in the decision making of action plans at the state and regional level.

University of California's Cooperative Extensions (UCCE) has decades of pioneering research, leadership, development, extension and education within California. UCCE was developed to connect research and education from the universities to communities. Yet historical models of technology and knowledge transfer were dominantly one way. Current models now seek farmers and farming communities at the center of the research and education development phase as well as incorporating their feedback, experiences and knowledge throughout programs. Putting farmers at the center of agricultural research and extension efforts has many benefits. Participatory methods can promote co-learning, knowledge exchange, and the co-development of targeted solutions to overcome challenges identified by communities of practice. At the same time, UCCE has evolved in understanding and moving interdisciplinary research into the field, particularly the intersection between agriculture, natural resource conservation, and healthy communities. The UCCE Regenerative Agriculture Action Plan dispels new knowledge around what the current baseline and understanding of regenerative agriculture is in distinct regions of California, including Northern San Joaquin Valley, and Central Sierra Foothills, and articulates crucial and achievable extension and research goals. This action plan therefore is rooted in a regional context of what works and what knowledge gaps exists, and what resources are needed to support successful transitions.

UCCE recently instated two Regenerative Agriculture advisory roles to develop and implement an extensive and interdisciplinary program to meet these needs. The regional Farm Advisory roles cover services for Mariposa, Merced and Stanislaus Counties. While Specialist role housed at UC Merced, provides statewide support. Program development for these positions requires a comprehensive and rigorous needs assessment to inform the UCCE Regenerative Agriculture Program in achieving the goal of supporting successful adoption and transition to regenerative agriculture systems. To this end the UCCE's first embedded regenerative agriculture program, spent the last two years learning more about what

regenerative farming looks like in these regions, and how farmers understand and perceive regenerative agriculture.

Objectives of the needs assessment include:

- Learn how growers perceive and understand Regenerative Agriculture
- Learn what regenerative agriculture looks like in each region, what regenerative practices are being used by farms, and how they experience benefits
- Determine agronomic, economic and ecological challenges and barriers limiting successful transitions
- Identify opportunities for future research and extension goals for the Regenerative Agriculture program

Methods

Mariposa	8	Interviews
	5	Field/ home visits
SJV	20	Interviews
	5	Field visits
Total	38	

to achieve our objectives, a mixed method approach was implemented including using surveys, semi structured interviews, and focus groups, as well as field visits. Thus far the needs assessment has conducted 28 interviews, 10 field tours, organized four listening sessions and one regenerative agriculture conference at UC Merced. Surveys have also been collected from roughly 50 farmers and over 100 UCCE employees. Qualitative coding software (Nvivo) was used to explore semi structured interviews and uploaded summary notes of focus group responses by analyzing themes and relationships using deductive methods. Interview questions covered topics related to three themes: Perceptions and attitudes, what farming regeneratively looks like in the region, and what challenges exist.

The analysis process was iterative. Interviews were analyzed and preliminary results were shared back to community members at the listening sessions, then discussions were facilitated to gain feedback on current outcomes and expanding on findings. Questions such as what if anything do you feel is missing? How can we successfully support regenerative agriculture transitions? What resources and information are needed? Four listening sessions were held with 12- 50 participants attending. Sessions were held in Merced, Modesto, and Cathey's Valley. One session was aimed at tree nut producers, one was aimed at annual cropping systems, one was for small farms, and one for the Mariposa region specific. A fifth

listening session, not organized by UCCE, was held in Fresno.

For the small farms listening session, the topic of SGMA and water conservation were selected as topics to learn about and discussions arose around what types of water conservation practices were used on small farms, what knowledge and experiences exists about SGMA regulations, and what may be needed to increase knowledge flow of SGMA for small farmers.



Photo: Listening session held at Burroughs Family Farm October 2024. Photo credit Rosie Burroughs

Needs assessment participation

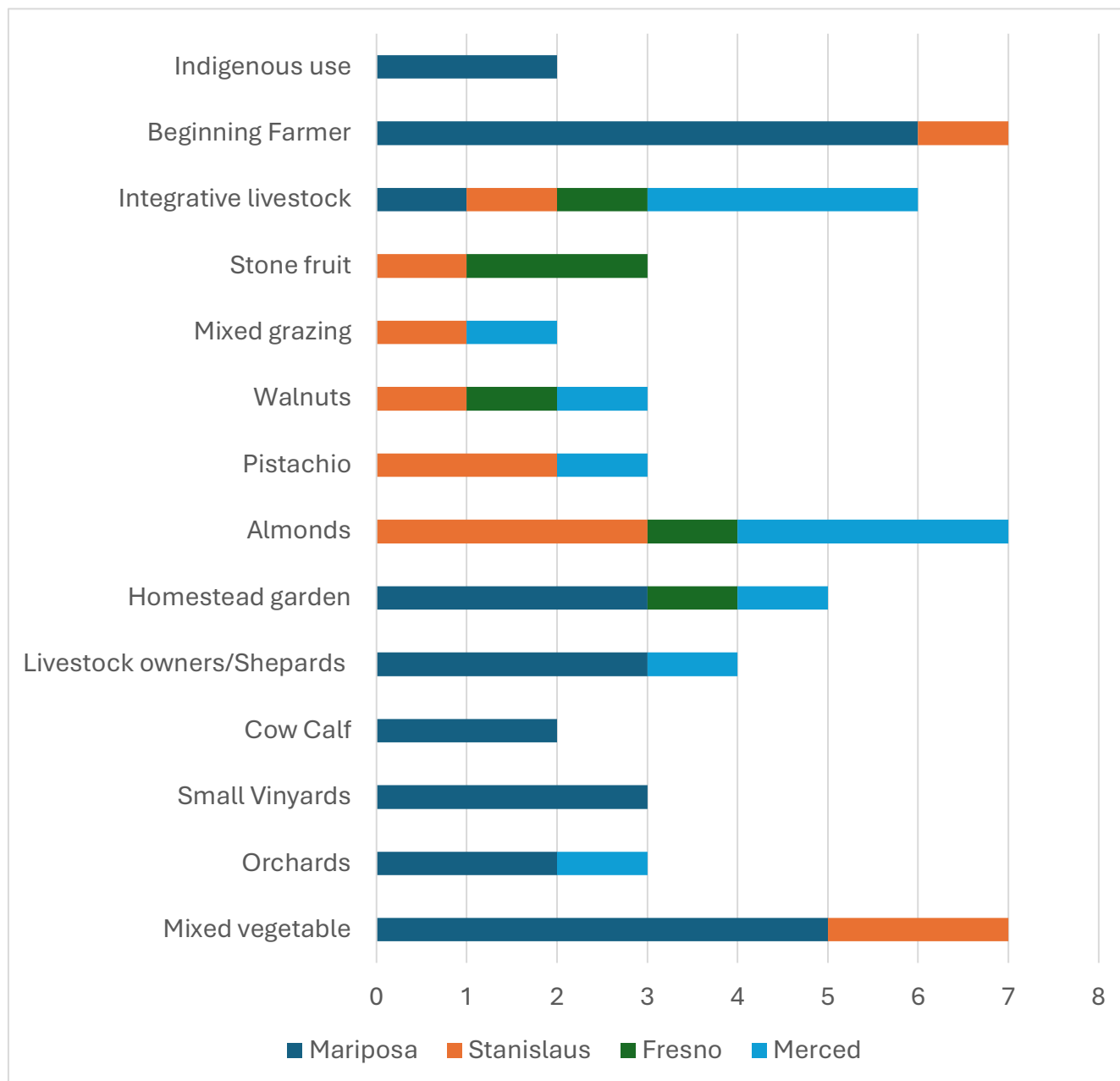


Figure 1: Types of production and land stewardship that interviewers identified with by county. Some producers had more than one type of system then managed.

Of the interviews that took place some farmers had more than one crop or production system type (Figure 1). In Merced and Stanislaus, Interviews tended to focus on tree nut producers and livestock operations, while Mariposa County focused on small scale farms, mixed vegetable crops, and beginning farmers. Fresno had the fewest farmers interviewed.

Practices used in the region

Based on the interviews, organic fertilizers, compost, IPM, volunteer vegetation, cover crops, livestock integration, and use of biologicals were the practices most often used in the farming systems that were using regenerative practices. Other practices that came up in conversation include hedge rows, no till, permaculture design for water conservation, whole orchard recycling, agroforestry and types of rangeland management such as targeted grazing or holistic grazing.

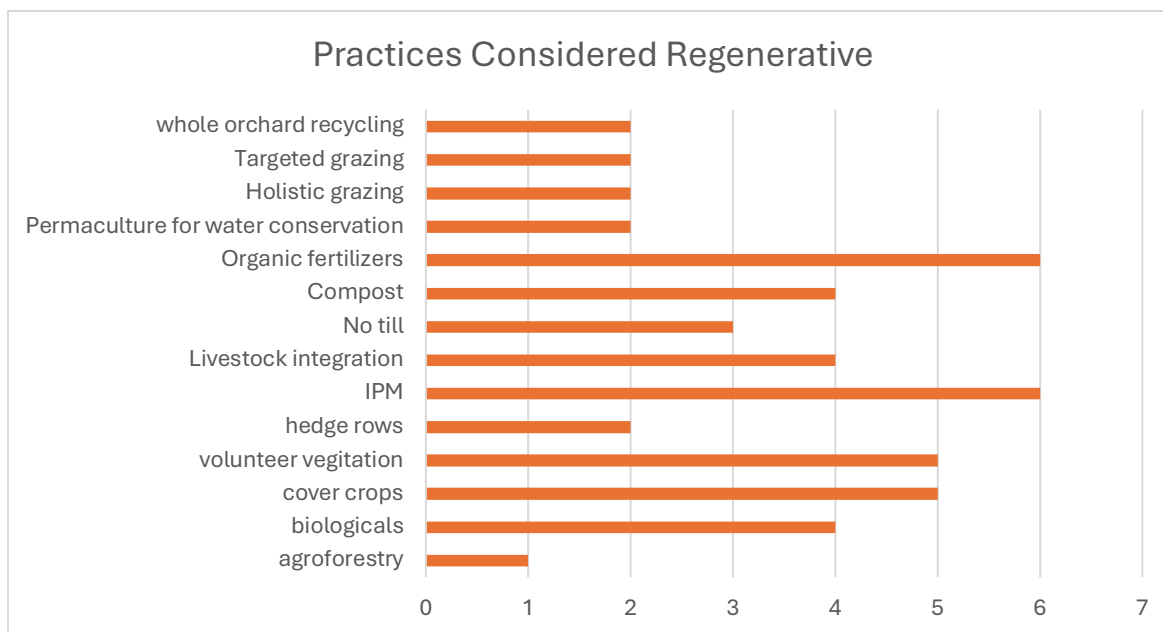


Figure 2: Regenerative Practices growers reported using in interviews. Count is number of growers that mentioned using the practice.

Regional Typology

Regenerative farms, and how growers place themselves on the regenerative spectrum is highly diverse, context and cropping system specific, and motivated by a number of both cultural, marketing, social, and agroeconomic factors. These differences are important to acknowledge because they are factors that enable or disable adoption, and they help us to understand motivations for and perceptions of regenerative practices. Being able to meet growers where they are and work with them to support sustainability goals will improve adoption potential.

San Joaquin Valley



The San Joaquin valley regions (SJV), Merced, Stanislaus, and Fresno are dominated by medium sized farms, over 85% are 300 acres or less. However, the landscape is also dominated by mono-cropped orchard systems. The top crops in the counties are fruit and nut orchards at 465,282 acres and field and forage crops covering 716,330 acres, and the livestock and poultry sector which brought in over \$662,659,000 in 2023. Beyond these less diverse medium sized farms, Merced has a large population of small, diversified farms, that are managed by Hmong and Hispanic communities.

“In my area of Merced, we have a lot of almond trees. We have a lot of row crops from the Hmong small farming communities, and they do a lot of farmers markets. As well as dairies where they're raising mainly corn and silage.”

Fresno county top crops are also fruit and nut orchards with a focus on stone fruit and fresh

fruit production, totaling 773,780 (2023 County Crop Report, USDA ag census). Merced County ranks fifth in the state and sixth nationally in market value of farm products according to the USDA-NASS. Current trends show a lot of orchards are coming out, due to water shortages or orchards surpassing their peak production ages. Fields are either transitioning back into trees or out completely because of markets and water challenges.

“In my area there are a lot of almonds going out because of SGMA, not enough water.”

Mariposa County

Mariposa county is nestled in the Central Sierra Foothills and is made up largely of grasslands, oak woodlands, and mountain environments. Here we have a rising population of beginning farmers, and new rural landowners in the region. Most agricultural products are direct to market. The region struggles with food-insecurity. Many land stewardship practices in the area include indigenous land use, fire and ranching. There is a lot of parceling of property for private landowners which makes land management more challenging at scale. There is a need to balance multiple goals here including habitat, wildlife, landowner goals and agriculture goals, as well as Forest Service, National Park, BLM goals.



“You can own an acre and completely self-sustain your family, doing Market Garden, right? That's the whole premise of, like, high intensity vegetable farming, and there's unlimited need in this community”

Sierra foothill regions fostered mostly ranches and small diversified specialty crop farms that focus on direct to market and support local food systems. Specialty crops grown in Mariposa County are also growing and include organic fruit and vegetables, apple orchards, and flower farms, and vineyards. In recent years, there has been a greater interest in growing new crops and new methods such as Hydroponics and aquaculture techniques. The County's diverse soils and microclimates provide opportunities for increasing the number of specialty crops. These small farms provide opportunities to attract the investors to the County and serve as incubators. Small farms, specialty crops, and working ranches provide opportunities for agritourism. With over three million visitors to Yosemite National Park annually, agritourism can provide benefits that farm through extra income, diversify county economic streams from the park and provide a reason for tourists to stay longer, and provide educational opportunities for the public.

“...I mean, our biggest challenge is our own stupidity. We're new! we're learning as fast as we possibly can, but we make mistakes.”

Perspectives on regenerative agriculture

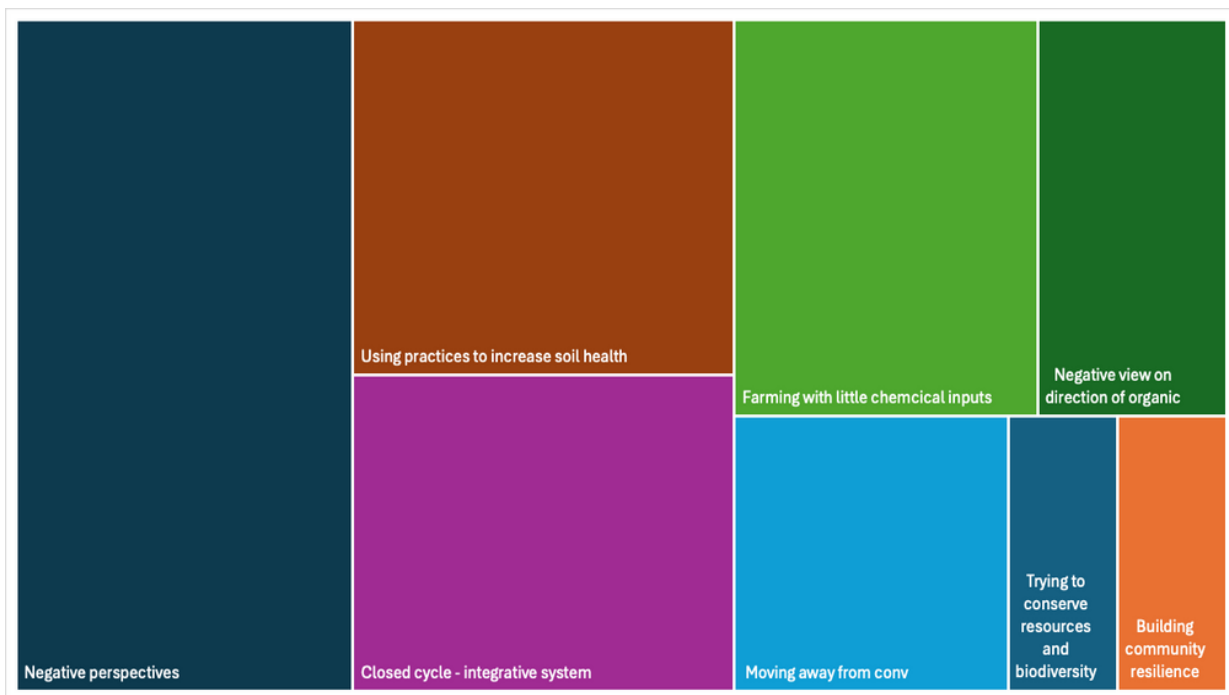


Figure 3: Perspectives of RA. The size of each square is based on the number of references from the interviews coded to each theme.

There is agreement among growers about the goals that regenerative farms are trying to achieve. Most comments described regenerative practices as a “holistic approach to farming” that integrated practice to achieve soil health, water conservation and biodiversity goals. The four major themes that growers brought up in conversation include *using practices that increase soil health, developing a closed cycle approach to farming that is integrative, farming with little chemical inputs, and moving away from conventional methods*. While most growers described RA as more than just soil health, most of the statements shared perspectives that soil health was the central principle for a regenerative system. And that if you could attain soil health then you were achieving regenerative outcomes. “[Soil health] ...It corrects everything. It's true it corrects whatever problem you're having.” But just as many statements connected this sentiment to a broader understanding that a regenerative system replicates nature or mimics an ecological closed system that reduces waste or inputs. Growers agreed that a regenerative system was not just one new practice but an integration of many practices that produced a holistic approach to farming.

“It seems to mean, farming in a way that allows the ecosystem to develop more fully the ecosystem to more and more act like an ecosystem um rather than just being simplified down to a very like a strict manageable level... something like that.”

There were significant distinctions between regions. In the San Joaquin Valley, there were many opinions that regenerative was synonymous with moving away from conventional systems, largely aimed at reducing input dependency of high usage of herbicides, miticides, pesticides and fertilizers. Mariposa County prioritized the goal of helping communities become healthier and likened regenerative farming to “good backyard gardening practices”. This is in alignment with the overall attributes of the region struggling with food insecurity and focused on direct to market farm sales, and small diversified farms.

“I think it's all about community resilience. If you have a community that's supporting you, you can trade produce. You don't have to grow everything you want to eat. You can do one thing and trade with your neighbor for this or that for resources and all that”

Many farmers presented with negative attitudes of the term regenerative, suggesting that it was overall meaningless. They worried about the greenwashing from larger companies, or farms and organizations taking advantage of the term for marketing purposes. Some felt it was just another evolution of the term sustainable or organic. All of them agreed it was a marketing term.

“It's just another buzzword. First, we were organic ...so then we started saying we're sustainable farmers and then everybody started saying they're sustainable farmers, and now we say we're regenerative farmers and it's all the same thing”

There was some contention in the San Joaquin Valley community between growers who aligned regenerative with an organic system and those who felt it was a separate effort. Those who diverged from the organic title felt like regenerative was a movement in reaction to the strict certification processes that organic had evolved into. The sentiment was that organic farms no longer foster the environmental and sustainable goals that it used to. Rather, it and has become

another version of a conventional system that just replaces synthetic inputs with organic certified inputs. Farmers also felt like there was no incentive to move into an organic certification because the organic markets were saturated in their regions and therefore premium prices were no better or finding contracts were limited. Generally, rather than situating themselves as organic or not organic, farmers who were interviewed in the San Joaquin Valley preferred to discuss regenerative as “farming with little chemicals”. This was a key component behind adoption and this mentality allowed for the inclusion of conventional growers to start “coming to the table”.

Benefits experienced by growers

All growers interviewed considered themselves regenerative to a degree. But some had been practicing much longer than others. Most farmers interviewed had been integrating practices for 3 years or less. Those that have been practicing for over five years started farming this way rather than transitioning the farm from a conventional or input heavy system. Growers defined several outcomes they were experiencing under three main categories, ecological, economic and agronomic. Water retention and soil health were the two biggest benefits that growers mentioned under ecological benefits. There was an emphasis throughout the interviews on how soil has been improving in its water holding abilities as well as its infiltration ability. All farmers that are implementing principles for soil health had a comparison story about their fields and the fields next door and how their fields were more resilient to heavy rains and flooding events.



Figure 4: Benefits growers experience with RA practices.

“I saw increased water holding capacity. The year of all those rains really, really did a number on our pasture at the time because we were also subleasing out to a man who had cattle and he did not adhere to the amount of cattle I told him was allowed on property. He didn't rotational graze. So like half of our pasture was just sitting water during all that those storms”

Pest management was a dominant benefit for small, diversified farms in the foothills as they discussed their focus on habitat and biodiversity. However, for the orchards, their discussions around pest management were focused on the limited need for chemical inputs to control mites and fungus, and they associated this with their tree crops associating a better natural defense system through fine tuning the crops nutritional needs. Biological inputs such as foliar applications and increasing soil biology were two ways that they were achieving this. These two dichotomies were relevant among the ways in which regenerative agriculture was implemented and talked about.

The two economic benefits experienced included cost savings, and social impact on community health and food access.

“And we are using half as much chemistry as other people. Fertilizers I am using is sparingly and effectively

Categorizing regenerative systems

While regenerative is often understood as a spectrum, where growers are continuously improving towards a full integrated system redesign, interviews revealed a slightly different paradigm. While there were degrees of integration, which ranged from being fully integrated and organic, to a lesser integrated more conventional system, growers were not internally understanding their systems on a progressive scale.

Conventional Regenerative

The largest group that was interviewed would fall on the conventional regenerative space, where they identify themselves as regenerative, but still use the conventional toolbox, such as synthetic nutrient inputs pesticides, and herbicides. This group has a motivation to integrate practices such as maintaining soil coverage, integrating cover crops or volunteer grasses, integrating livestock, integrating IPM practices and integrating biological sprays. The hybrid approach and use of these practices have reduced their dependencies on inputs greatly. Though they still use them sparingly in their management system when needed. In this same group, many growers had more than one crop they managed, and how and when they integrated practices depended on the cropping system, and year. Sometimes growers took breaks from planting cover crops. Or if they could not terminate the cover crop in time for harvest or planting, they would not use this practice with this crop. Similarly, food safety issues was a major hindrance for integrating livestock in certain

crops.

Organic, Regenerative, or Organic Regenerative

Generally, when regenerative farms are advertised, they are the face of farms that identify under these highly integrated levels. Fewer farms interview was under this category. These farms were often practicing organic protocols, and often certified either as organic, regenerative, or a hybrid of regenerative and organic. Though these farms are in the minority- the distinguish themselves by integrating most of the commonly used practices considered regenerative.

The fully integrated perception that focuses heavily on biodiversity tended to focus beyond the crop itself and the growers were also concerned about building habitat using hedge rows or managing wildland or wildlife corridors, to some degree. These growers seemed to value external ecosystem services directly. While those who were still transitioning or considering themselves conventional still took a crop centric approach and focused on applications that could target building crop health. Both groups acknowledged the need to support soil health, microbial function, and water conservation, and encouraged high levels of biology on the farm.

Regional Distinctions

There were certainly regional distinctions for how communities both identified themselves as regenerative and what the farming looks like. In the foothills most farms that identified as regenerative to some degrees were small diversified market gardens. There were also interests in exploring regenerative practices from an agrotourism standpoint.

Regenerative ranching was not as prevalent in interviews, but these systems also exist separately from the spectrum and may have their own spectrum. Majority of practices for these land management operations centered around grazing practices, with a concentration on density and duration of grazing to regenerate grasslands, as well as land conservation incorporation to reintroduce habitat, restore riparian zones, and increase silvopasture.

A related branch is also fire mitigation through targeted grazing. Which is becoming a popular option in the foothills both with cattle and goats. In the foothills, there is a lot of "unused farmland" one farmer stated:

"There's a lot of previously cultivated farmland that was orchard or ranching, and then it turned residential... and we just keep meeting community members who know they live on former ag land want to do something about it, but don't know what to do."

Beyond the small, parceled land, home gardeners and market gardens, most of the range land is used for cow calf operations, or there's some stocker operations.

In the Fresno regions growers were described as trying to transition through multiple avenues and innovative ways. There are many medium to small farms that are involved in the network developing in the region trying new practices considered regenerative. For example,

"a blueberry patch next door doesn't spray anything, but they are not organic. Another farmer

nearby is trying to make their own fertilizer, with organic walnuts. Pistachio grower running sheep in his pistachios. Most growers felt that the initial motivation was financial. One neighbor here has nothing to do with regenerative. He's just like I'm not putting inputs anymore, I'm just going to put water in and that's it. So, um the joke on my podcast is being accidentally regenerative."

Motivations for Becoming Regenerative

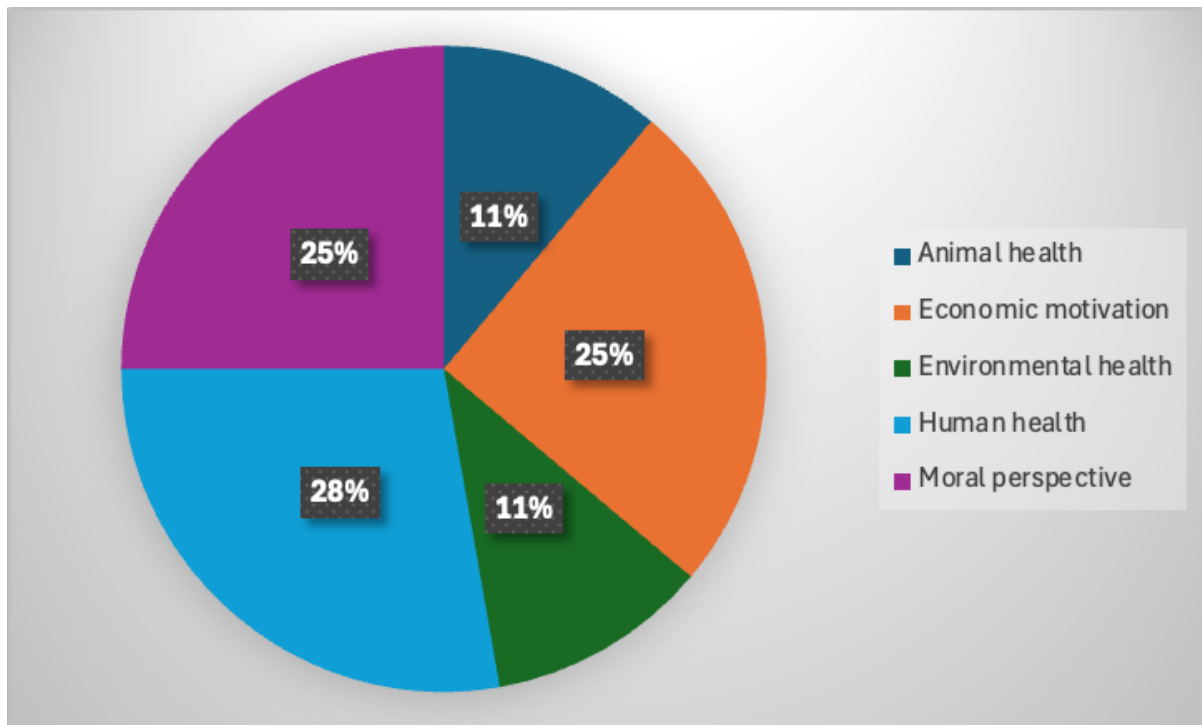


Figure 5: Motivations for adopting regenerative practices. Percentages based on number of growers.

Understanding what motivates farmers to adopt practices is important for how we may start to communicate benefits and how we may start to target our research focus. Farmers fell under 5 main categories for what motivated them to use regenerative practices in their farms. Two major motivations stood out for the conventional regenerative group, 1) the value of human health and wanting to maintain a healthy work environment for their workers, and consumers, 2) adapting principles for water and nutrient management when it made sense for the cropping system. Farmers are choosing to integrate practices often when it makes sense for the crop management needs, this includes harvest time, labor demand, certain requirements like frost needs,

and marketability.

“For me it has a lot to do with the fact that almost all my friends have an autistic kid. I almost feel embarrassed that our kids are not. I could name of 15 closest friends 8 of them have autistic kids.”

“My dad was spraying all this crap when I was younger, and I had to spray it too. You have this consideration that this isn’t good. You have systems in place where, you’re buying everything from a chemical company, you have a system in place you are fighting a system and having a life revelation that you are doing something wrong. It's easier to keep doing something wrong than to acknowledge it and change. My friend’s dad died of cancer at 69 but we don’t connect it to that.”

“Whether you believe it's inherently better for the soil, inherently better for animals, or for human health, or higher nutrition product side of things, the motivation to change cannot be purely economic.”

Barriers to adoption SJV

The barriers for adoption fell into seven major categories for SJV. This includes transitioning barriers, or agronomic tradeoffs, which was the largest topic that came up, followed by economic barriers, challenges with incentive programs, challenges with integrating livestock, barriers due to SGMA regulations, marketing barriers, and land ownership barriers (mostly for small farms). Below, percentages are reflecting the number of references coded to each theme.

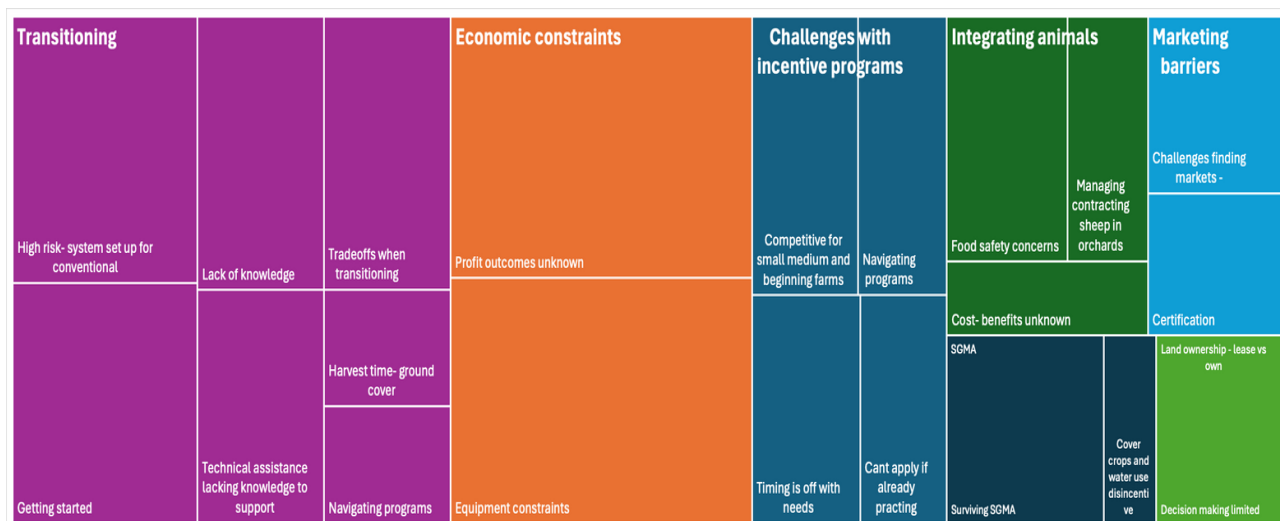


Figure 6: Barriers to adoption for successful integration of regenerative practices in SJV. The size of each square is based on the number of references from the interviews coded to each theme.

- 1) **Agronomic Transitioning Challenges 38%:** Conversations included high risk to change the system. Growers continually discussed that their farm systems were set up for a conventional model such as the spraying regimes, the equipment used for harvest, and irrigation design. Adapting new practices came with what was described as “domino effects” of tradeoffs. This was compounded by limited guidance, lack of knowledge and inability to get started or know where to start. Some examples of these challenges included irrigation damage due to an increase in rodent pressure, a lack of proper equipment to manage biomass from ground cover growth, increased fungal pressure, or needing to adapt new nutrient management regimes. Growers are still struggling to know when to terminate cover crops and how based on the different cropping systems. Multiple farmers had decided that maintaining volunteer vegetation growth rather than cover crop growth due to the management ease.

- **Transitioning irrigation needs-** “Those weeds will grow up above the irrigation lines, and you won't get good cover with the water.”
- **Nutrient management challenges -** “Okay It's hard to correlate less fertilizer. I feel like I do a lot of soil and tissue analysis, but I'm always putting on something because I'm trying to try to have the soil do as much work as it can for me but I'm always deficient in Nitrogen or potash.”

- **Tradeoffs with cover crops - “Yeah, I had massive gopher problems with the cover crops, so I'm realizing I can't do that again.”**
- **“The reason I don’t use cover crops is because of the frost issue-a few years back we had a cover crop go to seed, and it returned the next year/ and it was the year we had a lot of rain. We mowed it for crop protection, and we got smoked by frost. I put them in baby trees, but then we had gopher city in the cherries.”**

2) Economic constraints 26%: There is a lot of hesitation to invest in management changes due to limited understanding on when profitability would be realized. This data gap continues to limit farmers ability to transition and take risk. Current low returns of crops, high debt, and high costs of labor and equipment limit farmers' ability to take the chance to adopt new strategies as well. Some technology and equipment that are needed to transition to new practices include different harvest equipment, moving irrigation off the ground, mowing equipment, and equipment to help move biomass around and different spraying options for biological input applications”.

- **Low crop prices, farms are still struggling with debt- “There's a lot of debt and prices are low”**
- **Needing to invest in new machinery is difficult- “New equipment has just gone through the roof; we don't have that kind of money”**
- **Unknown cost benefits- “When can I expect returns? It’s too risky”**

- Challenges working with technical advisors and navigating incentive programs 17%:
Challenges with incentive programs continue to arise in conversations. While incentive programs have helped, there were a lot of comments regarding how the execution and program structures are difficult to navigate. Some comments included a need to increase competitiveness for small and medium scale farmers, support in navigating programs, timing of those programs not linking up with grower needs, and an inability to apply if they already have implemented some practices. Discussion about the lack of knowledge PCAs and CCAs have regarding RA systems also arose as a barrier because they are key advisory roles for growers. Educating PCAs and CCAs on regenerative management is also needed. Related to

this, there are many challenges growers have when working directly with the UC system. There is contention with researchers due to historic power dynamics, and a lack of inviting growers to the table when discussing research questions or outcomes. While growers were interested in furthering research in the field, they felt like they wanted to be given a voice in the direction of that research, and program development. There was also a big concern for how our incentive programs were providing support. Growers described sentiments that programs tend to home in on conventional farms who have never done these practices before, trying to get scale rather than support successful adoption on a farm that is on the journey of regenerative integration and needs to build their capacity. In general, there is a lack of programmatic funding for continuous support- the lack of follow through limits successful adoption in the long term.

“Then navigate all these programs, and these programs take twelve months to apply, and you're like; I need this next week.”

- 3) Integrative livestock challenges 11%: The SJV offers an agroecological landscape that can support integrative livestock due to the large amount of orchard crops and livestock. Furthermore, there is an interest from orchard producers in integrative livestock, however the concerns with food safety, management and unknown economic benefits, remain the leading barriers for coupling livestock and crops in the region. At the same time limited research has focused on the impacts of ICL on livestock wellness and contract grazing economic considerations.

- **Food safety barriers- “We have chickens at our house, I brought the chickens out and cherries fell, and it was the best day of the chicken’s life, chickens and cherries. In a perfect world I would have 500 chickens, and I would run them out there after harvest, they would eat all the cherries. But if I told the marketer, packer or retailer that we have chickens, it’s not a fanciful story of closing the loop for nature, it’s a huge food risk.”**

- **Not seeing fertilizer or labor reduction benefits early on. -“I’m not seeing any fertilizer benefit with the sheep yet, and I still end up coming in and mowing after they graze.”**

4) Marketing limitations 8%: Finally, and not surprisingly, respondent are interested in certifications and transitioning to regenerative but feel that there is little market incentive for wholesale and this remains a barrier. Surprisingly this was not a topic of conversation that came up often. Weather because it is expected and already known as an issue, or because it wasn't a priority concern for farmers is unknown.

Barriers to adoption for Mariposa County

Mariposa county presented with different challenges then SJV, which points to requiring a different programmatic focus to support regenerative food systems and land management system transitions. Percentages presented below are based on the number of references coded to each theme

- 1) Beginning farmer and land-owner challenges - 42%: There is an influx of beginning farmers and second career farmers, as well as new landowners in the region. Beginning farmers tended to be in positions where they want to venture into regenerative farming and start a farm from scratch but had financial limitations and knowledge limitations. Knowledge barriers include there being a steep learning curve for beginning farms and overall lack of understanding about what regenerative farming is. complimenting this is the knowledge required for new landowners. Many new landowners from the bay area or other parts of California are moving to the region. This comes with limited knowledge or how to manage lands for fire prevention, and stewards' wildlife habitat or grazing lands. Other small farms, particularly vineyards are going out of business or changing land ownership structures. Being situated in the Sierra Foothills and mountain regions means major limitations related to marketing as well. Many growers focus on local farmers markets and CSA models. However, there is a concern if more farmers move into the area, these markets will be saturated. Due to the small farming matrix, there are financial start up imitations for beginning farmers in the region as well.

“It's hard to do something if you've never seen it done before or you don't have anybody to talk to it about and

you're like You know. It would have been a lot nicer when I switched over to No Till to have somebody else, I could have talked to instead of just reading a book or watching it on YouTube or something."

Regional markets are limited. Well, we don't have the scale to do a regional market. We don't have enough produce. Yeah, it's uh, It's a tough business. That's, you know, that's why Fouch Farms doesn't do veggies anymore. Like, when I started Fouch Farms, we did everything. Like, everything. We had broilers, we had goats, we had pigs, we had beef, we had eggs.

- 2) Access to resources - 19%: Input access is a challenged due to the isolation factor in the region. Farmers are expected to drive to the valley if they need to purchase fertilizers, soil amendments like gypsum or lime, or irrigation supplies. Compost is difficult to access due to the transportation fee to travel up the mountain. This is a concern with cover crop seed as well. The transportation cost for delivery is high, and sourcing for small parcels of land is also difficult. Finally, labor is limited in the region. Finding local full time farm managers or part time labor is a challenge for most farms in the region.

Compost brings it out here or there as needed. And they charge like the transportation fee and then the hourly fee and a diesel price. So it ends up being, you know, then that adds it quick, especially if you're on fixed income or doing anything commercially. Just your little homestead, your land that you're managing. Right.

- 3) Socioeconomics - 17%: Food insecurity and isolation are two challenged the region broadly faces and is a motivation for increasing local food systems. There is a lack of capitalizing on social assets in the region, despite the community being close knit, sentiments were that groups did not talk to each other as much as they would like. Economic challenges include financial limitations, ranches and vineyards going out of business or selling land, and some livestock owners complained about increased feed prices during years when fodder was scarce.

So yeah, so that was like the little bit of market research, as you did for her grant, really revealed the food insecurity issue. And then Mariposa County, HSA put out a very similar findings when they did their own internal study that, well, not internally, a study that they published to the Board of Supervisors HSA Health and Human Services. So, yes, so they, they published that, I think, earlier this year or late last year, and is a very similar, you know, insecurity, food insecurity, is a challenge.

- 4) Indigenous food systems under recognized - 14%

There is a large indigenous presence in the region, and their land stewardship is not recognized as a part of agriculture resource paradigm. The Southern Sierra Miwolk, furthermore, is not federally recognized

- 1) Limited technical support - 8%. Due to the size and isolation of the region, and historical focus on rangeland and livestock, there is limited technical support in the area. Farm advisors limited. Inter cooperation among organizations is also limited.

Future research and extension needs in SJV:

The integration of the interviews and the focus groups resolved four major themes required for SJV extension program development. Importantly, a number of these efforts are currently under development. But the outcomes help to reinforce that these efforts align with community needs.:

1) Increase Knowledge and Resources

- a. Participants at the focus groups discussed the need for developing an information hub for RA, whether that was a physical location or a better network and online resources that can be accessed for regional information, resources and networking needs. Come together and create a resource hub for growers looking for tech/grant support.
- b. Roadmap/Blueprint - Stakeholders discussed a roadmap that would be helpful, for how to transition and start to integrate practices considered regenerative, particularly for year 1 transition. There were comments that these needed to be separated by cropping system and frameworks for small vs large scale, as well as for post-harvest management. These decision support tools could support cleaner and more successful transitions. A clearer understanding of the expected agronomic benefits and the expected tradeoffs and management changes needed such as when to terminate cover crops, how to manage berms, how to and by how much to reduce fertilizer usage, what to expect for returns.
- c. While a roadmap was discussed to support farmers interested in transitioning, the idea of a prescriptive approach is not ideal and may cause more failures if adaptive management training is not also prioritized. IPM and integrative nutrient management trainings are crucial for growers to learn adaptive management principles and practices. Providing adaptive management courses would be useful to move away

from this prescriptive approach. This includes ecological literacy, soil health training, and integrative nutrient management and integrative pest management.

- d. More information on certification options was requested by some growers. They were interested in what the steps are to comply with FISMA/SGMA as well. Related to this was the complete lack of understanding about SGMA requirements, particularly by small, underrepresented farms.
- e. Equipment share programs were a big topic of interest. But, for both small and medium sized farms.

2) Increase Social Capital

- a. Social networking among these growers is grower across the entire San Joaquin Valley and needs to be invested in to build social capital. For increasing social capital, farmers consistently spoke of wanting to develop a regenerative agriculture mentorship program. Though there are organic mentorship programs through the Organic Agriculture Institute and CCOF, none exist for those who do not want to transition to organic and want to maintain the conventional toolbox.
- b. Growers also mentioned an interested in increase on-farm experiments and field demonstrations to show real-world results which support grower-to-grower learning opportunities. Related to this was the interest in sharing stories that reflect the regenerative journey and can create clarity in practices and encourage the practice.

“I think seeing how the other farmer did it and actually seeing it work on a day-to-day level in person in real time , I think changed everything. And I think that's where your position and your advisors can offer the most support for farmers by, setting up those demonstrations.”

- c. There is a need to increase coordination efforts between stakeholders. Growers are overwhelmed and frustrated with the number of stakeholders and all the different programs being offered. Increasing the coordination and collaboration among all of us would be beneficial for assuring program impacts and limiting competition and redundancy. Other issues that were dominating the conversation included supporting building better relationships between researchers, extension, and other technical advisors

“It was nice to have that invite and space to talk and feel like we could run things as farmers and not have a PhD or whatever.”

- d. Related to improving relationships between growers and other stakeholders was a need to increase the capacity to communicate with growers. Rather than expressing the benefits of certain practices or principles as benefits for the environment, home in on the practices that can be solutions to their specific agronomic challenges. “We should be working with growers to include sustainable practices as solutions to growers’ agronomic challenges instead of focusing on just the environmental benefit.” And usually these go hand in hand. But how we communicate them could be more deliberate for the agronomic side. For example, most programs focus on carbon outcomes. But the majority of growers in SJV are extremely concerned with water and high input resources. Looking at how to articulate benefits in the form of water credits or nutrient saving credits would be helpful.

3) Reduce Risk.

- a. Though the term free to fail trials did not strictly come up, the frustration with the high economic risk of transitioning conventional systems to hybrid approaches was a main topic. Providing a space for farmers to freely experiment, and innovate, to learn how management needs to change when implementing new practices or combinations of practices would alleviate this risk barrier.

- b. On top of this, information on economics of regenerative systems, long term, short term, and further information on understanding what the timeframe is for growers to experience profits would look like is greatly needed.
- c. Farmers are utilizing the incentive programs such as NRCS programs, HSP, RCD, and research students. These are helpful but may not be reaching everyone equitably still.

SJV research:

Based on a synthesis of interview results along with outcomes of the focus group discussions, five areas were illuminated for future research focuses.

- 1) **Further research on economic considerations of regenerative systems** such as flexible cost- benefit analysis and long-term modeling is needed. Understanding implementation costs of practices, and how direct and indirect benefits affect profitability over time will help growers understand risk better. Analyzing probability of achieving profits would be helpful as well. Targeting where profits and savings can be capitalized will also help growers identify ways to maximize profits with these systems.
- 2) **Quantifying system benefits and tradeoffs** and better understanding them at a regional level is still needed. Much of this work is currently happening with a large focus on almonds through UC Davis but expanding multifunctionality assessments which target farms within selected regions and for other tree crops such as pistachios, stone fruit, and annual systems is needed. More research on how different cover crops affect residue management would help growers with vegetation management. Similarly looking at organic versus conventional systems as well as homing in are scenarios such as cover cropping mixtures versus volunteer grasses. Similarly understanding implications of grazing on tree health, soil health but also on animal health is still needed, to maximize benefits across livestock and crop production. What are the expected thresholds for carbon accrual, water infiltration, and diversification?

3) **Further research on nutrient dynamics for regenerative farms is needed.**

Transitioning farms need more data on what the nutrient dynamic changes look like over time. This includes how to measure the reduction needs in synthetic fertilizers when pursuing an organic nutrient management and synthetic nutrient management hybrid approach. At the same time, growers who express the benefits of reduced inputs can provide mentorship and provide farmer - farmer evidence of the expected chemistry reduction, which may help encourage broader adoption.

4) **Livestock integration research.** There is a major interest in livestock integration in the region with an opportunity to capitalize on the large orchard cropping and livestock operations in the regions. Further research on integration Feasibility based on crop/animal, the timing requirements for selected crops to align with management, nutrient, and food safety needs, assessment on Animal health and food safety, and fine-tuning practices to assess density and duration of grazing on different cover crop mixtures or foraging mixtures is necessary.

5) In the SJV, we are at a turning point where orchards are coming out, new orchards are going in, and growers are unsure when they should be planting based on SGMA and climatic changes, as well as other economic considerations. **There is an opportunity to investigate possible options for transitioning orchards.** Providing evidence on orchard recycling scenarios such as orchard recycling + manure, compost, and/or biochar. investigate orchard recycling and rotation options for growers further. Before growers invest in re planting orchards back-to-back, we should provide a basket of options on how different crop rotations and land management considerations could support broader environmental and agronomic goals, and how they may fit into MLRP programs. Fallow options with cover crops as well as years into annual crops or forage crops before retuning back to orchard systems. Integrating orchard rotation options that may support wildlife habitat, increase soil fertility and soil health outcomes, reduce water requirements, and provide economic options for growers should also be investigated in

relation with MLRP programs and SGMA policy, and CARB.

- 6) **Further efficacy tests on Biologicals is needed.** There was popularity among growers for using biologicals as ways to support micronutrient health through foliar and fertigation applications. Many of these products have limited on farm data to show mechanisms for how they work or efficacy of if they work at all. This booming industry is becoming popular in the regenerative farming arena and needs attention.
- 7) **Water dynamics with RA systems** was a big topic in the SJV region that kept coming up. Conducting more research on over all water budgets with RA systems and understanding which management practices are driving these outcomes. At the same time a lot of research currently exists but are siloed. Mechanisms to bring research together and explore outcomes through a metanalysis and extend findings (preliminary and completed) to grower communities and other stakeholders is greatly needed. Finding ways to incorporate this information into GSA SGMA is crucial for providing credits, and advising on management protocol from a water savings perspective. There is concern and misinformation over how cover crops affect water use in regenerative agriculture. Research suggests 30% less water is used but there is still need for water budget research. Cover crops are important for soil health but concerns over management is still active. More research needs to be done on the right species for land and how to best manage the left-over plant material. An additional incentive to transition to regenerative agriculture is the consumer demand for nutrient-dense food. More data is needed to back up claims about regenerative agriculture foods being more nutritious. Conduct more research on water usage, focusing on what management practices drives less water use.
- 8) **More research on how RA systems affect nutrient density** outcomes and what this means for consumers is a big data gap. Collect data on nutrient levels in food grown using regenerative practices and tie the finding to consumer education and demand-building efforts.

Mariposa extension needs

- 1) Beginning farmer and land manager trainings.
- 2) The focus groups highlighted a want to engage in more field days and farmer events- for example there is a farm tour each fall that should be reignited and other types of education networking activities for both farmers and the public would help build community networking increase knowledge of the local agriculture scene and develop farmer to farmer educational activities.
- 3) Current cover crop variety trials/demos on farms are taking place but more on farm trials would be useful to be used as demonstrations.
- 4) The focus group also identified a need to lift up agrotourism industry. Of particular interest is efforts to revitalize the small winery industry that has dissipated over the years.
- 5) Other areas of interest that the community has raised are implementing community composting programs, as well as community seed saving programs for cover crop species.
- 6) The master gardeners have several programs that are aimed at supporting food insecurity and back yard gardening which could be a foundation to build off of for increasing reach and scale.

Mariposa research needs:

- 1) Legacy effect of no till market gardening on Sierra foothill soils can provide insight into potential carbon accrual by depth and how different management may affect these outcomes, along with co benefits like infiltration, soil moisture, and soil biodiversity
- 2) Understanding the effect of prescribed fire durations on soil health is a big black box. Collaborating with prescribed fire program at ucanr can provides a number for sites to assess this area. Furthermore, the interaction between grazing and prescribed fire is unknown, as well as how these management options effect plant diversity changes. Looking into success rated of reseeding natives is also needed.
- 3) Providing a toolbox for landowners for how top maintain fire preparedness and mitigate fire risk while also maximizing habitat restoration and food production goals is needed in the foothills.