

Advancing Strategic Land Repurposing and Groundwater Sustainability in California

A guide for developing regional
strategies to create multiple benefits



Finding the ways that work

This report was developed by Environmental Defense Fund with support from Environmental Incentives and New Current Water and Land. We thank all workshop participants for their valuable contributions.

One of the world's leading international nonprofit organizations, **Environmental Defense Fund** creates transformational solutions to the most serious environmental problems. To do so, EDF links science, economics, law and innovative private-sector partnerships. With more than 2.5 million members and offices in the United States, China, Mexico, Indonesia and the European Union, EDF's scientists, economists, attorneys and policy experts are working in 28 countries to turn our solutions into action.

© March 2021 Environmental Defense Fund

Cover photo courtesy of the California Department of Water Resources.

Contents

Introduction	4
Workshop Series.....	6
Considerations for Designing a Land Repurposing Strategy	7
WHY consider developing a land repurposing strategy?	7
WHAT should be included in a land repurposing strategy?	8
HOW can a land repurposing strategy be developed and funded?.....	10
1) <i>Setting the Context</i>	10
2) <i>Defining Funding Sources & Incentives</i>	10
3) <i>Connecting Funding Sources with Willing Landowners</i>	14
WHO should be involved in the development and implementation of a land repurposing strategy?	16
WHERE should lands be prioritized for repurposing to achieve the greatest impact?.....	20
WHEN is the right time to develop a land repurposing strategy?	21
Getting Started: A Roadmap for Program Developers	23
1. Create the Vision.....	23
2. Conduct Stakeholder Outreach	24
3. Design the Repurposing Strategy.....	25
4. Fund the Program	26
5. Implement & Track Benefits	27
Conclusion	28
Appendix A. Tools & Resources	29
Appendix B. Case Studies	32
Appendix C. Funding Opportunities	37
Financial Incentives to Support Land Repurposing in California.....	37
Summary of Key Findings	38
<i>Existing Funding Programs</i>	39
<i>Emerging Markets</i>	43
Finance Analysis Citations	46
Appendix D. Workshop Series Overview	48
Participant List	50

Introduction

For decades, California has been on a steady trajectory toward water scarcity, which is now exacerbated by climate change. More frequent and intense droughts and increased demands have affected the reliability of surface water supplies. As a result, many have looked to groundwater to fill the gap. Groundwater overpumping has resulted in adverse impacts such as reduction in groundwater storage, subsidence, water quality degradation, sea water intrusion, wells going dry and depletion of interconnected surface waters throughout many areas in California's San Joaquin Valley. These impacts led to the passage of the Sustainable Groundwater Management Act (SGMA) by the state Legislature in 2014, which mandates sustainable use of groundwater by 2040 for the most critically overdrafted basins.

Sustainable use of groundwater will require, in many regions of the state, shifting from irrigated cropland to less water-intensive agriculture or taking land out of production. It is estimated that at least 500,000 to over 1 million acres, primarily in the San Joaquin Valley, may need to be taken out of production over the next several decades as local agencies and water managers take action to meet the sustainability mandate of SGMA¹ and deal with increased water scarcity overall.

The San Joaquin Valley has reached a fork in the road. On one path, the valley could become a haphazard patchwork of barren, dusty lands and fields covered with invasive weeds and pests, further impairing already poor air quality and putting many farmworkers out of work. On another path, the valley can transform into a region with a thriving agricultural economy, sustainable groundwater supplies and vibrant wildlife habitat, outdoor recreation and jobs, and healthy air and soil.

What is the Sustainable Groundwater Management Act?

The Sustainable Groundwater Management Act provides a framework for long-term sustainable groundwater management in California. Local and regional authorities in medium- and high-priority groundwater basins formed groundwater sustainability agencies (GSAs) that oversee local groundwater sustainability plans (GSPs).

The California Department of Water Resources has developed regulations for the content of GSPs. Critically-overdrafted basins have already submitted GSPs. For basins that are not critically overdrafting groundwater, stakeholders have until 2022 to develop, prepare, and begin to implement of GSPs. GSAs will have until 2040 and 2042 to achieve groundwater sustainability.

¹ Public Policy Institute of California, (2019). Water and the Future of the San Joaquin Valley. Technical Report. DOI: 10.13140/RG.2.2.24360.83208

It is possible to achieve this second vision by strategically repurposing previously irrigated land to create new uses and value. While land repurposing is not a new concept, in many cases, previous changes in land use addressed singular objectives rather than evaluating multibenefit opportunities, thus limiting the ability to minimize economic impacts of the land transition and overlooking inequities.

This white paper defines “land repurposing” as any activity that is undertaken by a public or private entity that converts previously irrigated agricultural land to new uses that both 1) reduce groundwater demand or use, and 2) provide some other measurable benefits to the environment or broader San Joaquin Valley community. Land repurposing can:

- Provide a number of different benefits, such as reducing water use, improving air quality, creating habitat corridors and recreational spaces and generating new sources of revenue and local jobs.
- Work in combination with ongoing productive agriculture.
- Encompass economic, environmental and/or societal benefits.

The goal of this white paper is to provide practical and creative approaches to support the development of regionally coordinated land repurposing strategies, including incentive-based voluntary programs that prioritize the health and resilience of communities and landscapes in the San Joaquin Valley. Achieving coordinated land repurposing in a manner consistent with SGMA’s long term sustainability goals will require 1) securing adequate local, regional and state funding that allows for increased flexibility in SGMA implementation; and 2) ensuring equitable solutions are in place for impacted landowners and communities.

This white paper is intended primarily for groundwater sustainability agencies (GSAs), water agencies, local governments and land use planners, collectively referred to as “program developers,” who are most likely to face the issue of land conversion as SGMA is implemented, and who may be considering whether to pursue a land repurposing program. This white paper can also provide helpful guidance to landowners evaluating their options for land and water management in the face of increased water scarcity, as well as other stakeholders, such as state and federal policy makers considering new funding for land repurposing, and local community advocates interested in maximizing land repurposing benefits for community members.

Specifically, this white paper provides considerations and a defined path forward for regional resilient water and land-use planning through:

- Policy and other program design considerations (*Considerations for Designing a Land Repurposing Strategy*).
- Process steps for developing a new program (*Getting Started*).
- Tools and resources to help lay the groundwork for a successful multibenefit land repurposing program (*Appendix A*).
- Case studies that provide insights and helpful examples from similar programs (*Appendix B*).
- A finance analysis summarizing current and potential future funding options for multibenefit repurposing (*Appendix C*).

Together, this information can help program developers interested in land repurposing begin to explore a strategy in their region.

Workshop Series

Between September 2020 and February 2021, Environmental Defense Fund (EDF), with support from Environmental Incentives (EI) and New Current Water and Land, LLC (NCWL), conducted a four-part workshop series to explore how locally-driven strategies can achieve beneficial outcomes through land repurposing that support thriving economies, ecosystems and communities. Workshops were attended by representatives from key sectors interested in water management and land use alternatives. Specifically, participants included growers and farming interests, GSA leads, landuse planners, conservation organizations, environmental justice groups and more (see Appendix D for a detailed description of workshops and a full participant list). This workshop series created an open forum to discuss creative, big-picture and practical approaches to regionally coordinated land repurposing that give water managers and users flexibility and produce equitable solutions for impacted landowners and communities. This white paper aims to synthesize key insights, themes, and recommendations gleaned from the workshop series.

Considerations for Designing a Land Repurposing Strategy

The following recommendations and best practices can help guide the development of new land repurposing programs, and are informed by extensive input collected during the workshop series. This section raises important “*Why, What, How, Where, Who and When*” questions to help guide the development of future land repurposing programs.

WHY consider developing a land repurposing strategy?

The development of any local or regional land repurposing strategy should begin with the question of “*why?*” – Why is a land repurposing strategy desired for this particular region, and what do program developers hope to achieve through this approach? Why should stakeholders engage in this process?

Most land repurposing strategies should begin by considering groundwater supply and demand reduction objectives, since the need for repurposing will often be driven by SGMA implementation and the mandate to bring groundwater basins back into balance. Clearly defining demand reduction objectives can help stakeholders better understand the economic and agronomic limitations and opportunities that may, over time, give rise to long-term changes in land use, cropping choices and water management options. Once demand reduction objectives are understood, then additional values and opportunities can be scoped and put into context. It can be challenging for stakeholders, particularly growers, to weigh in on a relatively abstract concept like land repurposing without understanding the current context, alternative pathways, and defined implications for land management in their particular region.

"For decades California land use planners and water managers have operated independently of one another, resulting in unsustainable and inequitable development practices. SGMA provides a nudge in the right direction, requiring some coordination (albeit minimal) between GSPs and general plans. If even a fraction of the land transition projected for the San Joaquin Valley occurs, it will be imperative that GSAs, land use agencies, landowners and community advocates coordinate efforts to ensure this transition is socially equitable, environmentally responsible, and economically sustainable. Otherwise, we risk losing the San Joaquin Valley altogether."

Danielle Dolan, Local Government Commission

Once the need to rebalance groundwater is established, a wide number and variety of environmental and community benefits can be gained from a land repurposing strategy, such as:

- **Creating valuable community assets**, such as high-quality habitat, water recharge and recreation areas.

- **Avoiding undesirable results in high-vulnerability areas**, such as subsidence near infrastructure and lowering groundwater levels near shallow domestic wells.
- **Avoiding and minimizing threats** associated with land fallowing, such as erosion, pest infestations, and inundation of weeds.
- **Becoming more competitive for supplemental external funding**, like state and federal grants, habitat mitigation payments and solar development.
- **Creating new opportunities for historically underserved communities and small growers** who are likely to be the most impacted under SGMA.

WHAT should be included in a land repurposing strategy?

There is a diverse array of land repurposing options that can produce groundwater savings while also providing water and land conservation and/or other benefits. Practices supported under a land repurposing strategy may include switching irrigated crops to rangeland or dryland farming, providing valuable habitat for at-risk species, developing solar infrastructure, installing groundwater recharge basins and more. Any practice incorporated into a land repurposing strategy needs to reduce groundwater demand. When considering types of repurposing options, local community priorities and regional context need to be taken into account. Program developers should ask what types of alternative values would be the most beneficial for their community, including historically underrepresented community members and small farmers. Community residents are the best experts on local conditions impacting their communities and potential unintended consequences of land use decisions. Therefore, agencies should seek direct input from residents on what kinds of land uses would be most beneficial for their communities when forming ideas about how to develop a land repurposing program. See Table 1 for a list of potential land repurposing actions and associated funding sources.



John Greening

TABLE 1

Menu of funding options to include in a land repurposing strategy

Action	Description	Potential Funding Sources
Habitat restoration or stewardship	Restoring or enhancing native habitats can provide crucial benefits for at-risk species and ecosystems.	Conservation easements, Mitigation Credit Agreements (MCAs), nonprofit land trusts, and state and federal grant programs
Restoring floodplains	Floodplains, e.g., areas inundated with flows 1-2 weeks most years, offer multiple benefits, including groundwater recharge and wildlife habitat.	Nonprofits (e.g., Ducks Unlimited), state and federal grant programs
Creating wildlife-friendly recharge areas	Groundwater recharge areas that double as habitat for wildlife can qualify for a more diverse array of funding opportunities and provide multiple benefits. Recharge areas should have minimal hardscaping to maximize recharge.	Floodplain managed aquifer recharge programs (Flood-MAR), Water Storage Investment Program (WSIP)
Plant cover crops, native vegetation or hedgerows ¹	Providing native habitat for pollinators like bees can increase fruit set in almond orchards, build populations of natural predators of common crop pests and improve soil health. Cover crops should be incorporated in a way to avoid increasing consumptive water demands, likely by replacing portions of formerly irrigated crops.	Natural Resource Conservation Service (NRCS) grants, California Department of Food & Agriculture (CDFA) Healthy Soils Initiative
Solar leases or other renewable energy development	Renewable energy infrastructure could provide lease payments for a fixed amount of time but does require new infrastructure and may be inaccessible to smaller growers.	Utilities, energy companies
Water conservation and trading programs	Water trading programs could become viable options for specific regions, but require establishing trading infrastructure, inclusive decision-making and governance structures and robust protections to prevent impacts on communities and ecosystems. To be considered as a "land repurposing" action, water savings would need to be paired with other conservation and community values. ²	Private participants, state and local agencies
Unirrigated or low water use agriculture and agricultural management practices	Converting to dryland farming, less water-intensive crops or unirrigated rangeland can produce water savings and improve water supply certainty for growers.	No supplemental funding needed although there could be potential grant funding from CDF or NRCS for related practices
Creating open space, public access, parks or other community recreation areas	Providing accessible open spaces or recreational areas, such as city or county parks, with dry-scaping or low-water use landscaping reduces water demand and increases community benefits.	Local and state agencies, land trusts
New technology or equipment	Similar to water markets, funding for new technology can help growers maximize and prioritize available water supplies on priority lands while supporting the transition to new land uses on less viable lands but would have to be paired with other benefits either directly or indirectly somewhere within the same basin to be considered a land repurposing strategy.	Grants for water use efficiency technology
Non-sprawl sustainable urban development	Prioritizing healthy, strategically planned urban development that supports sustainable community growth, while minimizing the loss of high-quality farmland (e.g., maximizing densities of new development, implementing conservation easements on agricultural land, providing housing and services for the agricultural workforce, etc.).	Conservation easements, state and federal grant programs, Williamson Act provisions, HUD Sustainable Communities Regional Planning Grants

¹While the potential increase in evapotranspiration from planting irrigated cover crops can be a concern in groundwater-limited areas, recent research has found no differences in soil moisture and only minimal losses from evapotranspiration when comparing commercial agricultural production with fields that use cover crops and native vegetation. Visit www.edf.org/ecosystems/treenut for more information.

²For example, the Imperial Valley Water Conservation Program paid landowners for conserving water on poor quality land.

While many resources already exist for supporting beneficial land repurposing (see Appendix C for more information), current funding sources are simply not sufficient to ensure that reduced groundwater use will lead to grower and community benefits more broadly. New incentive programs are needed across the San Joaquin Valley to ensure that landowners have a full suite of options, and that repurposing is implemented strategically (see “How” section below).

“As SGMA reduces water availability, growers face difficult choices about what to do with the land that no longer has enough water for farming. Programs that facilitate other economic uses for retired farmland and provide resources to help manage the land will reduce the economic burden of this transition on agricultural communities.”

Emmy Cattani, Landowner,
Cattani Farming

Lastly, land repurposing does not need to be an all-or-nothing approach. Instead, land repurposing strategies should seek to create a mosaic of different values across the groundwater basin. Importantly, this also applies to individual farms, where a grower may choose to repurpose certain fields while continuing agricultural production on others.

HOW can a land repurposing strategy be developed and funded?

The core of any land repurposing strategy involves 1) setting the context of water demand reduction targets, 2) defining the funding source(s) and incentives to create various beneficial outcomes, and then 3) connecting that funding or resource with willing landowners.

1) Setting the Context

A critical step in creating a land repurposing strategy is building the political will to support the program and, conversely, to overcome negative perceptions and opposition to land conversion as a concept. Any successful land repurposing program will require strong, local champions as well as a broad-base of support in the community. This can only be accomplished through deliberate and strategic outreach. See the “Who” section for more recommendations related to stakeholder outreach.

To set the stage, GSAs can acknowledge and consider land repurposing as one critical component of sustainability. This will set the right context around groundwater balance objectives and a range of options for adaptation, as described in the “Why” section.

2) Defining Funding Sources & Incentives

Ideally, land repurposing programs will create new economic values, more flexibility, and greater certainty for landowners while also preserving agricultural ways of life and an ongoing

tax base for the region. Incentives for growers can come in the form of either direct or indirect assistance, or compensation from one or a combination of **1) existing funding sources, 2) new funding sources and 3) non-monetary incentives.**

It is important for program developers, conservation interests, and other proponents of alternative use projects to remember that as they are defining funding sources for landowner payments, they must not neglect the resources (time and financial) needed to scope, design and implement the land repurposing program itself, apart from the cost of landowner contracts. Incentive payments should also be considered from the perspective of the individual landowner. Any incentive payments would need to be sufficient to encourage participation in the program, which requires evaluating other options available to the landowner. This requires thinking about values that landowners receive from current land uses, how that value changes in the future as SGMA is implemented and other GSP programs being developed in which a landowner may participate. Payment schedules, when considered from the landowner perspective, may be shorter than traditional payment structures.

"In terms of 'land repurposing,' there is not some magic formula separate from water. Rather, figuring out how much water each basin has is the magic formula that will sort out the economics of how and where land repurposing may make sense."

Justin Fredrickson,
California Farm Bureau
Federation

Program developers should start by **leveraging existing funding** and private investment in the target region. This could include:

- State and federal grant funding programs.
- GSA fees or grower-generated revenue with direct benefit to other growers.
- Resource Conservation District (RCD) grant programs.
- Local community foundations, land trusts, community-based organizations or non-governmental organizations with pass-through funding.
- Unencumbered, or accessible, local funding that does not require extensive paperwork or financial backing.
- Private investors (e.g., solar development).

While existing funding sources are a natural place to start, these resources may have barriers that prevent landowners from participating (otherwise, more would have already enrolled). Program developers can work to lower these barriers. Where funding application processes are lengthy and complicated, local agencies and other partners can work with funders to centralize

and streamline grant application processes, and potentially even administer and distribute grants themselves. It is often best if multiple, complementary funding programs can be combined to maximize impact. Program developers, in partnership with GSAs and other local agencies, can also advocate for more flexibility in state and federal funding programs in terms of practices, length of funding commitments and more. For example:

- Where *mitigation projects* typically require permanent conservation easements and significant upfront investment, local partners can explore shorter-term mitigation options (e.g., mitigation credit agreements through a Regional Conservation Investment Strategy) or established funding sources to cover the upfront costs of restoration work and enrollment.
- Where *grant programs* often lack clear regulatory protections for participating landowners or their neighbors, local agencies and partners can work with regulatory agencies to create regional, programmatic regulatory assurances (e.g., Safe Harbor Agreements). For grants with local match requirements, GSAs or other entities may be able to pool available funding into a local program that can fulfill state and federal funding programs' match requirements for multiple interested growers.
- Where NRCS-Environmental Quality Incentives Program (EQIP) practices are misaligned with local needs or have challenging prerequisites, local partners can work with NRCS and partnering RCD offices to highlight relevant EQIP practices for their community and pool match funding.

One of the major challenges of relying on existing funding programs is that they often do not provide a stable, long-term funding source on which local agencies and landowners can rely. At the same time, obtaining high-quality, coordinated land repurposing will take both time to design and funding to sustain implementation over years in order to achieve real impact. Program developers may want to consider using existing, shorter-term funding programs as a bridge to creating new funding measures that are more stable and long-term. While there is an administrative cost to applying for and administering the grants, this type of funding can provide the resources needed for “proof of concept” approaches and scoping pilot projects that can help to justify new local funding measures.

As mentioned previously, **new local, state and/or federal funding sources** will be needed to fully support multibenefit land repurposing strategies across the San Joaquin Valley; existing funding programs simply do not meet the magnitude of need. To best support strategic land repurposing, new funding should:

- **Support multibenefit outcomes**, considering the need to move beyond groundwater demand management and considering additional values such as wildlife habitat and healthy soils.
- Create an amount of **funding sufficient to motivate landowner participation**, particularly when considering a range of possible alternatives.
- Be **accessible to growers in highly impacted regions**, and avoid high transaction costs and match requirements.
- Have **clear, stable requirements** that can be coordinated through a local partner.
- Include **meaningful community engagement** to scope and deliver funding, especially in regions where there may be high socioeconomic impacts of SGMA implementation.
- **Encourage large and consolidated projects** that can be coordinated across multiple properties.
- Be **compatible with existing regulations**, including for food safety.
- **Explore opportunities for private investment**, while maintaining an inclusive and transparent process.
- To the extent possible, provide **continuous, stable, long-term funding** over years.

New Funding Source: Assembly Bill 252

In January 2021, Assemblymembers Robert Rivas (D-Hollister), chair of the Assembly Agriculture Committee and vice-chair of the California Latino Legislative Caucus, and Rudy Salas (D-Bakersfield) introduced a bill, [AB 252](#), to help farmers and rural communities adapt to more sustainable groundwater use while simultaneously creating new benefits for people and wildlife.

AB 252, sponsored by EDF, will help create opportunities on previously irrigated agricultural land and ease the transition to sustainable groundwater management. It will create a new program through the California Department of Conservation to provide incentive payments to landowners who voluntarily and strategically repurpose at least some portion of their agricultural land to other less water-intensive uses for at least 10 years. If passed, AB 252 would provide a critical new funding source for land repurposing programs in the near future.

When possible, any new or existing funding sources should also be paired with **other non-monetary incentives** for growers, particularly those that GSAs or other local partners are well-positioned to provide. Non-monetary incentives could include providing technical assistance and reducing access barriers by shouldering the administrative costs of directing

state and federal funding to landowners. This could include reducing the paperwork requirements for applying for funding and reporting on outcomes, or having an established entity to manage the paperwork. It could also involve serving as a liaison between growers and funding and regulatory agencies. Other non-monetary incentives could include providing groundwater credits, long-term allocation assurances or streamlining permits.

3) Connecting Funding Sources with Willing Landowners

Local program developers should work to ensure that land repurposing strategies and program requirements will create the right opportunities and values for growers and local communities, such that repurposing is an incentive rather than a disincentive. Program developers can also help to ensure broad participation by building trust and transparency through effective stakeholder outreach and engagement, developing policies that work for small farmers and rural communities, and increasing accessibility to community members for whom English is a second language (see “Who” Section for more information on outreach).

Land repurposing programs must also include regionally specific considerations. This includes working within groundwater rules and other local regulations to ensure landowners can participate. Specifically, repurposing options need to work in the context of available water supply and allocations, and connect funding levels to water supply value. Williamson Act² protections, where local governments enter into contracts with private landowners to keep specific parcels of land in agricultural or a related open space use, and in return, landowners receive property tax assessments that are lower than full market value, should be retained, if possible. Compatible land use rules on Williamson Act contracted lands can be complicated and locally specific. Program developers should consult with the California Department of Conservation to understand compatibility with identified land repurposing strategies.

Landowners need to understand how they can realize value or avoid negative impacts if they participate in land repurposing. One way to communicate value is to establish what a “do-nothing” scenario looks like economically so that landowners, and especially growers, can determine whether the proposed incentives are right for them as they consider recouping any potential financial losses.

To engage growers, land repurposing programs need to create the right incentives for participation, considering the profitability of different land uses, revenue potential, upfront capital requirements and more. To the greatest extent possible, land repurposing programs

² *Williamson Act Program*. CA Department of Conservation. Available at <https://www.conservation.ca.gov/dlrp/wa>

should retain local control and grower decision-making authority. This can be achieved by building flexibility into the program (e.g., providing both long- and short-term contract options). Consider if the proposed land management alternatives can fit within a grower's business, resources and skill sets. If not, consider how partners can have a role in implementation (e.g., by providing technical assistance or grouped management across multiple properties).

One way to increase flexibility for growers both upfront and over time is to incorporate both short- and long-term opportunities into the land repurposing strategy. Short-term options (e.g., five- and ten-year contracts) could include providing habitat enhancement through a mitigation credit agreement as mitigation for short-term impacts, rotational fallowing, seasonal cover crop planting or short-term grant funding agreements. Permanent options include conservation easements with endowment funding or recreational areas. However, program developers should recognize that there is more conservation value in longer-term or permanent options, even if the flexibility associated with shorter-term agreements may be more attractive to landowners. Program developers could consider a "floating permanency" approach, where there is a regional commitment to a set amount of long-term conservation outcomes, but the individual properties providing those values could rotate over time (see textbox below).

Case Study: Walking Wetlands Program

The [Walking Wetlands Program](#) in the Tule Lake and Lower Klamath National Wildlife Refuges was developed to meet the unique dual mandate for maintaining a coexistence of wetland wildlife habitat and commercial agriculture within the refuges. The program restored experimental wetlands on former agricultural fields for the benefit of waterbirds using specific water management regimes. Although representing only 4% of Refuge wetlands, these experimental wetlands were found to support up to 30-90% of some waterbird species. Importantly, after several years in wetland status, these fields were returned to the farming program, thus allowing local growers the opportunity to determine whether wetlands in rotation with agricultural crops would be beneficial to their operations.

Although initially skeptical, farmers reported that wetlands suppressed populations of soil pathogens to crops, enhanced soil fertility and tilth, reduced farming inputs, and boosted the quantity and quality of yields. In participating in the "Walking Wetlands" program, growers have found that following wetland cycles of one to four years, no soil fumigation is required, thereby, saving up to \$200/acre and yields of some crops increased 25%. The program has also now attracted the interest of private growers adjacent to the refuge.

Learn more at <https://www.fws.gov/refuge/tulelake/walkingwetlands.html>

WHO should be involved in the development and implementation of a land repurposing strategy?

While SGMA implementation and reducing groundwater consumption are the responsibility of GSAs, undertaking the development of a comprehensive land repurposing strategy is likely too big of a job for any one agency to take on alone. To be successful, it will require coordination among key stakeholders, existing grant programs and multiple agencies, particularly those with land authority such as cities, counties, Local Agency Formation Commissions and other key stakeholder groups. These local agencies can lower barriers to accessing funding by compiling information on available options, some of which growers may not be currently aware of. Program developers should also consider the role that existing institutions, like RCDs and land trusts, can play in providing technical assistance to landowners to facilitate land repurposing projects.

“Residents that we work with in the San Joaquin Valley experience the worst air quality and drinking water issues in the valley, and have been advocating for years to address those issues. Now that we are rethinking how to use our land and water resources in a sustainable way, we must look to residents’ expertise to help shape land repurposing programs in a way that prioritizes the health and safety of all communities. Residents are already part of the conversation, and have exciting ideas about buffer zones, green spaces, and more.”

Amanda Monaco, Leadership Counsel for Justice and Accountability

Although multiple organizations will likely need to be involved, land repurposing opportunities can often best be coordinated through a GSA or other local land use agency. Every program will need a trusted organization as a champion to guide it. The lead organization(s) should seek direct input from residents throughout the planning process and implementation, though participation should be voluntary. Land repurposing strategies should be co-developed with both potential participants and those who may also be affected – particularly low-income rural community residents, small farmers and farmers of color. Program developers should recognize that the considerations of participation for a small family-owned farm may be very different than a larger corporate farm. While large corporate farms will likely have greater capacity to engage in the process, they should not gain an outsized influence in the outcomes. Incentive options should be included for small growers who lease the land they farm, and program developers should consider the potential socioeconomic impacts of land repurposing options to farming operations of different sizes.

Resource Spotlight: Guiding Principles for Equitable Engagement in Coordinated Planning

Recognizing the pressing need to include historically underrepresented voices (often predominantly Black, Brown and Indigenous communities of color) in local planning efforts, Local Government Commission developed the following seven principles to guide equitable collaborative planning.

1. Acknowledge and re-evaluate previous histories of inequitable decision-making.
2. Require all planning processes, projects and/or grantees to develop a plan for building authentic community relationships.
3. Increase and promote accessibility to public meetings, whether online or in person.
4. Foster two-way communication and reciprocity with your community.
5. Focus on building relationships with local organizations or informal groups that are already engaging with marginalized communities.
6. Coordinate with partner agencies and across internal departments to leverage resources, staff and data to address engagement fatigue.
7. Governments must be responsive to the interconnectedness of community concerns.

This work was supported by Smart Growth California through the Community Foundation Water Initiative. For more information, visit: <https://www.lgc.org/resource/water-and-land-use/>

While effective community engagement can sometimes be challenging due to language, geographic, technological and other barriers, it is critical to gather input and build trust in the planning process. Broad, ongoing community engagement is essential to ensure programs can effectively achieve regional goals and avoid potential disproportionate impacts to already overburdened communities. Historic and ongoing exclusion of immigrant, Black, Indigenous, and communities of color from planning processes and land and water use decision-making poses a significant barrier to the development of equitable programs. Land repurposing planning efforts should actively work to include marginalized and underrepresented groups in any land-use planning and decision-making processes. Inclusive planning can help the region move forward and shape landscapes that can be supportive of all people that live in the San Joaquin Valley. See Appendix A for a list of guidance materials on effective engagement.

The values and tradeoffs of the alternative land uses needs to be clearly articulated and understood by all stakeholders. Thoughtful outreach and education will be necessary to reduce potential resistance and increase local decision-makers' understanding of the potential values of land repurposing strategies. Landowners and local land use agencies need information on the anticipated values, options and time commitments as they relate to future land use decisions, including intergenerational land use decisions. They also will benefit from guidance on what options and funding are currently available for repurposing, and what each option could deliver in terms of revenue.

As additional values beyond reducing groundwater demand are built into a land repurposing strategy, it is important to consider who is responsible for funding and stewarding these new values. For example, farmers converting some of their irrigated agriculture to habitat areas may not want or be able to take on the responsibility for managing those habitat features over the long term. Grouped management or stewardship partners (e.g., land trusts) can play a role in ensuring these areas are maintained effectively over time, thereby reducing barriers to participation for growers. Additionally, GSAs may be able to fund groundwater demand reduction through assessments or other revenue sources, but additional conservation or other values may be better suited to receive financial support from other public and private funders (e.g., state or federal agencies, investors, etc.). See Table 2 below for additional considerations around potential roles for different stakeholders in a multibenefit land repurposing strategy.



Alloy Photography

TABLE 2

Potential Stakeholder Roles in Promoting Land Repurposing Benefits

Stakeholders	Roles
Groundwater Sustainability Agencies (GSAs)	<ul style="list-style-type: none"> • Ensuring compliance with SGMA • Defining allocation budgets • Administering grants and coordinating financial opportunities • Collecting fees for implementation • Paying directly for groundwater reductions • Providing water trading guidance (at a GSA-level) • Avoiding undesirable results • Providing regulatory support for landowner project proponents
State, Federal, & Tribal Agencies	<ul style="list-style-type: none"> • Aligning existing funding programs • Coordinating data collection • Enabling permit streamlining for restoration projects • Funding land repurposing benefits (grants, loans, etc.) • Educating and outreach • Providing technical support • Providing standardized rules on well-designed water trading programs and land repurposing guidance • Developing safe harbor agreements or similar regulatory assurances
Resource Conservation Districts, Land Trusts, NGOs, IRWMs, Tribal-led Organizations	<ul style="list-style-type: none"> • Providing implementation and technical support • Supporting education and outreach • Advocating for permit streamlining and effective, enabling land repurposing policy • Supporting on-farm water use efficiency • Providing project lists, stakeholder outreach lists, tribal and historically underserved communities' needs assessments
Cities, Counties, Local Agency Formation Commissions & Metropolitan Planning Organizations	<ul style="list-style-type: none"> • Ensuring repurposing strategies work with Williamson Act provisions • Providing education and outreach • Providing permitting incentives (waiving fees for projects that promote recharge/habitat) • Coordinating with GSAs regarding opportunities • Providing local water conservation incentives, aligning with existing structures
Landowners, Growers & Community Members	<ul style="list-style-type: none"> • Providing community input in policy decisions • Implementing land repurposing strategies • Providing lessons learned and best practices for implementation strategies
Private Investors	<ul style="list-style-type: none"> • Ensuring community values are considered in investments • Providing guidance from industry associations • Developing on-farm water use efficiency technology • Purchasing mitigation credits from multibenefit working lands, including encouraging advanced payments for ecosystem services • Supporting recreation and other community values (e.g., hunting) • Paying for solar leases or other renewable energy infrastructure

WHERE should lands be prioritized for repurposing to achieve the greatest impact?

Incentives that are suitable for a particular land repurposing strategy will vary among landowners. Factors such as physical land suitability (e.g., proximity to other conserved acreage, soil type and productivity), current operations (e.g., crop types, property rights), water supply certainty (e.g., availability, cost) and ability to support groundwater recharge (e.g., soil, location, water sources) will all influence landowner willingness and interest in participating in different repurposing opportunities. Therefore, developing a range of setting-specific approaches to land repurposing may help to increase incentives for landowner participation in a variety of contexts.

Program developers may want to build in incentives for consolidating land repurposing projects across multiple parcels or at a district or basin level in order to create larger, more impactful projects. It will be important to drive incentives towards those areas with the greatest potential benefits, and geographic information system (GIS) analyses can help with that. While it is important to avoid targeting specific lands for particular purposes, GIS analyses can be used to visualize different geospatial features and resources in relation to different goals, priorities, and potential scenarios to guide development of different potential land and water management strategies.

One approach that program developers may want to consider is creating tiered incentive structures to encourage land repurposing in regional “**opportunity zones**” or “**benefit zones**” that can serve as a means of both mitigating undesirable results in local high-risk areas as well as maximizing alternative benefits (e.g., recharge areas or “Habitat Hubs”³). These could resemble established management areas created by GSAs for monitoring or management of specific undesirable results under SGMA. GSAs could start by identifying areas for groundwater demand reduction and recharge potential that best meet the strategic goals outlined in their GSP. Next, program developers could prioritize areas to avoid the undesirable impacts of groundwater overdraft (e.g., subsidence hot spots, at-risk wells) to help meet SGMA sustainable management criteria. Lastly, program developers could find opportunities to match problem areas with land repurposing actions that achieve multiple benefits. This could include identifying prime farmland areas that should be protected or prioritized for future production, prioritizing opportunities that serve or directly benefit vulnerable populations and identifying the areas best suited for land repurposing.

³ The Nature Conservancy (2020). Roadmap to Restoration. Policy Brief. Available at <https://www.scienceforconservation.org/products/roadmap-to-restoration>

Determining where to prioritize lands for repurposing can be one of the most important and potentially challenging components of defining a strategy. Program developers may consider creating a set of defined criteria to assess land use potential for prioritized conservation and community values. Repurposing should occur where the highest societal and environmental values can best be realized (e.g., achieving water balance or maximizing recharge potential).

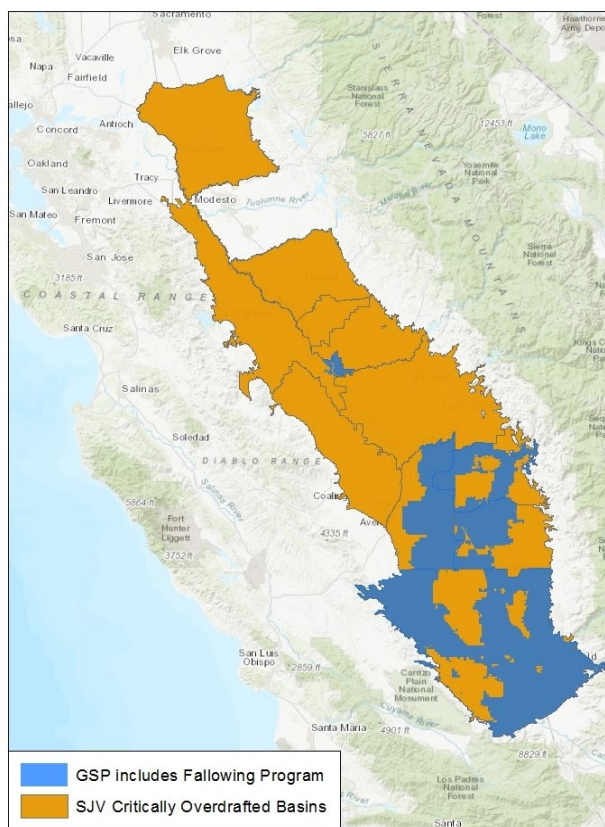
WHEN is the right time to develop a land repurposing strategy?

While SGMA implementation is still getting underway (GSPs were due 1/31/2020 for critically overdrafted subbasins), it is timely to begin considering the role of land repurposing to achieve groundwater demand reduction and other values. Of the 30+ workshop participants (representing growers, GSAs, counties, land use planning agencies, and community and conservation representatives), nearly all indicated that this is a topic that they already think about frequently. All participants observed this becoming a more pressing issue for them in the next several years, if it was not an issue already.

Land repurposing to aid in SGMA implementation and achieving other benefits is a relatively new strategy. Therefore, developing a program from the ground up and with the right level of stakeholder engagement and input will take time. Being proactive and starting early is important so that an inclusive set of values can be

FIGURE 1

Critically overdrafted basins in the San Joaquin Valley and GSAs considering land fallowing or retirement projects and programs in their GSPs⁴



⁴ Public Policy Institute of California. (2020). A Review of Groundwater Sustainability Plans in the San Joaquin Valley. Available at <https://www.pplic.org/wp-content/uploads/ppic-review-of-groundwater-sustainability-plans-in-the-san-joaquin-valley.pdf>

considered and a broader set of stakeholders can be engaged in the scoping effort. It is particularly important to begin developing trust and buy-in as early as possible with diverse community representation that may not be regularly engaged in land and water use planning efforts. When developing new funding sources, consider the additional time that may be required to conduct studies for proposed pilot projects and apply for grant funding for outreach and process development. This also may require program developers to undergo a Proposition 218 approval process for new appropriations, which takes time⁵.

Ultimately, different regions will vary in their readiness for launching this type of land repurposing strategy. Regional land repurposing strategies may start out small and then expand or ramp up over time as long-term management options in an area gradually come into sharper focus. Signs of readiness for a region may include, but are not limited to:

- GSAs have allocated their groundwater or are in discussions on allocation strategies.
- Users and managers in the basin have explored opportunities to augment and maximize available supplies, and are ready to also consider express demand-side management strategies to close the remaining supply-demand gap.
- GSAs have successfully applied for SGMA-related grant support previously.
- The region has undertaken regional planning efforts to identify priorities, like that of a Regional Conservation Investment Strategy process, a Climate Adaption Strategy or Habitat Conservation plan.
- The community is or will be updating its General Plan and/or zoning codes.
- The region is already considering programs to take land out of production in their GSPs.

Even regions that are not as far along in terms of readiness for this type of approach can still begin outreach and education with key stakeholders about the real, potential outcomes of reducing groundwater demand and how this type of repurposing strategy could play a beneficial role. See *Getting Started* for concrete next steps and process recommendations. After a land repurposing program is established and moves into implementation, progress should be periodically measured against program objectives, with appropriate program adjustments and adaptive management strategies in response to changing conditions over time.

⁵ Proposition 218 restricts local governments' ability to impose assessments and property-related fees and requires elections to approve many local government revenue raising methods.

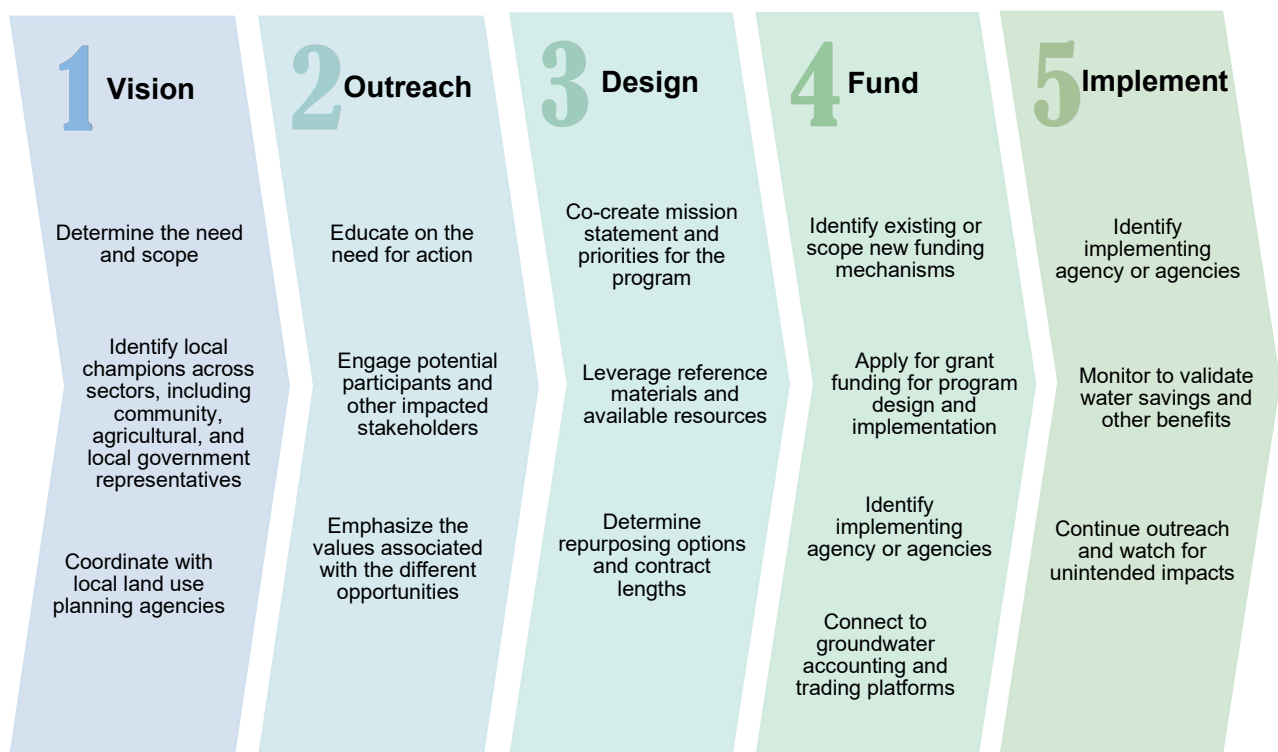
Getting Started: A Roadmap for Program Developers

For program developers ready to pursue a local land repurposing strategy, this section provides a summary of steps and resources to explore, design and implement a new program.

Researching examples and referencing available tools and resources will help introduce program developers to the breadth and potential of these types of land repurposing programs. Therefore, case studies, tools and resources are included in Appendix A and referenced in the process step descriptions below. Similarly, references to key considerations in *Considerations for Designing a Land Repurposing Strategy* are linked throughout.

FIGURE 2

Steps in exploring, designing, and implementing a land repurposing program



1. Create the Vision

The first step in developing a strategic land repurposing program is to determine the need for such a program - '[Why](#)' is *land repurposing needed for this region*? Establishing a general acknowledgement of the need to reduce groundwater demand, avoid undesirable results and potentially create multibenefit opportunities in the region will help create the enabling

conditions needed to initiate program development. Generally, programs will be able to more efficiently reduce demand and tap into higher repurposing potential when developed at a broader geographic scale; although other challenges may arise (e.g., large-scale coordination). While an individual district or GSA can still find value in a repurposing program, it may be preferable to scope land repurposing programs at a subbasin or watershed scale, as long as effective regional coordination among various entities is feasible. It is also useful to consider *'When'* a region may be ready to launch on this type of strategy, based on specific contextual factors.

Identifying and equipping program champions is a crucial step in the early stages of program development. Assembling a coalition of supportive and committed champions across sectors *'Who'* can help anticipate and identify solutions to potential future barriers, while fostering broad support for the initiative from the outset is a critical early step. Broad stakeholder representation at this stage will help ensure all perspectives, opportunities, and risks are considered from the outset - during the earliest visioning exercises.

2. Conduct Stakeholder Outreach

Developing an outreach strategy is the next step in creating a strategic land repurposing program. Sharing information on the need and opportunity for a land repurposing program can be accomplished through multiple information networks including GSA meetings, community-based organizations, resource conservation districts, agricultural groups, email listservs, social media platforms and local news outlets. It is important to reach out to not only potential participants of the program, but also a broad base of stakeholders *'Who'* may be impacted by the strategy, particularly Black, Indigenous, and people of color and immigrant communities who have often disproportionately experienced the negative impacts of land and water use changes.

In addition to education, outreach activities should aim to encourage engagement and input iteratively throughout the program development planning process. Program developers should ask stakeholders *'What'* types of land repurposing actions may be of greatest interest or value to them.

Resources & Tools

- [CaliWaterAg – Vicky Espinoza, UC Merced](#)
- [Climate Change in the San Joaquin Valley; A Household and Community Guide to Taking Action - Union of Concerned Scientists](#)
- [Sustainable Groundwater Management – Community Water Center \(available in English and Spanish\)](#)
- [Guiding Principles for Equitable Engagement in Coordinated Planning – Local Government Commission and Smart Growth California](#)

3. Design the Repurposing Strategy

With direct stakeholder input, program developers can identify an appropriate set of objectives for a regional land repurposing program. Collectively defining a program mission statement can help to consistently guide program development through subsequent stages of planning and implementation process.

With the input of stakeholders, program developers define ‘*What*’ options are available to landowners. Program objectives could be as simple as reducing long-term groundwater demand and avoiding harmful impacts associated with fallowing. However, additional regional benefits can also be included, such as habitat, community parks and recreation, solar development, or avoiding undesirable results like subsidence near infrastructure. Economic signals, risk reduction options and increased flexibility can be especially important to motivate behaviors and shape program direction.

Depending on the local vision and objectives, a program may need to create a spatially and temporally tiered incentive structure to coordinate land management at the appropriate time scale and locations. This can help to prioritize areas ‘*Where*’ repurposing can create the greatest value for the local community and economy, such as areas with the greatest potential to connect habitat or mitigate subsidence near vulnerable infrastructure. Setting these objectives early will help planners structure a program to effectively incentivize voluntary land management action that will achieve regional goals.

Input and involvement of an advisory group will help ensure the program is designed to complement existing programs and regulations. An advisory group should include potential participants (i.e., growers), impacted stakeholders (e.g., farmworkers and community members) and relevant agencies and groups (e.g., county planners, local land trusts, resource conservation districts, NRCS and wildlife agencies). Establishing an advisory group that reflects the diversity of the region and stakeholders will help guide development of the program and create equitable outcomes. This will help to ensure that participants understand ‘[How](#)’ program objectives and contracting options can work for them.

Resources & Tools

- [Recharge for Resilience – UC Santa Barbara Bren School, Environmental Defense Fund](#)
- [Groundwater Recharge Assessment Tool - Sustainable Conservation](#)
- [Groundwater Elevation Toolbox - Olsson Consulting Group](#)
- [BasinScout Tool – The Freshwater Trust](#)

4. Fund the Program

Program developers must next decide ‘[How](#)’ the program will be funded. As a demand management strategy, strategic land repurposing programs can be funded similarly to other GSA-led sustainability projects and programs. Funds may be generated through assessments to local groundwater pumpers or through SGMA grant programs, such as Proposition 68 implementation funds. Using a trusted water use accounting system will help managers better understand and visualize groundwater savings associated with land repurposing efforts. When the groundwater savings of land repurposing actions are well quantified, they can be accounted for in groundwater basin budgeting and potentially funded through groundwater trading programs or GSA-led demand management programs.

These supplemental funds for multibenefit programs work at a variety of scales. Some are designed to provide payments directly to landowners or project proponents, while others provide block grants to an organizing agency, such as a GSA. Both types of programs can be channeled to support multibenefit land repurposing while reducing groundwater demand. Grant programs are available for both planning (such as the Department of Conservation’s

SGMA Watershed Coordinator Grant) and for implementation (such as NRCS' Conservation Reserve Program).

Resources & Tools

- [Appendix C. Funding Opportunities](#)

5. Implement & Track Benefits

Once the program objectives, structure and funding mechanisms are developed, it is time to initiate projects with those *'Who'* may be interested in early adoption. GSAs, NRCS offices, cooperative extensions, integrated regional water management (IRWM) groups and RCDs can serve as excellent information networks to raise awareness of the program and help identify interested participants. Particularly for early projects, it is essential to monitor and assess outcomes to ensure program efficacy and avoid unintended consequences. The program development advisory committee can help to determine the most important indicators to track based on the collectively identified program objectives. There will likely be some overlap with monitoring and reporting already required by SGMA, but additional indicators, such as local air quality, domestic well function, regional revenue and acres of habitat may also be monitored.

In addition to tracking broad indicators of success, it is important to also examine how the program is impacting various stakeholders in the region, particularly low-income populations and historically underrepresented groups, including and Black, Indigenous, and people of color. Program developers should be prepared to make amendments to program design in the event that undesirable impacts are disproportionately affecting rural communities, small growers or other socially vulnerable groups.

Resources & Tools

- [Accounting and Trading Platform – Environmental Defense Fund, Sitka Technology Group](#)
- [OpenET - Environmental Defense Fund, NASA, Google Earth Engine](#)

Conclusion

Regions across the San Joaquin Valley are facing the significant challenge of bringing groundwater basins into balance while minimizing economic and societal impacts. While efforts to maximize water and demand management alternatives, such as groundwater recharge and well-designed water trading programs, are important and hold the potential to help support socioeconomic values, it will also be necessary to reduce groundwater pumping to meet SGMA goals. Reduced pumping, particularly in areas facing chronic surface and groundwater supply deficits, will result in a significant reduction in the irrigated agricultural footprint. If this transition is not managed strategically and proactively, it could have devastating impacts on the health and economic well-being of the San Joaquin Valley's communities.

Getting out ahead of this looming problem and creating new opportunities for the San Joaquin Valley will require proactive planning to design incentive programs that motivate positive change. Creating and implementing land repurposing incentive programs will require both time and an understanding of local opportunities and priorities. New and expanded federal, state, local and private funding sources will be needed. Early initiation to scope land repurposing strategies can lead to a more comprehensive and beneficial result – one that maintains productive agriculture, while also creating additional environmental benefits, economic opportunities and biodiversity across the changing landscape.

Program developers are encouraged to consider the strategies and concepts discussed in this white paper and start the conversation early on the potential role of strategic land repurposing in long-term sustainable groundwater management. In doing so, **strategic land repurposing can help to transform parts of the San Joaquin Valley into sustainable agricultural regions that not only put food on our plates, but also ensure equitable outcomes for all community members while supporting wildlife, outdoor recreation, soil health, groundwater recharge and other multibenefit objectives.**

Appendix A. Tools & Resources

Several nonprofit organizations, consulting firms and academic groups have developed resources and technical tools to support sustainable management of groundwater supplies in critically overdrafted basins. These resources may be helpful for program developers in planning and implementing multibenefit land repurposing programs. Please see Table A1 below for more information on available decision-support tools, guidance documents and other relevant resources.

TABLE A1

Stakeholder Roles in Promoting Land Repurposing Benefits

Tool	Author(s)	Description	Link
Stakeholder Outreach and Education			
CaliWaterAg	Vicky Espinoza, UC Merced	YouTube, Facebook, and Instagram platform that shares short informational videos in English, Spanish and Hmong on SGMA and anticipated land use change.	https://www.youtube.com/channel/UCym_U7oaloj9dW9EM7s5NQw
Groundwater Markets: Recommendations to Ensure Drinking Water Protections for Communities	Community Water Center, Self-Help Enterprises, TNC, Environmental Defense Fund, Union of Concerned Scientists	Provides best management practices and recommendations for developing groundwater markets to avoid impacts and protect community water supplies.	https://www.communitywatercenter.org/s/Groundwater_Markets.pdf
Climate Change in the San Joaquin Valley; A Household and Community Guide to Taking Action	Union of Concerned Scientists	A guide designed to help people living in the San Joaquin Valley understand how climate change threatens communities and what they can do to prepare. Available in English and Spanish.	https://www.ucsusa.org/sites/default/files/2020-10/climate-change-in-SJValley.pdf
Collaborating for Success: Stakeholder Engagement for Sustainable Groundwater Management Act Implementation	Community Water Center, Clean Water Fund, Union of Concerned Scientists,	This paper aims to convey the value of stakeholder engagement to sustainable groundwater management and to provide tools that will help maximize its benefits, including examples of best practices	https://static1.squarespace.com/static/5e83c5f78f0db40cb837cfb5/t/5f3ca8c136dbe60157dd5664/1597810892937/SGMA_Stakeholder_Engagement_White_Paper.pdf
Guiding Principles for Equitable Engagement in Coordinated Planning	Local Government Commission	Outlines eight guiding principles for equitable engagement in coordinated planning and highlights case studies.	https://www.lgc.org/worpress/wp-content/uploads/2020/09/Guiding-Principles-for-Equitable-Engagement-2.pdf
Technical Support Tools			
Recharge for Resilience	UC Santa Barbara Bren School,	Free online and ArcGIS tool to recommend areas for multibenefit recharge projects. Includes considerations for at-risk domestic wells,	https://waterresilience.wixsite.com/waterresilienceca/download-the-tool

	Environmental Defense Fund	groundwater dependent ecosystems and potential to introduce nitrogen to the aquifer.	
Accounting and Trading Platform	Environmental Defense Fund, Sitka Technology Group	Open-source platform to help landowner track their water usage, and enable trades between water users.	https://www.edf.org/waterplatformstory
OpenET	Environmental Defense Fund, NASA, Google Earth Engine	Low to no-cost online tool to track historic and near-real time evapotranspiration using an ensemble of evapotranspiration models.	https://openetdata.org
Groundwater Elevation Toolbox	Olsson Consulting Group	Subscription-based service that allows groundwater managers to model scenarios, such as groundwater trades or recharge activities, and the impact they may have on groundwater levels.	https://get.olsson.com
Groundwater Recharge Assessment Tool	Sustainable Conservation	Cloud-based application that integrates hydrologic, agronomic and geologic science with best-available data from local, state and federal sources to create an indexed ranking of suitable recharge sites.	http://www.groundwaterrecharge.org
BasinScout	Freshwater Trust	Platform uses satellite data and machine learning to allow users to rapidly assess field-level agricultural management practices and their impact on water resources, as well as run possible scenarios for achieving conservation outcomes within budget constraints.	https://www.thefreshwatertrust.org/tag/basin-scout
Project Prioritization Tool	American Farmland Trust, Conservation Biology Institute	Conservation decision-making tool to select and support projects that have the greatest potential to effectively infiltrate and conserve water.	https://farmland.org/project-prioritization-tool
Reports and Guidance			
Multibenefit Recharge Guide	Audubon, Environmental Defense Fund, Point Blue Conservation Sciences and Sustainable Conservation	Guide that outlines design and management techniques to maximize water bird habitat benefits on groundwater recharge basins. Emphasis on practices that enhance the operational efficiency of basins.	https://www.edf.org/rechargeguide
Water and the Future of the San Joaquin Valley	Public Policy Institute of California	Presents analysis of anticipated changes associated with SGMA implementation, climate change and other drivers through an economic, agricultural and environmental lens.	https://www.ppic.org/publication/water-and-the-future-of-the-san-joaquin-valley
Roadmap to Restoration	The Nature Conservancy, Stanford's Water in the West	Reports findings from an economic and spatial land use modelling effort to identify high priority areas for land retirement and endangered species habitat restoration.	https://www.scienceforconservation.org/products/roadmap-to-restoration
Bringing Water and Land Together	Local Government Commission	Provides an analysis of various policies and conversations with water and land-use experts, based on a review of existing literature. Offers general recommendations for successful integration of water management and land-use planning.	https://www.lgc.org/wp-content/uploads/2019/06/CFWI-Phase-1b-Final.pdf
Recharge Net Metering to Enhance Groundwater Sustainability	Mike Kiparsky, UC Berkeley	Report presents a description of Recharge Net Metering, as well as a brief account of its first implementation as a pilot program in the Pajaro Valley of California.	https://www.law.berkeley.edu/research/clee/research/wheeler/renem

FloodMAR	California Department of Water Resources	Integrated and voluntary water resource management strategy, including a white paper to explore opportunities for integration in flood water and aquifer recharge.	https://water.ca.gov/Programs/All-Programs/Flood-MAR
Getting Involved in Groundwater: A Guide to California's Groundwater Sustainability Plans	Union of Concerned Scientists	Reviews groundwater sustainability plans, planning, and goals for community members, agencies, scientists and consultants.	https://groundwaterexchange.org/wp-content/uploads/2020/03/Getting_Involved_in_Groundwater_Toolkit.pdf
Groundwater Markets: Recommendations to Ensure Drinking Water Protections for Communities	Community Water Center	Presents drinking water supply considerations for groundwater markets in the face of SGMA. Introduces tools to help community stakeholders engage in the market design and implementation process.	https://static1.squarespace.com/static/5e83c5f78f0db40cb837cfb5/t/5f3ca923f889b5e15ac10c0/1597810980321/Groundwater_Markets.pdf
Groundwater Trading as a Tool for Implementing California's Sustainable Groundwater Management Act	Environmental Defense Fund	This report describes how groundwater trading can be a compelling, cost-effective tool to achieve the goals of SGMA. While trading is not a panacea, it can reward conservation, create new revenue streams for groundwater users, boost a community's drought resilience and improve aquifer conditions.	https://www.edf.org/sites/default/files/documents/water-markets.pdf
San Joaquin Land and Water Strategy: Exploring the Intersection of Agricultural Land & Water Resources in California's San Joaquin Valley	American Farmland Trust	Reports findings from an analysis showing that the highest-quality farmland with the most reliable water resources. Provides management and policy recommendations.	https://farmlandinfo.org/publications/san-joaquin-land-water-strategy/
Saving Farmland, Growing Cities: A Framework for Implementing Effective Farmland Conservation Policies in the San Joaquin Valley	American Farmland Trust	Outlines a new framework for land use policy choices that affect farmland and agriculture. Identifies key challenges that must be addressed to conserve farmland and proposes specific, measurable outcomes by which to evaluate success.	https://farmlandinfo.org/publications/saving-farmland-growing-cities-a-framework-for-implementing-effective-farmland-conservation-policies-in-the-san-joaquin-valley/
The Sustainable Groundwater Management Act and the Common Law of Groundwater Rights—Finding a Consistent Path Forward for Groundwater Allocation	Environmental Defense Fund	To provide more clarity to groundwater agencies on how to navigate this challenge, Environmental Defense Fund partnered with four leading law experts to coauthor this article in the UCLA Journal of Environmental Law & Policy, which takes a deep dive into the relationship between SGMA and groundwater rights.	https://www.edf.org/sites/default/files/documents/01JELP38-2_Garner_etal.pdf
Trading Sustainably: Critical Considerations for Local Groundwater Markets Under the Sustainable Groundwater Management Act	Nell Green Nylen, UC Berkeley	Outlines a set of considerations designed to help decision-makers and stakeholders evaluate whether and under what conditions a local groundwater market might be a viable tool that contributes to sustainably managing a particular groundwater basin.	https://www.law.berkeley.edu/research/clee/research/wheeler/trading-sustainably/

Appendix B. Case Studies

While most groundwater sustainability agencies (GSAs) are still in the early stages of Sustainable Groundwater Management Act (SGMA) implementation, there are a few past and current examples of land repurposing and retirement programs that can provide insights and lessons learned to inform a successful multibenefit land repurposing program. Below are brief overviews of some of these examples to highlight critical components and innovative approaches emerging in the SGMA context.

- Kaweah Subbasin Regional Conservation Investment Strategy (RCIS)
- Tule Basin Land & Water Conservation Trust
- Madera County GSA Strategic Agricultural Land Conservation
- Westlands Water District Land Retirement Program

CASE STUDY: KAWEAH SUBBASIN REGIONAL CONSERVATION INVESTMENT STRATEGY



In early 2020 the Kaweah Subbasin was awarded a \$515,000 grant from the California Wildlife Conservation Board to develop a Regional Conservation Investment Strategy (RCIS) plan.

The plan development is directed by a local steering committee that includes the three groundwater sustainability agencies in the subbasin, agricultural landowners, county and city officials, local conservation non-profit staff, and community representatives.

The Kaweah RCIS will identify regional conservation strategies and provide an opportunity for landowners to repurpose lands to upland habitat and wildlife friendly groundwater recharge areas. Participating landowners will receive payments from public sources or from habitat mitigation buyers (e.g., government agencies or private developers). This will create a new revenue opportunity while reducing irrigation demand and supporting endangered plants and wildlife in the region.

You can find more information at:
KaweahRCIS.org

“To balance groundwater supply and demand, it’s an unfortunate reality that we will have less water to irrigate the current acreage of farmland. This RCIS process will help us bring together stakeholders to create a holistic vision of what our region can become as we repurpose some agricultural land to create benefits for farmers, farmworkers and the community as a whole.”

Mike Hagman, Executive Director, East Kaweah Groundwater Sustainability Agency



CASE STUDY: TULE BASIN LAND & WATER CONSERVATION TRUST



The Tule Basin Land & Water Conservation Trust's mission is a "Tule Basin brought into water balance by integrating habitat enhancement with sustainable farming to create one healthy ecosystem."

The Tule Basin Land & Water Trust was founded in 2020 to address groundwater overdraft in the Tule Subbasin through demand management via land and easement acquisition and to serve as a vehicle in meeting SGMA related land use needs. Agricultural land acquired by the trust will be restored to upland habitat or repurposed to wildlife friendly recharge basins.

Project development is expected to begin in 2021 through an initial purchase and upland habitat restoration on a 500-acre site adjacent to the Pixley Wildlife Refuge. The site was formerly a dairy and farming operation.

The Trust is funded through local support of the GSAs, commodity groups and NGOs. Public grants will be used in part to support habitat restoration projects.

Stakeholders involved include local irrigation districts, groundwater sustainability agencies, other conservation organizations and nonprofits.

You can find more information at:
www.tuletrust.org/

"The Trust is working cooperatively with the stakeholders in the sub basin to ensure a reliable water supply for agriculture while providing and enhancing a healthy ecosystem."

Frank Fernandes, Tule Basin Land & Water Conservation Trust Board Chair



CASE STUDY: MADERA COUNTY GSA

Strategic Agricultural Land Conservation



Madera County is undertaking a study using a grant from the Sustainable Agricultural Land Conservation (SALC) program. The grant is funding creation of an incentive structure for dry land farming and resting and retiring land for a short or long duration.

General land categories that are being considered for the program incentive structure in the study include:

- Unirrigated land that may remain unirrigated
- Irrigated land that may become unirrigated
- Irrigated farmland that may remain irrigated

Local stakeholders have been encouraged to participate in the process through the Madera County GSAs, including local landowners, agricultural groups, and conservation and environmental groups.

It is anticipated that this program will be part of a portfolio of demand management and supply augmentation actions to achieve sustainability goals in the Madera County GSAs. It will use existing and future water supplies efficiently and promoting groundwater recharge to maintain a productive agricultural sector for future generations.

You can find more information at:
www.maderacountywater.com/land-conservation

“Incentivizing land resting and retirement is one of our key strategies for complying with SGMA.”

Stephanie Anagnoson, Director of Water and Natural Resources, Madera County



CASE STUDY: WESTLANDS WATER DISTRICT Land Retirement Program



In 1998, the District began purchasing drainage impaired land through various land acquisition programs in order to resolve a drainage issue and redistribute the water allocation from impaired land to other irrigable land in the District. Some of this retired land, no longer suitable for farming, has been converted to solar. Converting to solar gives this land a second life and helps avoid the need to develop solar projects on prime agricultural land and previously undisturbed lands. Due to this land's previous agricultural use, there is significantly lower risk of negative impact to native species from solar development.

As of January 2021, the District and other agencies removed approximately 93,200 acres from irrigated agriculture, and of these acres, to date, approximately 7,700 acres have been converted to solar development within Westlands. The solar energy produced on these lands is sold into the California Electrical Grid for the benefit of the entities that contracted to purchase energy from the solar development.

You can find more information at:
wwd.ca.gov/resource-management/land-management/

"In order to ensure a sustainable future for the District, Westlands began purchasing and retiring land in the late 1990's to address a drainage issue and conserve available water in the District. While these lands are no longer viable for irrigated agriculture, they are uniquely suited for solar production, upland habitat restoration, and possible groundwater recharge projects."

Jose Gutierrez, Chief Operating Officer, Westlands



Appendix C. Funding Opportunities

Financial Incentives to Support Land Repurposing in California

What financial resources are available to growers in the San Joaquin Valley who choose to repurpose their land to both reduce groundwater consumption and create alternative values (e.g., habitat, recreation, solar development, etc.)?

This analysis provides a realistic menu of existing and potential funding sources for land repurposing, and how each could work to support landowners impacted by the Sustainable Groundwater Management Act (SGMA). This analysis captures information from a funding program analysis completed by EDF and partners in 2020. This analysis included conducting a thorough review of existing and emerging funding programs, as well as conducting interviews with six farmers in the Southern San Joaquin Region. This analysis aimed to answer the following questions.

- What type of financial gains could landowners reasonably expect from participating in different funding programs or management options that support voluntary land repurposing?
- What are the conditions and considerations of participation in these different funding programs that may make a grower more or less likely to participate?

This analysis provides:

- **A summary of key findings** from the funding program analysis;
- **A list of existing funding programs** that are currently accessible to growers for land repurposing; and
- **A description of emerging markets** that are likely to create additional funding opportunities for land repurposing in the foreseeable future

This information can serve as a guide for local groundwater sustainability agencies (GSAs) and state policy makers scoping funding sources for local land repurposing programs, recognizing that some land will likely come out of agricultural production.

Summary of Key Findings

There are already many public and private funding options that could be used to support land repurposing. It is important to note, however, that most conservation programs cannot fully replace the revenue lost by transitioning away from traditional agriculture. Further, current funding sources are not sufficient to ensure that reduced groundwater use will lead to grower and community benefits more broadly – new funding sources are needed.

Of the funding options assessed, only **conservation banks** and **solar rental fees** come close to providing equivalent revenue that would otherwise be provided by low-value crops in the San Joaquin Valley. Additionally, the practical constraints of participating in many funding programs will determine the feasibility of these options for individual landowners (e.g., match requirements, location).

It is worth considering how different funding options may be **able to be used together** to increase revenue for landowners. For example, water trading, mitigation credit agreements, groundwater management, and other investments in water rights can help to support existing programs.



John Greening

Existing Funding Programs

The following funding programs are already potential sources of revenue for landowners who are looking at options for land repurposing. Each option includes a general description, a range of revenue, ecosystem benefits that must be created, and a summary of the questions a landowner should consider when evaluating their options.

1. Mitigation or Conservation Banks

Mitigation and conservation banks are well-established, regulatory tools for establishing valuable habitat and water projects. A mitigation bank is a wetland, stream or other aquatic resource area that has been restored, established, enhanced or (in certain circumstances) preserved for the purpose of providing compensation for unavoidable impacts to aquatic resources permitted under Section 404 of the Clean Water Act, or a similar state or local wetland regulation ⁶. A conservation bank is a permanently protected land area that contains natural resource values, and is conserved and permanently managed for species that are endangered, threatened, candidates for listing as endangered or threatened, or are otherwise species-at-risk ⁷.

A landowner can create a permanent mitigation or conservation bank on their property. Once created, they can sell “credits” to agencies, developers or others who need to fulfill permit requirements. There are companies that specialize in creating mitigation and conservation banks that can fully manage a project for the landowner from start to finish.

Mitigation credit agreements (see ‘Emerging Markets’ below) are a new California state mitigation tool that serve as an alternative to banks. Mitigation and conservation banks usually require a permanent conservation easement to be established, and the role of the landowner is limited. Mitigation credit agreements, however, provide more flexible mitigation options, such as the ability to create temporary credits (e.g., 10-year contracts) and compatibility with some types of wildlife-friendly agriculture. In that way, they can provide a more direct path for landowners to receive financial compensation for providing protected species habitat.

While profitable, mitigation and conservation banks require a significant level of investment to develop and approve them and require a permanent encumbrance of lands to create conservation values.

⁶ *Mitigation Banks under CWA Section 404*. US Environmental Protection Agency. Available at <https://www.epa.gov/cwa-404/mitigation-banks-under-cwa-section-404>

⁷ *Conservation Banking for Landowners*. US Fish and Wildlife Service. Available at <https://www.fws.gov/endangered/landowners/conservation-banking.html>

Potential Revenue	Medium to high. \$1,000-\$50,000/acre one-time payment, depending on species.
Funding type	Private
Ecosystem Benefits	<ul style="list-style-type: none"> • Habitat for endangered, threatened or at-risk species • Wetland, stream or other aquatic resource
Landowner Considerations	<ul style="list-style-type: none"> • <i>Are you willing to permanently commit your land to habitat?</i> • <i>Are you in an area that can create habitat for listed species, and can you establish species presence on your land?</i> • <i>How much capital can you invest up front in restoration before credits are sold?</i> • <i>Are you willing to go through an extensive agency negotiation and review process to approve your conservation bank?</i>

2. Conservation Easements

Conservation easements permanently remove the development rights on a parcel of land to protect the habitat, open space or agricultural value of the property. These easements are attached to the land deed and are usually permanent. Landowners maintain management and ownership responsibilities, but the land is preserved in perpetuity. Usually landowners work with a land trust or similar conservation group to fund and monitor the easement. Easements can be funded through grant programs (discussed below) or permittee-responsible mitigation projects, in partnership with an agency who has permitting requirements.

Potential Revenue	Medium. 40-60% of appraised land value, provided as a one-time payment.
Funding type	Usually public, but can also be from a private funding source.
Ecosystem Benefits	<ul style="list-style-type: none"> • Open space/agricultural land • Habitat for endangered, threatened or at-risk species
Landowner Considerations	<ul style="list-style-type: none"> • <i>What are the intrinsic values of your land (e.g., specific species, proximity to other protected land)? Identifying these will help identify potential funding sources.</i> • <i>Are you willing to commit to a perpetual easement tied to your land deed?</i> • <i>Is there a local land trust or conservation group that can help guide you through the process?</i>

3. Solar Rentals

Solar power companies are now leasing farmland to create semipermanent solar farms. These leases are often for around 30 years, and involve solar panels being constructed on the property. There can sometimes be alternative land uses around the panels, such as pollinator benefits, but they are very limited and depend on the agreement with the solar company.

Potential Revenue	Medium to high. \$200-\$2,000/acre/year
Funding type	Private
Ecosystem Benefits	<ul style="list-style-type: none"> • Renewable energy generation • Any additional benefits that cover crops may provide (e.g., pollinator benefits, soil retention).
Landowner Considerations	<ul style="list-style-type: none"> • <i>Does your property have solar generation potential?</i> • <i>Are you willing to commit to a multidecade contract?</i> • <i>Is your property able to connect to the 'grid'?</i>

4. Grazing Leases

Repurposed agricultural land can often be converted to dryland grazing. Working with a rancher, landowners can lease their land for sheep, cattle or goats. These are often annual contracts between landowners and ranchers. Fencing costs can be high and could create an impediment for converting agricultural fields to grazing land. NRCS (see *Federal and State Grant Funding Programs* below) could provide a cost share to install fencing.

Potential Revenue	Low. \$30-60/acre/year
Funding type	Private
Ecosystem Benefits	<ul style="list-style-type: none"> • Open space/agricultural land • Soil retention • Invasive species management • Carbon storage
Landowner Considerations	<ul style="list-style-type: none"> • <i>What are the upfront costs of installing fences, water tanks, etc. to create a high-quality pasture?</i> • <i>Are there additional management options you could pair with grazing to bring in additional revenue? Options include: carbon credits, upland habitat for mitigation or conservation, others. See Emerging Markets below.</i>

5. Converting to Low Water Intensity Crops

If traditional crops are no longer feasible given the need to reduce groundwater demand, landowners can consider switching to a lower water intensity crop, such as winter wheat. The ability to grow this type of crop depends on the climate, surface water availability, and ability to harvest and sell. However, there are additional ecosystem benefits associated with cover crops and other low water intensity crops.

Potential Revenue	Variable but low, depending on crop type and success rate.
Funding type	Private
Ecosystem Benefits	<ul style="list-style-type: none"> • Soil retention • Invasive species management • Carbon storage
Landowner Considerations	<ul style="list-style-type: none"> • <i>Do you have the infrastructure in place to grow this crop on your land?</i> • <i>Can you grow a successful crop with limited water resources?</i>

6. Federal and State Grant Funding Programs

There is a diverse array of federal and state grant funding programs available to growers for land repurposing (see Table C1). These programs vary widely, and landowners should review the specifics for each grant program before applying. These programs can also shift in their priorities and available funding, so growers should contact the relevant grant manager to ensure they have the most up to date information before applying.

Potential Revenue	Variable depending on the grant program.
Funding type	Public
Ecosystem Benefits	Multiple
Landowner Considerations	<ul style="list-style-type: none"> • <i>Do you have the capacity to apply for a grant?</i> • <i>Can you comply with the grant program's rules?</i> • <i>Can you work with a local partner (RCD, land trust, community organization, etc.) to help with application for or administration of the grant?</i> <p>See www.fundingresource.org for examples.</p>

Most existing funding opportunities are offered through state and federal programs. See Table C1 for a list of programs and the ecosystem services they fund.



TABLE C1

Existing grant programs for alternative uses of repurposed land

Granting Agency/Program	Ecosystem Services Funded	More Information
Federal		
Natural Resources Conservation Service (NRCS)		
<ul style="list-style-type: none"> • Environmental Quality Improvement Program (EQIP) • Conservation Reserve Program (CRP) • Others 	<ul style="list-style-type: none"> • Agricultural resources • Soil Health • Water Quality • Habitat benefits 	EQIP NRCS Conservation Programs
U.S. Fish & Wildlife Service		
<ul style="list-style-type: none"> ▪ Partners for Fish & Wildlife ▪ North American Wetlands Conservation Act 	<ul style="list-style-type: none"> • Water retention • Wetlands • Migratory bird habitat 	Partners for Fish & Wildlife NAWCA
U.S. Bureau of Reclamation		
<ul style="list-style-type: none"> • Central Valley Project Improvement Act (CVPIA) • Central Valley Program Conservation Program (CVPCP) • WaterSMART Grants 	<ul style="list-style-type: none"> • Species habitat • Water markets • Water use efficiency 	CVPIA CVPCP WaterSMART
State		
California Wildlife Conservation Board		
<ul style="list-style-type: none"> • Riparian Habitat Conservation Program • Pacific Flyway Conservation Program • Stream Flow Enhancement Program • Others 	<ul style="list-style-type: none"> • Species habitat • Water quality 	WCB Grants
California Department of Conservation		
<ul style="list-style-type: none"> • Sustainable Agricultural Lands Conservation (SALC) Program • Working Lands and Riparian Corridors Program • Agricultural Land Mitigation Program (ALMP) 	<ul style="list-style-type: none"> • Agricultural resources • Climate resilience • Riparian corridors 	SALC Other Department of Conservation grant programs
California Department of Food & Agriculture		
<ul style="list-style-type: none"> • Healthy Soils Program 	<ul style="list-style-type: none"> • Soil health • Carbon sequestration • GHG reduction 	Healthy Soils

Emerging Markets

Several emerging funding markets, like water trading markets and mitigation credit agreements, are likely to create real benefits for landowners considering land repurposing in the near future. These markets have seen only limited or no transactions, but landowners should consider these opportunities, especially if they are looking to repurposing their land in a 5- to 10-year timeframe. However, potential revenue from these markets is not estimated here, as they have not been tested in a scalable way.

Water Trading Markets

Equitable, well-designed groundwater trading, as described in “[Groundwater Markets: Recommendations to Ensure Drinking Water Protections for Communities](#)”, is a critical tool to address groundwater overdraft. It is not a panacea, but one of many important tools that can help address water scarcity challenges with enhanced flexibility to enable more resilient outcomes.

Water trading markets can create more flexibility for complying with SGMA, giving farmers choices, greater certainty, and helping them and the entire basin to operate within their water budgets. A farmer can choose to fallow his land for one year, sell his water, and then go back to farming the next year. Water markets are also highly customizable, and can be tailored to the conditions of the basin and the visions and needs of stakeholders. In fact, it is imperative that water markets create rules that protect the water needs and policy preferences of affected communities, market participants, and the environment. Water markets can also help to build up the resilience of a region to outside stressors, such as climate change, population growth, and changing demands for different crops.

Before trading happens, a region needs to create a water budget. The region needs to determine how much water is needed to meet community drinking water needs, and the water needs of the environment. It’s critical to understand environmental and community water needs and make sure those needs are taken care of first -- before trading happens. Once established, groundwater credits can provide a valuable income source for landowners.

Increasingly, water managers are considering water trading markets as a tool to manage scarce water resources and comply with SGMA. For example, the Rosedale-Rio Bravo Water Storage District has co-developed an open-source water accounting and trading platform with its landowners, EDF, and other partners specifically designed to help comply with SGMA. Rosedale established a water budget for the entire district and has defined allocations rules. Rosedale does not put a limit on the quantity of water used to meet domestic and municipal needs and has adopted the use of a groundwater modeling decision support tool that can be used to inform the development of trading rules and evaluate trades over time to ensure avoidance of negative impacts. Within Rosedale, the accounting portion of the platform is currently in use and trading will come online once the district deems it is needed.

For a detailed look at local groundwater trading, among other sources, interested parties can consult “[Groundwater Trading as a Tool for Implementing California’s Sustainable Groundwater Management Act](#)” report and “[The Sustainable Groundwater Management Act](#)

[and the Common Law of Groundwater Rights—Finding a Consistent Path Forward for Groundwater Allocation.](#)”

Mitigation Credit Agreements

Under the relatively new [Regional Conservation Investment Strategy \(RCIS\) program](#) in California, landowners in an approved RCIS region can create mitigation credit agreements (MCAs) on their land. MCAs function similarly to conservation banks (discussed above) but have the benefits of being more flexible (e.g., temporary credits, non-acreage-based credits), and having a more streamlined approval process. For landowners who want to create valuable species habitat on their land without committing to a permanent land encumbrance, MCAs could become a valuable option to consider.

Soil Carbon Credits

As California’s Cap and Trade market expands, there is continued discussion around the carbon sequestration potential of healthy soils. The Sustainable Agricultural Land Conservation (SALC) program supports farmers who implement specific management practices, but a private market could further incentivize carbon sequestration and soil retention on protected lands. The [Marin Carbon Project](#) is a pilot program that could provide a useful example. Importantly, streamlining monitoring and increasing the value of carbon credits will be critical to create a robust market.

Private Investment

Private investment firms are becoming more active in the San Joaquin Valley, motivated by the high economic value of agriculture and water. These investors have a wide range of motivations and strategies, but several are looking to fund sustainable agriculture, support land repurposing or create water credits. Working with external funders could provide a landowner the capital needed to repurpose and manage their land.

Finance Analysis Citations

Mitigation Banks

Army Corps of Engineers. Regulatory In-lieu fee and Bank Information Tracking System.
<https://ribits.ops.usace.army.mil/>

California Department of Fish & Wildlife. Conservation and Mitigation Banking.
<https://wildlife.ca.gov/Conservation/Planning/Banking>

US Fish & Wildlife Service. Conservation Banking for Landowners.
<https://www.fws.gov/endangered/landowners/conservation-banking.html>

Ecosystem Marketplace. State of Biodiversity Mitigation 2017. Markets and Compensation for Global Infrastructure Development. October 2017.

Conservation Easements

California Conservation Areas Database. Available at <https://www.calands.org/>

Conservation Easements in California. California Civil Code § 815.

Land Trust Alliance. Conservation Easement FAQ. <https://www.landtrustalliance.org/what-you-can-do/conserv-your-land>

Land Trust Alliance. Economic Benefits.
<https://www.landtrustalliance.org/topics/economic-benefits>

Solar Rentals

Hoffacker, MK, Allen, MF, Hernandez, RR. Land-Sparing Opportunities for Solar Energy Development in Agricultural Landscapes: A Case Study of the Great Central Valley, CA, United States. *Environ. Science & Technology*. 2017, 51(4), 14472–14482.
<https://pubs.acs.org/doi/abs/10.1021/acs.est.7b05110>

Moore, Robert. Weigh risks before signing solar lease. *Farm Progress*. Sept 15, 2017.
<https://www.farmprogress.com/land-management/weigh-risks-signing-solar-lease>

Solar Land Lease. Lease Rates for Solar Farms: How Valuable Is My Land?
<https://www.solarlandlease.com/lease-rates-for-solar-farms-how-valuable-is-my-land>

Grazing Leases

Landowner Interview 2. Conducted in 2019.

Wildlife Conservation Board. Rangeland, Grazing Land, and Grassland Protection Program.
<https://wcb.ca.gov/Programs/Rangeland>

Natural Resources Conservation Service. Conservation Reserve Program. County Average Rate and Grassland Rates.

Low Water Intensity Crops

Landowner Interview #4, 2019.

Lundy, Mark and Leah Puro. Greeting the uncertain with the flexible: winter cropping system strategies in a variable rainfall environment. PPIC Meeting. Sept 2016.

Lundy, Mark. Personal Comment to Boysen, K and Schiller, Anna via telephone. March, 2020.

Shuford, W.D. et al. The benefits of crops and field management practices to wintering waterbirds in the Sacramento–San Joaquin River Delta of California. *Renewable Agriculture and Food Systems*: 31(6); 495–506

Federal and State Grant Funding Programs

Bureau of Reclamation. Central Valley Plan Conservation Program (CVPCP)

Bureau of Reclamation. Central Valley Plan Improvement Act (CVPIA)

California Association of Resource Conservation Districts. RCD Funding Opportunities.
<https://carcd.org/our-work/funding-opportunities/>

California Department of Conservation. Grant Programs.
<https://www.conservation.ca.gov/dlrp/grant-programs/Pages/Index.aspx>

California Department of Fish and Wildlife. CDFW Grant Opportunities.
<https://wildlife.ca.gov/Grants>

California Department of Fish and Wildlife. Wildlife Conservation Board Grant Programs.
<https://wcb.ca.gov/Grants>

California Department of Fish and Wildlife. Wildlife Conservation Board Habitat Enhancement and Restoration Program. <https://wcb.ca.gov/Programs/Habitat-Enhancement>

California Department of Food and Agriculture. California Healthy Soils Initiative.
<https://www.cdfa.ca.gov/healthysoils/>

California Strategy Growth Council. Sustainable Agricultural Lands Conservation.
<https://sgc.ca.gov/programs/salc/>

National Resource Conservation Service. Conservation Stewardship Program.
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/>

National Resource Conservation Service. Conservation Stewardship Program California.
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/ca/programs/financial/csp/>

National Resource Conservation Service. EQIP Practice List.
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/about/?cid=nrcs142p2_034717

National Resource Conservation Service. EQIP.
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/>

US Department of Agriculture. Farm Service Agency. Conservation Reserve Enhancement Program. <https://www.fsa.usda.gov/FSA/webapp?area=home&subject=lown&topic=cep>

US Department of Agriculture. Farm Service Agency. Conservation Reserve Program.
<https://www.fsa.usda.gov/FSA/webapp?area=home&subject=lown&topic=crp>

US Fish & Wildlife Section 6 Grants. <https://www.fws.gov/endangered/grants/>

US Fish & Wildlife. North American Wetlands Conservation Act.
<https://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php>

US Fish & Wildlife. Partners for Fish & Wildlife. <https://www.fws.gov/partners/>

Emerging Markets

CA Department of Fish and Wildlife. Regional Conservation Investment Strategies Program.
<https://wildlife.ca.gov/Conservation/Planning/Regional-Conservation>

E. Hanak et al. Water and the Future of the San Joaquin Valley. Public Policy Institute of California, 2019.

Govaerts, B, et al. Conservation Agriculture and Soil Carbon Sequestration: Between Myth and Farmer Reality. *Critical Reviews in Plant Science*, 28:97–122, 2009.

Landowner interview #4, 2019.

Marin Carbon Project. <https://www.marincarbonproject.org/science/measurement--models>

Appendix D. Workshop Series Overview

The four-part workshop series created a forum to discuss creative, big-picture and practical approaches to regionally coordinated land repurposing that allow water users flexibility and produce equitable solutions for impacted landowners and communities. The workshops took place September 2020 through February 2021.

- Workshop #1 set the foundation, established positive working relationships and set the vision for the series.
- Workshop #2 focused on key elements of the ideal program from various stakeholder perspectives and explored barriers and solutions for overcoming them.
- Workshop #3 resulted in draft recommendations and program components that are further detailed in this paper.
- Workshop #4 gave participants the chance to review an early draft and provide final input.

Workshop series content was developed in advance and iteratively as the workshops progressed with the objectives of engaging a diverse group of stakeholders (including groundwater sustainability agency representatives, landowners, land use planners, and land trust and nonprofit representatives) and gaining thorough insights to inform a set of recommendations for developing coordinated land repurposing programs.

In each workshop, participants gained context and deeper understanding of relevant topics through brief presentations and engaged actively in large group sessions. Small group sessions provided platforms for deeper discussion. Small group sessions were led by workshop planning team members and guided with questions developed by the team, distributed to participants in advance with each workshop agenda.

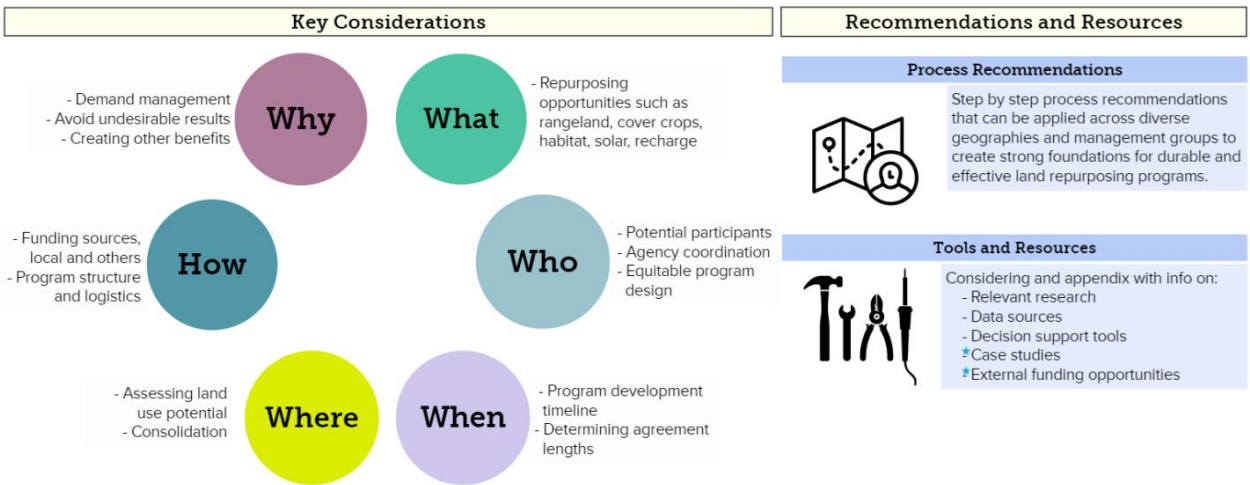
Workshops were held virtually via Zoom with an accompanying virtual interactive platform called Mural for visualizing session content and for participants to share responses to questions (see Figure D1). Participants could access the workshop agendas, platform and any presentation materials via the workshop website during and after each workshop. The workshop series resulted in the identification of practical and creative approaches to support regionally coordinated land repurposing.

FIGURE D1

Example workshop mural board section

White Paper Overview: Local Land Repurposing Program Design Recommendations

Audience	Purpose	Timeline	We want to give credit to everyone who so generously participated in these workshops. Please let us know if there are challenges to attributing you by name.
GSA's, Local Land Use Planners, Landowners, State & Federal Policy Makers	Provide practical and creative approaches to support the development of regionally coordinated land repurposing programs that allow for increased flexibility in SGMA implementation, provide new sources of revenue for growers, and create equitable solutions for impacted landowners and communities.	First Draft: January 2020 Participant Review: January 2020 Final Draft: March 2020	



Participant List

Amanda Monaco , Leadership Counsel for Justice and Accountability	Kara Heckert , American Farmland Trust
Analise Rivero , Priority Strategies, Inc.	Katie Riley , Environmental Incentives
Ann Hayden , Environmental Defense Fund	Kristen Boysen , Environmental Incentives
Anna Schiller , Environmental Defense Fund	Laurel Angell , Madera/Chowchilla RCD
Carl Evers III , Hancock Farmland Services	Mary Pitto , Rural County Representatives of California (RCRC)
Danielle V. Dolan , Local Government Commission	Mary-Ann Warmerdam , Rural County Representatives of California (RCRC)
Dave Orth , New Current Water & Land, LLC	Matt Angell , Landowner
Deanna Jackson , Tri-County WA GSA	Matt Hurley , McMullin Area GSA
Denise England , Tulare County Administrative Office	Maurice Hall , Environmental Defense Fund
Donna Meyers , Salinas Valley GSA	Mike Chrisman , Water Education Foundation
Duncan MacEwan , ERA Economics, LLC	Mike Hagman , East Kaweah GSA
Eddie O'Campo , Self Help Enterprises	Molly Daniels , Environmental Incentives
Emily Gardner , Salinas Valley GSA	Paul Boyer , Self Help Enterprises
Emmy Cattani , Cattani Farming	Paul Smith , Rural County Representatives of California (RCRC)
Eric Averett , Rosedale-Rio Bravo Water Storage District	Ronna Kelly , Environmental Defense Fund
Jack Rice , Western Resource Strategies, LLC	Ruth M Dahlquist-Willard , UC Extension, small grower
Jaymee Go , Priority Strategies, Inc.	Stacie-Ann Silva , New Current Water & Land, LLC
Jeannie Habben , Madera County GSA	Stephanie Anagnoson , Madera County GSA
Jeff Powers , Sequoia Riverlands Trust	Vicky Espinoza , University of California, Merced
Justin Frederickson , California Farm Bureau Federation	