GUIDE

Working with Nature to Protect California's Agricultural Regions

How Nature-Based Solutions Can Build Resilience

HIGHLIGHTS

California's agricultural regions face interconnected challenges, including unsustainable water use, extreme heat, flooding, air pollution, subsidence, and economic instability. Traditional infrastructure is often too expensive and siloed to solve these complex problems.

Nature-based solutions offer a powerful and transdisciplinary approach that works with natural systems to tackle multiple challenges simultaneously while creating economic opportunities, supporting communities and farmers, and reducing impacts on the environment and public health. Nature-based solutions projects span multiple applications, including managed aquifer recharge that improves local water supplies, native habitat restoration for wildlife and educational opportunities, ecovoltaic systems that combine solar energy with environmental enhancement, and floodplain restoration for flood protection and green areas.

Leveraging available public funding, nature-based solutions can help agricultural regions balance water use and bring multiple benefits on repurposed land. California has the resources, expertise, and financial mechanisms to implement these transformative approaches to addressing climate and water issues while benefiting communities, farmers, landowners, Native Americans, the environment, and public health.

What Are Nature-Based Solutions?

Traditional infrastructure is insufficient to address the interconnected challenges in California's agricultural regions: unsustainable water use, extreme heat, flooding, air pollution, and economic instability. Nature-based solutions work with natural systems offering powerful, transdisciplinary approaches to tackle these issues, creating economic opportunities and reducing negative impacts on the environment and public health.

Cropland repurposing projects can use nature-based solutions to improve agricultural landscapes benefiting farmers, communities, Indigenous peoples, and the environment (Fernandez-Bou et al. 2025; Penny et al. 2025). For example, restored wetlands can filter pollutants, recharge groundwater supplies, reduce flood risk, provide habitat for native species, and offer green spaces for recreation.

Leveraging available public funding, nature-based solutions can help California agricultural regions balance water use and create multiple benefits on repurposed cropland.

Union of Concerned Scientists

MLRP Statewide Support Entity

Nature-Based Solutions for California's Agricultural Regions

Options for nature-based solutions projects are broad, but local priorities guided by community, environmental, and groundwater needs can provide a meaningful focus to achieve multiple benefits (Table 1). Possible projects include native habitat restoration that creates wildlife corridors and recreation near communities, ecovoltaic systems that combine solar energy with environmental enhancement, floodplain restoration that offers flood protection and educational opportunities, and multibenefit managed aquifer recharge that increases water security for communities, agriculture, and the environment.

Water Management Projects

Multibenefit Managed Aquifer Recharge

Multibenefit managed aquifer recharge (MAR) replenishes groundwater storage areas while incorporating other benefits (Case Study 1). These include reducing flood risk, improving drinking water and water for agriculture, introducing habitat elements that provide multiple ecosystem services, and supporting local recreation. For example:

- **Dedicated recharge systems**: Multibenefit recharge basins can be planted with native vegetation and create pollinator habitats.
- **Agricultural integration**: On-farm recharge can be implemented during tree dormancy in wet years in perennial orchards or on annual cropland between growing seasons. Erosion can be controlled using native plants as cover crops or modifying the soil with berms. Recharge near agricultural canals can incorporate native riparian vegetation to enhance infiltration and provide habitat benefits.
- **Community benefits**: Replenishing community aquifers with clean water can improve water quality and access, and projects can create community amenities such as accessible trails with interpretive features and educational opportunities for local schools.
- **Coastal aquifer protection**: In strategic coastal sites, aquifer recharge can create freshwater barriers that address seawater intrusion.

Site Selection Criteria

- Clean soils near disadvantaged communities that lack water security, particularly those communities that cannot physically or financially consolidate with other water systems
- Clean soils with adequate permeability and suitability for groundwater storage
- Sites near canals, creeks, or rivers for water conveyance
- Critically overdrafted groundwater basins and coastal areas vulnerable to seawater intrusion
- Agricultural lands before trees break winter dormancy or between annual crops growing seasons

For more recommendations about managed aquifer recharge, see this table of advantages, risks, and solutions and best practices, and this factsheet about Managed Aquifer Recharge Policy Recommendations.

Case Study 1. Okieville Managed Aquifer Recharge: A Partnership for Water Security

Location: Okieville, Tulare County, California

Landowner: Tulare Irrigation District

Description: Okieville, a severely disadvantaged California community, faced groundwater depletion and water quality issues affecting the Okieville–Highland Acres Mutual Water Company well system. During the 2012–2016 drought, Self-Help Enterprises noticed that homes on the south side of Okieville had higher water levels and better water quality than homes to the north. This occurred because the Kaweah Delta Water Conservation District and the Tulare Irrigation District had built a basin south of the community for managed aquifer recharge in the 1950s. However, since groundwater flows southwest toward Tulare Lake basin, this basin only benefited southern residents. Learning from this pattern, the Okieville Recharge Basin Project strategically positioned a new recharge basin up-gradient in the north (Figure 1), increasing recharge capacity during wet years while improving water quality for all residents. The facility provides 630 acre-feet annually and up to 1,400 acre-feet during wet years using high-quality Sierra Nevada surface water, with comprehensive monitoring wells assessing groundwater benefits.

Figure 1. Multibenefit Managed Aquifer Recharge in Okieville, California

Aerial view of the new managed aquifer recharge basin (bottom of the figure) north of Okieville and another aquifer recharge basin built in the 1950s (top right). These basins help improve water quality for the community. SOURCE: Aaron Fukuda, Tulare Irrigation District and Mid-Kaweah Groundwater Sustainability Agency.

Community Benefits: By recharging high-quality surface water up-gradient of the community, the project directly improves both the quantity and the quality of groundwater available to local residents. This approach can address critical concerns around water security for disadvantaged communities in the San Joaquin Valley while supporting local farmers who depend on groundwater.

Success stems from the project's community-centered approach, the strategic positioning, the quality of the water source, the comprehensive infrastructure built, and a robust monitoring program. The collaborative partnership model among the community, a nonprofit organization, and the irrigation district helped overcome construction delays and other obstacles.

Broader Impact: Okieville demonstrates how managed aquifer recharge, developed collaboratively, can achieve multiple goals toward groundwater sustainability. The project offers a replicable model, showing that strategic partnerships and multibenefit design can address groundwater depletion while prioritizing community water security.

Floodplain Restoration

Floodplain restoration reestablishes the natural connections of rivers with their historical floodplains (Figure 2). As a result, natural river processes safely accommodate floods while infiltrating water to replenish aquifers and maintain steadier river flows over extended periods (Case Study 2).

These restored floodplains are natural overflow areas that allow water to spread across landscapes during high flows. In contrast, levees and channelized infrastructure confine water to narrow channels, which increases flood risks by creating faster-moving water that can overwhelm downstream communities and infrastructure—for example, the catastrophic levee failure in California's Pajaro River in March 2023. Confinement also prevents groundwater recharge and reduces habitat for wildlife.

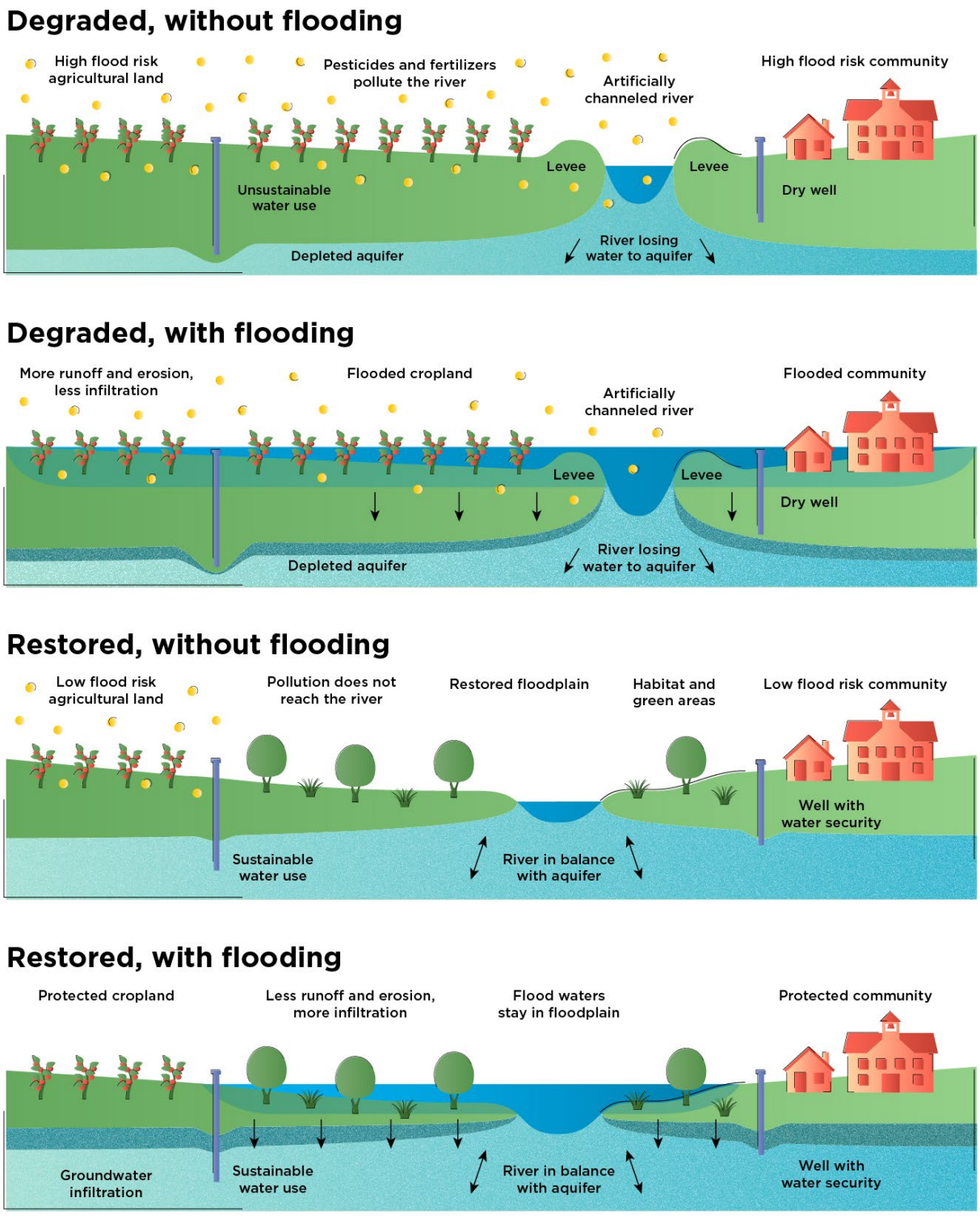
Riparian and wetland systems offer versatile, nature-based solutions for addressing multiple challenges, from cleaning polluted water to providing suitable habitat. Wetlands can yield significant benefits for the environment and public health, and they contribute to agricultural sustainability and broader community well-being. For example:

- **Floodplain reconnection**: Removing or setting back levees and implementing flood bypass systems to allow controlled overflow during peak flows gives rivers more room to spread naturally across landscapes. These approaches decrease water velocity and height at peak flows, protecting downstream communities from flooding while providing recharge and other benefits.
- **Riparian and seasonal wetland restoration**: Restoring riparian forests and seasonal wetlands provides habitat for native species and increases floodplain capacity and connectivity. Such projects vary by location, from seasonal wetlands supporting migratory waterfowl along the Pacific Flyway to perennial wetlands that support diverse native species. Other possibilities include expanding major wetland complexes such as the Central Valley's Grassland Ecological Area, or National Wildlife Refuges such as the Pixley, Kern, Merced, Sacramento, and San Luis.
- **Vernal pool restoration**: Restoring vernal pool ecosystems that fill with winter rains and dry up during the summer supports highly specialized and often endangered species, including the fairy shrimp and native amphibian plants.
- **Coastal wetland restoration**: Restoring tidally influenced coastal wetlands in areas like Monterey Bay provides natural protection from storm surge and rising sea levels.
- **Cultural preservation**: Incorporating tribal perspectives and protecting sacred lands of high cultural significance, such as Pa'ashi (Tulare Lake), helps ensure that restoration efforts honor Indigenous connections to these landscapes.

Site Selection Criteria

- Historical floodplains and wetland areas
- Sites where frequent flooding damages operations
- Near or upstream from communities that are vulnerable to flood damage
- Sites with potential to improve habitat by maintaining or restoring connections between surface water and groundwater

Figure 2. Floodplain Restoration



Rivers that are artificially confined to narrow channels are more likely to overflow and cause flooding in nearby lands and communities. Reconnecting rivers to their historical floodplains allows water to be safely distributed along the floodplain, creating habitat, green areas, and a larger space for aquifer recharge.

Case Study 2. Dos Rios Multibenefit Floodplain Restoration

Location: Near Grayson, Stanislaus County, California

Landowner: River Partners and California State Parks

Description: The Dos Rios Ranch Preserve exemplifies multibenefit land repurposing on a large scale. The nonprofit River Partners, landowner and project lead, converted 1,600 acres of a former dairy into California's largest floodplain restoration to date (Figure 3). It is located at the confluence of the Tuolumne and San Joaquin rivers, near the disadvantaged unincorporated community of Grayson.

Figure 3. Floodplain Restoration at Dos Rios Ranch Preserve

The Dos Rios Ranch Preserve protects downstream communities from floods while conserving about 7,000 acre-feet of freshwater annually. SOURCE: River Partners.

Implementation and Outcomes: River Partners managed $40 million in funding from multiple sources to purchase the land and plant over 280,000 native trees and shrubs. This created critical habitat for nine priority species, including the endangered riparian brush rabbit and Least Bell's vireo. The restoration protects downstream communities from floods while conserving about 7,000 acre-feet of freshwater annually. A three-acre Native Use Garden, which includes plants used for Indigenous basketry and other cultural uses, honors the perspectives of Indigenous peoples.

Community Benefits: The project created 250 construction jobs in a region with limited economic opportunities. It also provides workforce development in environmental restoration. It has also improved local air and water quality by eliminating dairy-related emissions and nutrient runoff, which had contributed to regional pollution.

Long-Term Value: In 2024, the preserve achieved permanent protection status as a California State Park, ensuring long-term public access and ecological benefits. The site serves as a recreational destination and an educational resource with cultural significance for Indigenous peoples. At the same time, it provides flood management, carbon sequestration, and wildlife habitat services. The transition from intensive agricultural use to nature-based solutions demonstrates how strategic land repurposing can simultaneously address environmental justice concerns, honor Traditional Ecological Knowledge, create economic opportunities, and deliver essential ecosystem services to surrounding communities.

Stormwater Systems

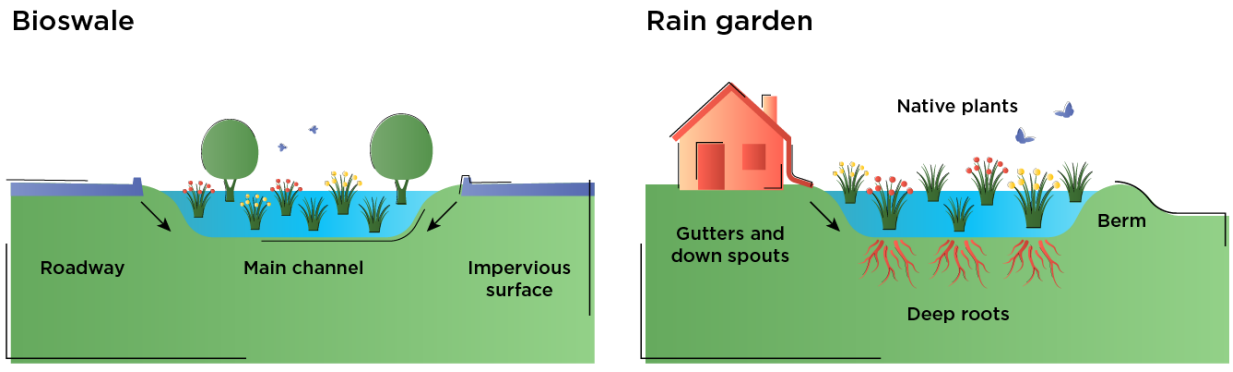
Nature-based stormwater systems address multiple infrastructure needs in urban and residential areas while providing essential services to disadvantaged locationsthat lack adequate drainage and green spaces (Figure 4 and Case Study 3). These systems manage rainfall and runoff naturally and improve the quality of life and environmental health. For example:

- **Bioswales**: Green infrastructure designed to harvest stormwater and convey it safely, remove debris and pollutants, and create green areas with local cooling effect.
- **Rain gardens**: Landscapes designed to capture stormwater runoff and filter pollutants while creating green areas and infiltrating water into the ground.
- **Dual-purpose stormwater basins**: Green areas can be designed for recreation during dry periods (e.g., soccer fields, parks) and to collect excess stormwater during wet periods.
- **Infrastructure retrofits**: Existing infrastructure can be upgraded with drains, retention ponds, bioswales, permeable surfaces, and vegetated infrastructure.
- **Permeable surfaces**: Parking areas and public spaces with permeable surfaces can allow water to penetrate the soil instead of becoming runoff.
- **Off-channel flood storage basins**: Outside urban areas, storage basins on low-permeability soils can capture stormwater and slowly release water when needed. This can supplement water supplies, improve flood protection, and increase water quality and sediment settling.

Site Selection Criteria

- Towns and cities with aging stormwater infrastructure or permit requirements related to water discharge or pollutant loads
- Areas that flood during storms
- Public spaces that need improved green infrastructure
- Communities interested in managing stormwater sustainably

Figure 4. Bioswales and Rain Gardens



Bioswales and rain gardens help control excess stormwater and filter pollutants by capturing runoff from impermeable surfaces (e.g., roadways, roofs).

Case Study 3. Fairmead Multibenefit Stormwater Basin: A Nature-Based Solution in a Community Buffer

Location: Fairmead, Madera County, California

Project Size: 17.3 acres of a former almond orchard

Landowner: Small farmer living on the land

Description: Fairmead is an unincorporated disadvantaged community facing environmental and infrastructural challenges, including failing water wells, groundwater depletion, flooding during storms, poor air quality, and a lack of community amenities.

Figure 5. Fairmead's Integrated Solution to Environmental and Infrastructure Challenges

The Fairmead Multibenefit Stormwater Basin uses a design that integrates native vegetation, a walking path, and habitat areas. SOURCE: Fairmead Community and Friends, Sustainable Conservation.

Community-Centered Success: The nonprofit Fairmead Community and Friends, with support from external partners, led six community workshops. This helped ensure that resident priorities guided project design. Community leaders, local farmers, and partner organizations collaborated for several years.

Nature-Based Solution: The Fairmead Groundwater Resilience Project is transforming a water-intensive almond orchard into an integrated stormwater management system. When complete, it will feature a 10-acre, habitat-friendly basin for flood capture and native vegetation, a community walking path—the area's first public green space—, and ecological restoration areas with cover crops and pollinator habitat (Figure 5).

Benefits: The project saves 37.6 acre-feet of groundwater annually, while infiltrating 47 to 72 acre-feet for aquifer recharge. Other environmental benefits include reducing more than 1,500 pounds of nitrate leaching to local aquifers. The basin can accommodate most flood events, protecting adjacent infrastructure.

Constructed Wetlands for Water Treatment and Habitat

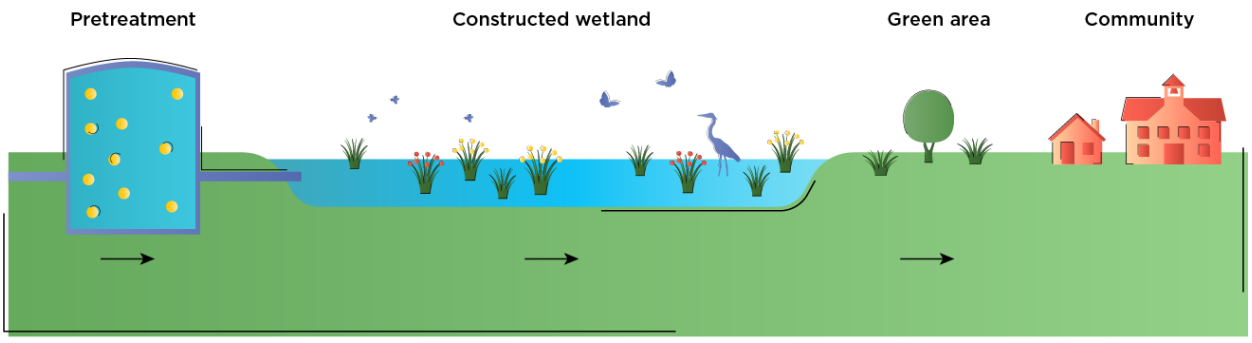
Constructed wetlands can be engineered to become water treatment systems that create habitat and deliver additional community benefits. In these systems, natural processes filter contaminants and nutrients, support biodiversity, and provide green spaces. Such projects can create excellent educational and research opportunities, demonstrating how infrastructure can serve multiple community needs (Figure 6). For example:

- **Community wastewater treatment**: Constructed wetlands can serve communities lacking wastewater infrastructure or enhance current water treatment facilities, while creating safe, sustainable green areas and contributing to habitat and recreation.
- **Agricultural runoff treatment**: Constructed wetlands can filter nutrients and contaminants from agricultural drainage, preventing water quality degradation while creating wildlife habitat. In coastal regions, treatment wetlands can be designed as systems that use natural tidal cycles to enhance treatment processes.

Site Selection Criteria

- Disadvantaged communities that need wastewater treatment solutions
- Sites with potential to accommodate water treatment and create habitat
- Downstream from agricultural drainage, with careful consideration of contaminant levels to avoid creating ecological traps (sites that attract wildlife but expose them to harmful pollution)

Figure 6. Constructed Wetlands for Wastewater Treament



Constructed wetlands can support or provide wastewater treatment for cities and communities in a safe way, and filter pollutants brought by runoff from different sources while also contributing to habitat creation, green areas, and more sustainable water use.

Community Infrastructure

Buffer and Revitalization Zones for Communities and Sensitive Environments

Transition zones between agricultural operations and communities or between agricultural operations and sensitive ecosystems provide benefits for farmers, residents, and ecosystems (Fernandez-Bou et al., 2023) (Figure 7). At the same time, they promote collaborative approaches and build understanding among people with different land use priorities (Case Study 4). These projects protect communities and sensitive ecosystems from exposures to some harmful agronomic practices (e.g., pesticide spraying or dust from tillage and farm operations). For example:

- **Community buffer zones**: Pesticide-free zones and rewilded areas around disadvantaged communities adjacent to agricultural lands reduce exposure to drifting pesticides, improve local air quality, and provide cooling effects. They also serve as physical barriers that protect residents from the harmful impacts of intensive agricultural operations.
- **Green belts and riparian corridors**: Native vegetation buffers can protect communities and sensitive environmental areas along waterways and irrigation systems located near agricultural operations. These buffers can filter agricultural runoff, separate communities from industrial farming, and create connected pathways for wildlife movement and community recreation.
- **Public greenways**: Safe walking and recreation spaces connecting rural communities.
- **Beneficial insect pathways**: Natural habitat corridors can connect pollinator populations across agricultural landscapes and help with pest management through beneficial insects.

Site Selection Criteria

- Revitalization zones up to one mile around disadvantaged communities and schools
- Buffer zones along waterways (e.g., rivers, wetlands) and other sensitive environments
- Agricultural lands near communities willing to transition to pesticide-free, ecofriendly farming

Green Spaces and Living Infrastructure

Multifunctional landscapes that integrate nature into built environments can provide underserved communities with recreational opportunities, access to natural and cultural resources, flood control, beautification, and climate cooling. These multibenefit community assets combine native vegetation, urban farming, and green building technologies to result in cooler, healthier, and more resilient communities. At the same time, they reduce maintenance costs and water demand. For example:

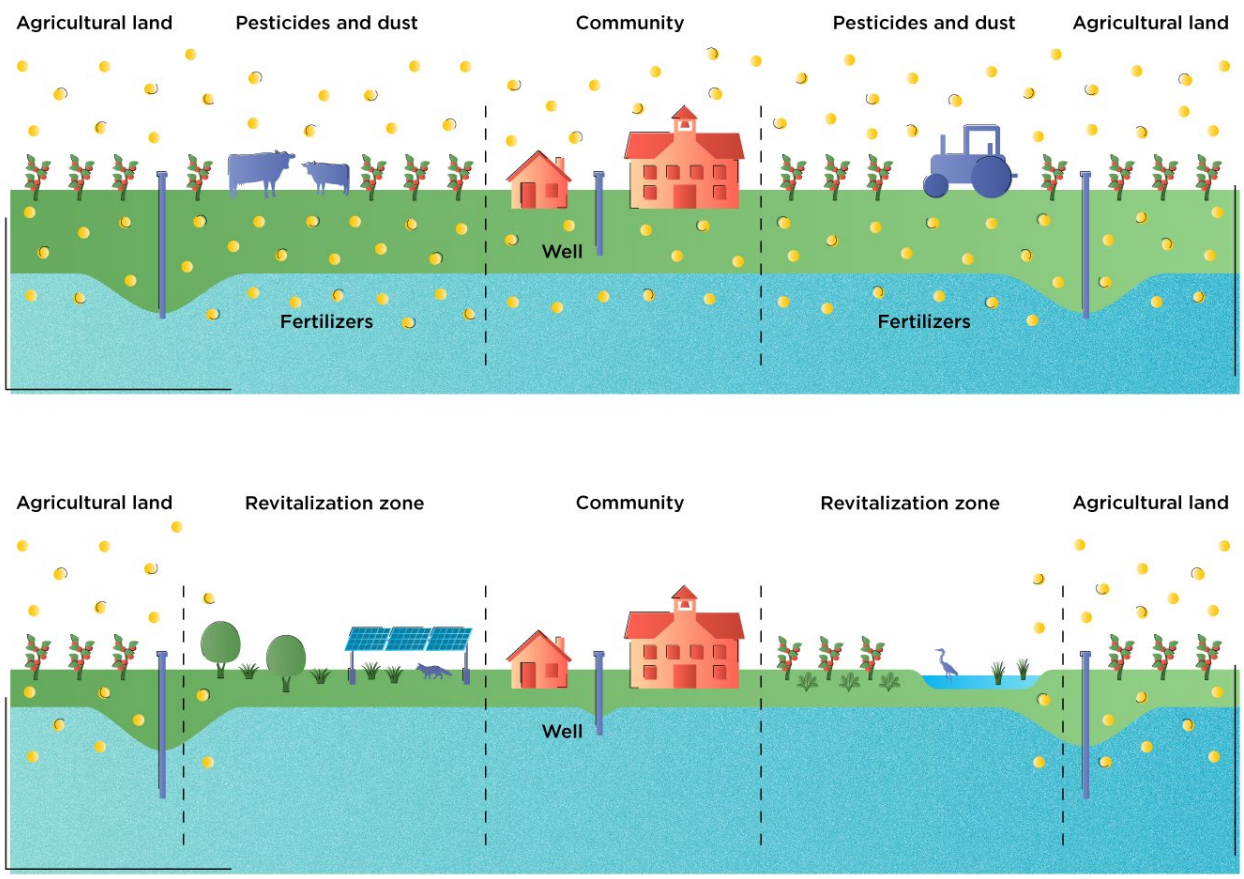
- **Community gardens**: Community safe spaces can combine the production of culturally relevant crops with native habitat. As gathering places, they strengthen social connections and provide fresh food and educational opportunities.
- **Cultural preservation**: Projects that support traditional farming knowledge and practices can be integrated with modern sustainable technologies in safe, community-based educational environments that preserve cultural identity and build climate resilience.

- **Green roofs and walls on buildings**: These approaches to construction provide insulation, reduce energy costs, and improve air quality while providing beautification.
- **Green streets**: Bioswales, permeable surfaces, and street trees can help manage runoff, reduce urban heat, and make neighborhoods more livable.

Site Selection Criteria

- Communities lacking green spaces
- Communities experiencing extreme heat, dust, flooding, or bad air quality

Figure 7. Buffers and Revitalization Zones



Strategically transitioning agricultural land within one mile of communities to green spaces, green economic activities, and sustainable agriculture can reduce community exposure to harmful agronomic practices, while providing multibenefit opportunities, including recreation, habitat and wildlife corridors, energy in ecovoltaic and agrivoltaic systems, enhanced local economies, toxic pesticide-free agriculture, agritourism and ecotourism, and other benefits to the community and local interests.

Case Study 4. Allensworth Community Transformation Through Regenerative Agriculture and Cropland Repurposing *by Allensworth Progressive Association Staff*

Location: Allensworth, Tulare County, California

Project Size: 2,000 acres to 4,000 acres

Project lead: Allensworth Progressive Association (APA)

Allensworth's Land Acknowledgement: The APA's vision for economic prosperity, solidarity, and a climate resilient ecosystem takes root on the ancestral lands of the Yokuts, which today includes the federally recognized Tachi Yokut Tribe and Tule River Indian Tribe. Pa'ashi is the center of the Yokuts' world and their creation place. Today, APA and the Tachi Yokuts work in solidarity together to restore thriving and healthy ecosystems and communities living within and along the lakebed.

Past, present, and future are woven together in Allensworth's soil. All our ancestors are buried in this ground. It holds their sweat, loves, struggles, dreams. It also holds crushed dreams and the damage done to soil, air, water, and people through the violence of industrial agribusiness aligned with racial oppression. We are reviving long-deferred dreams, and the promise of prosperity through agricultural enterprise—claiming the right to own, measure, and manage, not just to labor so that others may grow rich. We are lifting up the dignity of community-based farmers and repairing an alienated relationship between food producer and food consumer.

Challenges:
Allensworth experiences multiple, compounding issues created by a legacy of disinvestment and historical discrimination. Environmental health has suffered from centuries long colonial industrial agricultural practices, leading to polluted and taxed water supply, depleted and salted soils, and critically degraded air quality. Climate change is only exacerbating existing environmental and public health issues.

The lack of public investment in infrastructure has left the current infrastructure outdated and deteriorated, including inadequate water supply storage and dilapidated conveyance, and lack of appropriate wastewater treatment. Allensworth also lacks emergency services for drought, fire, and flood—there have been several fires in the community that have devastated a few residents' homes, and Allensworth flooded in 2023 while also experiencing drought-related water issues. There is also very little infrastructure and space for community work and events. In addition, the community has very limited access to natural areas and waterways for recreation and increased quality of life. Residents are burdened with high utility bills that only offer subpar and spotty services.

Allensworth has also experienced systemic racism and worker exploitation almost since its inception more than one century ago. The economic fallout in the agricultural sector caused by agricultural land retirement is looming in Allensworth's horizon, unclear if it will help public health or if it will exacerbate social, economic, and environmental issues in the community.

Multiple Benefits with Nature-Based Solutions in Allensworth

Agroecology Hub: Allensworth is planning a community-owned Agroecology Hub (Figure 9). The Hub will demonstrate regenerative farming practices and will showcase the process of cultivating a diverse range of healthy foods for the community and surrounding regions, employing practices that rebuild healthy soil, enhance biodiversity, and sequester carbon. Multiple nature-based solutions are featured in the Hub, including rain gardens and bioswales (Figure 4), agrivoltaics (Figure 10), and multibenefit aquifer recharge (Figure 11).

The harvest from the farm will increase access to fresh, nutritious produce, promoting a more resilient local food system. The Hub will also serve as a learning center with workshops and demonstrations on regenerative agriculture to empower growers. Saving seeds initiatives will foster seed biodiversity and self-reliance. The farm will increase crop biodiversity and strengthen the regenerative potential of the system. Together, these efforts will create a secure and healthy food and nutrition system for the community, generating local food sovereignty. The Hub will become a showcase for best practices of agricultural land use in the Central Valley and other agricultural regions in California and the United States.

Small scale, regenerative farm: The Agroecology Hub will have a Rabbitry for cultural practices of several groups in and around Allensworth. The Vermicompost facilities will provide high-quality soil amendments for the farm, for neighbors who grow their own food, and for sale. The Hub will also have speciality crop production and cultural gardens to preserve traditions of community residents.

Regenerative Agriculture Training: Allensworth will function as an educational space for community members and visitors. The community already has a Beginning Farmer Training Program aiming to train future local farmers in agroecology principles; a Summer Climate Youth Program in partnership with the nonprofit SEEN focused on providing locally contextualized knowledge for students and sparking in them the interest to pursue higher education; and an Adult Explorer Program.

Land Access Program for people and farmers of color: The Hub will promote affordable land access for small-scale regenerative agriculture. The community will also build low-cost climate resilient housing and community buildings like the proposed Allensworth Resiliency Center (Figure 8).

Agrivoltaic system for energy sovereignty: Allensworth experiences electricity issues that create water insecurity and prevent people from protecting themselves against extreme heat in the summer. To guarantee fundamental rights for the community, Allensworth is pursuing an agrivoltaic system targeting 10 MW of installed solar energy to provide low-cost electricity for residents and community services. Agrivoltaics also create new crop diversity opportunities for plants sensitive to excessive direct sunlight while reducing crop water demand thanks to reduced evapotranspiration (Figure 10).

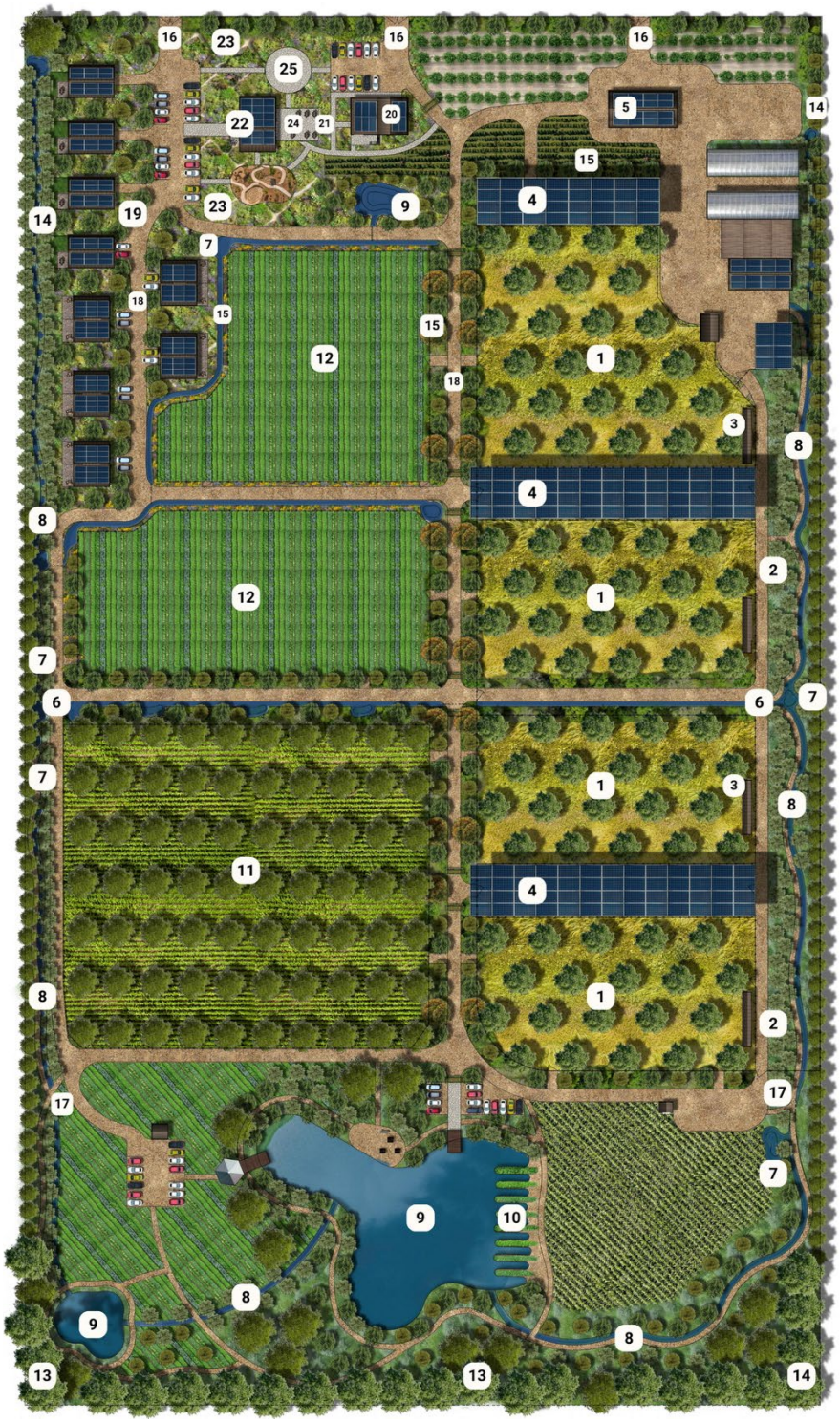
Economic opportunities and technology: The Agroecology Hub and the whole surroundings will be an Agroturism attraction and a teaching center for visitors. The Hub will also have a gift shop for tourism and will function as a grocery store to provide fresh, healthy, and nutritious food for the community. Allensworth is also partnering with multiple research groups and universities to bring technologies, such as a proof of concept for arsenic removal with UC Berkeley that will solve a major water quality problem in the community and will be licensed after the research done in Allensworth.

Constructed Wetland for Wastewater Treatment: A wetland wastewater system (Figure 6) will provide a buffer around the community (Figure 7) creating habitat for native species and migratory birds, and for aquifer recharge to improve our overall water supply and will better accommodate incremental and appropriate slow growth of the community (Figure 11). This new wastewater system will allow us to build additional climate resilient housing for new farmers and current residents and support the building of new infrastructure like our planned community resiliency center.

Figure 8. Allensworth Resiliency Center

Allensworth Resiliency Center will have green roofs and walls to decrease temperatures in the summer and help purify the air air. The Center will provide gathering, work, and learning space for residents and local agencies and organizations. SOURCE: Allensworth Progressive Association and Arthur Dyson Architects.

Figure 9. Allensworth Agroecology Hub



Legend

Rabbitry
1. Integrated rabbitry silvopasture system
2. Rabbit fodder riparian zone
3. Rabbit feed barn
4. Agrivoltaic vermiculture system
5. Multiuse two-story barn

Water management
6. Cultiverts to connect swales
7. Rain gardens
8. Water diversion swales
9. Ponds
10. Pond chinampa system

Growing areas
11. Integrated orchard & alley cropping systems
12. Row crops
13. Nut tree & Native forest zones
14. Perimeter forest
15. Hedgerow systems

Pathways and residences
16. Farm entrances
17. Pedestrian pathway system
18. Farm road system
19. Residential Village

Community areas
20. Gift store, commercial kitchen, and offices
21. Dynamic public interface
22. Community building and Culture center
23. Cultural (Ethnic) gardens
24. Outdoor dinning
25. Cultural gathering area

The Allensworth Community Cooperative Regenerative Farm including Agrivolatics. SOURCE: Allensworth Progressive Association and Permaculture Artisans.

Agricultural Practices

Sustainable agricultural practices can reduce water use, improve environmental conditions for disadvantaged communities and ecosystems, and provide economic benefits for farmers. These multibenefit approaches can replace conventional, resource-intensive agricultural practices; instead, agriculture can work with natural processes to address unsustainable water use, pollution, and habitat loss, while maintaining agricultural productivity and improving conditions for farmworkers. For example:

- **Natural drainage systems**: These include vegetated ditches with native sedges and rushes, two-stage systems with integrated floodplains, and farm-integrated wetlands that filter agricultural runoff.
- **Wildlife-friendly farming**: Native hedgerows and intercropping can support pollinators, provide raptor perches for natural pest control, and create wildlife corridors that connect preserved habitats across farmland.
- **Soil health practices**: No-till farming and cover cropping preserve soil structure, reduce erosion, increase water retention, improve soil fertility, and provide habitat for beneficial insects—all while decreasing input costs.
- **Compost and organic waste programs**: Local organic waste can yield nutrient-rich soil amendments that improve soil health, reduce synthetic fertilizer needs, and support circular waste-management systems.
- **Tree integration systems**: Agroforestry and silvopasture are practices that combine trees with crops or livestock to provide shade, windbreaks, diversified income sources, carbon sequestration, and improved water infiltration.
- **Agroecological practices**: Agricultural practices inspired by agroecology align with nature-based solutions and contribute to social, environmental, and economic sustainability for agricultural regions. They improve the quality of life, the environment, and the nutritional quality of the food produced.

Site Selection Criteria

- Farms experiencing runoff
- Operations interested in reducing input costs and diversifying income
- Agricultural areas needing habitat connectivity
- Pollinator-dependent ecosystems
- Farms on marginal soils or transitioning from intensive practices

Energy Integration and Infrastructure Corridors

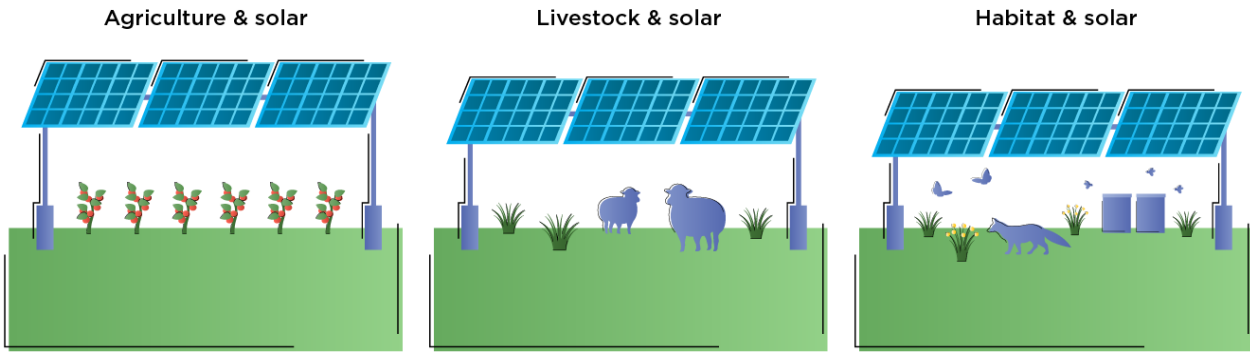
Integrating renewable energy production with agricultural activities (agrivoltaics) or with habitat restoration (ecovoltaics) maximizes land use benefits while creating diverse economic opportunities for rural communities (Fernandez-Bou et al., 2024) (Figure 10). Energy transmission is a necessity, but the land for its infrastructure can be used simultaneously for other purposes. For example, wildlife habitat can support biodiversity near transmission lines, even potentially reducing maintenance costs. For example:

- **Ecovoltaics**: Solar installations are compatible with native pollinator habitat, upland habitat, and wildlife-friendly fencing.
- **Agrivoltaics**: Combining solar with shade-tolerant crops reduces water and energy costs, while maintaining crop productivity.
- **Community solar**: Projects on retired agricultural land can provide local energy security and jobs.
- **Aquifer recharge and solar**: Solar can be combined with managed aquifer recharge systems.
- **Green infrastructure corridors**: Some examples are establishing habitats along power line rights-of-way, integrating utility needs and conservation, and creating wind breaks that protect infrastructure, wildlife, and agriculture.

Site Selection Criteria

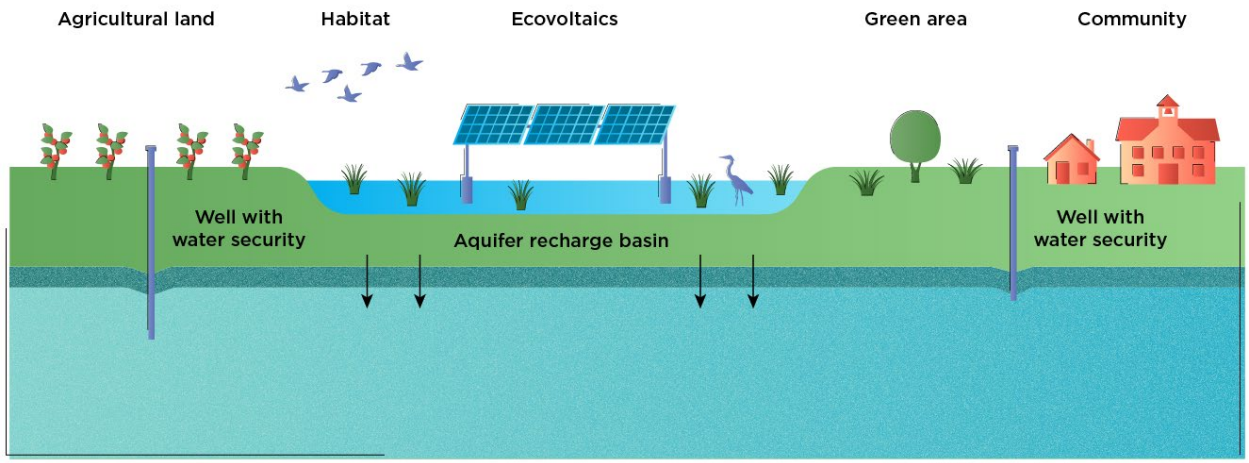
- Under transmission lines: Sites that allow habitat and energy connectivity, optimizing costs and maximizing environmental benefits
- Energy sovereignty projects: Energy projects that guarantee energy security to nearby communities
- Agrivoltaics: Any farm that can grow shade-tolerant crops or livestock to offset electricity bills or sell electricity; for projects selling electricity, sites near transmission lines are more suitable
- Ecovoltaics: Any solar energy facility. Ideally, projects enhance energy security for local disadvantaged communities and provide other benefits. For wildlife corridors, sites can include existing utility rights-of-way needing vegetation management, new renewable energy transmission corridors, and areas where infrastructure development has fragmented habitat connectivity.

Figure 10. Renewable Energy Enhancing Agriculture and Habitat



Solar arrays can be co-located with shade-tolerant crops, livestock, or wildlife habitat to support energy security while maintaining agricultural production or providing habitat corridors for wildlife.

Figure 11. Multibenefit Managed Aquifer Recharge with Ecovoltaics and Recreation



Including solar energy generation with projects to construct groundwater recharge basins can support renewable energy production while also allowing for seasonal groundwater recharge, habitat, and green areas.

Habitat Restoration

Habitat restoration can be a critical investment that provides essential ecosystem services and multiple other benefits, including carbon sequestration, improved water quality, flood control, local economic benefits, and recreational opportunities. Habitat restoration projects create system-level benefits while helping conserve native species through connected landscapes that support biodiversity and ecosystem resilience (Butterfield et al., 2017). Restoration projects can also support local community needs, offer tourism opportunities for birdwatching and recreation, and create opportunities for employment, especially near disadvantaged agricultural communities undergoing cropland repurposing. For example:

- **Wetland and riparian habitat**: Protection for the valley elderberry longhorn beetle and giant garter snake habitat along Central Valley waterways or for the California red-legged frog in Central Coast agricultural areas can also provide flood control, recreation, and educational opportunities.
- **Upland and desert scrub habitat**: Restoring habitats can create low-water systems compatible with arid conditions and agricultural landscapes. Two examples are habitats for the blunt-nosed leopard lizard on marginal Central Valley agricultural lands and California gnatcatcher coastal sage scrub restoration in Southern California agricultural areas.
- **Grassland and grazing habitat**: Restoring habitats for the Tipton kangaroo rat and restoring native coastal prairie can be compatible with grazing.
- **Endangered species recovery habitat**: Restoring San Joaquin kit fox habitat corridors in the Central Valley and steelhead trout riparian restoration along Central Coast watersheds can help connect fragmented populations across agricultural landscapes.
- **Landscape connectivity and integration**: Coordinating restoration across multiple habitat types can minimize fragmentation, maximize habitat investment benefits, and integrate with other nature-based solutions to create comprehensive ecosystem networks.

Site Selection Criteria

- Areas designated as critical habitat under California and federal endangered species legislation
- Sites identified in species-recovery plans as critical for population recovery
- Agricultural land retirement areas with suitable habitat conditions
- Sites where restoration can provide connectivity between existing preserves

Table 1. Benefits of Nature-Based Solutions for different Groups

	Water and Agriculture	Environmental Health	Community	Economy
Who Benefits	Water agencies, municipalities, farmers, rural communities	Disadvantaged communities, wildlife, ecosystems	Rural residents, families, community organizations	Farmers, landowners, local businesses, workers
Floodplain Restoration	Flood risk control, natural aquifer recharge	Seasonal habitat for migratory birds, ecosystem restoration	Recreational opportunities, accessible green areas	Waterfowl hunting lease revenue, reduced flood-damage costs
Multibenefit Managed Aquifer Recharge	Increased groundwater storage, overdraft reduction, enhanced water security	Ecosystem services, native vegetation habitat, carbon sequestration	Reduced flood risk, increased drinking-water security, educational opportunities	Reduced water pumping costs, less reliance on bottled water, increased property value
Stormwater Systems	Reduced flooding risks, improved water quality, pollutant filtration	Air quality improvement, reduced urban heat-island effects, green infrastructure	Recreational opportunities, community stewardship programs	Lower maintenance costs, infrastructure cost savings
Wetlands	Water treatment, pollutant removal, potential water reuse	Critical habitat for protected species, reduced groundwater pollution	Green spaces, educational opportunities, birdwatching recreation	Cost-effective water treatment, reduced infrastructure costs
Buffer Zones	Filtered agricultural runoff, improved water quality, better farm-community relations, pollinator support	Wildlife corridors, reduced pesticide drift, reduced air pollution	Safe walking and recreation spaces, reduced farm-community conflicts	Natural pest control, reduced chemical input costs
Community Green Spaces	Stormwater management, flood control, support for traditional farming knowledge and identity	Significant temperature reduction, improved air quality, urban habitat support	Safe recreational spaces, community gathering areas, cultural preservation, nutrition security	Reduced cooling costs, health cost savings, increased property value
Sustainable Agriculture	Reduced irrigation needs, improved soil health, farm resilience, reduced long-term costs	Reduced nutrient loading, natural pest control; habitat creation	Improved farmworker conditions, healthier rural environments	Reduced pesticide costs, carbon credit revenue, conservation program payments
Energy Integration	Water savings and shade in agrivoltaics, combined recharge systems	Pollinator habitat, wildlife movement corridors, reduced infrastructure maintenance	Local jobs, reduced electricity bills, energy security	Clean energy revenue, income from multiple land uses, local employment
Habitat Restoration	Improved watershed health, enhanced water quality, natural pest control, pollination support	Endangered species recovery, ecosystem resilience, biodiversity support	Educational opportunities, research collaboration, ecotourism potential	Conservation credit revenue, wildlife viewing income, research partnerships

Considerations for Implementing Nature-Based Solutions

Nature-based solutions can be incorporated into diverse projects ranging from water recharge to community green spaces and energy infrastructure (Smith et al., 2025). This section discusses a few general considerations, including community engagement, permitting, technical assessments, monitoring and maintenance, land ownership, and funding opportunities.

Community Engagement

Non-extractive community engagement should occur throughout project planning, from scoping and design through implementation (Fernandez-Bou et al., 2025). The appropriate scale and level of engagement may change according to each project's scope and phase. Before the design phase, community surveys or needs assessments can help decisionmakers understand self-described community needs and design projects that address those priorities (e.g., providing certain benefits or locating a project in a particular area).

During the design phase, engagement opportunities may inform community members who, in turn, can provide feedback to be incorporated into the project design. Well-designed projects directly address local needs and provide meaningful benefits—instead of incidental ones. Community engagement should be tailored to the project and community it serves (Fernandez-Bou et al., 2021).

Funding programs may include requirements around community engagement. For example, the California Department of Conservation has defined meaningful benefits for disadvantaged communities for grants awarded by the Multibenefit Land Repurposing Program (California Department of Conservation, 2025).

Permitting

Projects must comply with applicable local, state, and federal permits. Permitting should be considered early in the planning process to avoid unnecessary delays.

Recent California statutory and policy regulations have aimed to reduce permitting burdens and increase coordination for projects that benefit biodiversity or native species. Whether a project qualifies for a consolidated permit or an exemption to the California Environmental Quality Act will depend, among other factors, on project size and design, anticipated benefits, and anticipated impacts, as well as whether the project includes voluntary restoration or legally required mitigation.

State or federal agencies can provide program details; online resources include Sustainable Conservation's Essential Guide for Accelerated Restoration Permitting.

Technical Assessments

Project developers should conduct site suitability studies and technical assessments early in the planning process and before project construction and implementation. Technical studies can help evaluate whether an intended site is appropriate for the anticipated use and avoid unintended consequences. Studies may be necessary to comply with permitting and environmental review requirements. Technical assistance programs may be available through the Multibenefit Land Repurposing Program and other public funding programs.

Monitoring and Maintenance

Continuous project monitoring—before, during, and after implementation—helps track whether anticipated anticipated project benefits are achieved (Nuñez-Bolaño et al., 2025). Depending on the design, projects may need maintenance after implementation.

Monitoring also can provide important learning opportunities—for example, to better understand natural processes and species' needs and behavior and to access real-world performance data. Such learning can help guide future projects.

Strategic partnerships can help project developers with monitoring and maintenance. For example, public agencies or universities may be interested in research. Nonprofits may seek to engage in community science or to provide opportunities for volunteers.

Land Ownership

Land ownership and land use restrictions will affect development at potential project sites. Land use restrictions may result from government regulations (e.g., restrictions on certain activities on public lands), zoning restrictions, or agreements with private or public entities (e.g., Williamson Act contracts, conservation easements). Water access and availability also need to be considered for groundwater recharge, wetland restoration, and irrigation needs.

After construction, transferring land ownership or adding land use restrictions can support the long-term management of a project. A property owner who does not want to be responsible for long-term management could consider selling or donating the property to a qualified entity. Landowners who retain ownership could consider conservation easements. These voluntary legal agreements restrict private land use to support conservation values. Some easements may require maintaining agriculture or protecting wildlife habitat. Conservation easements are managed by qualified entities and are perpetual and tied to the land. Easements can be acquired with public funds or accepted as donations. Public and private entities, including parks districts, land trusts, and conservancies, can be landowners and sign agreements for property conservation.

Funding Opportunities

Numerous opportunities for state funding are available to support nature-based solutions, including funding for development and technical assistance, project implementation, and land acquisition. Mitigation programs can also fund habitat and species-specific restoration projects, although some grants prohibit using funds for mitigation. Some philanthropies, nonprofits, and other private entities can fund nature-based solutions projects too. Multiple funding sources may be creatively combined to implement multibenefit nature-based solutions projects where funding programs are limited to particular benefits or phases of a project (Grimm et al., 2025).

The California Grants Portal lists all state grant opportunities. It is important to stay up to date on funding guidelines, as project eligibility requirements may change over time. Project applications that include multiple benefits, benefit disadvantaged communities, and have demonstrated community support can be more competitive in the scoring process for certain programs.

When developing a project, consider the following funding sources:

- California Department of Water Resources: Grant programs fund water-quality improvements, ecosystem enhancement, sustainable groundwater management, and water resilience planning.
- California Wildlife Conservation Board: Multiple grant programs are available for habitat restoration, acquisition, and public access projects. Eligibility varies by program and funding source but may include nonprofit organizations, local government agencies, private landowners, and public utilities.
- California State Parks: Grant programs fund outdoor recreation, wildlife enhancement, and local parks. Projects can include trail systems, local parks, athletic fields, wetland restoration, picnic areas, and open space.
- California Department of Food and Agriculture: Multiple programs provide grants or technical assistance for farmers and ranchers interested in transitioning to organic farming, reducing chemical pesticide use, promoting pollinator habitat, and more.
- Energy: State and federal grants can support the inclusion of solar energy in nature-based solutions. More information about funding can be found in this *Agrivoltaics and Ecovoltaics* fact sheet (Fernandez-Bou et al. 2024).

The Future of Nature-Based Solutions in California Agriculture

Nature-based solutions can transform agricultural landscapes and rural communities into models of climate resilience and sustainable prosperity. Incorporating nature-based solutions in projects to repurpose land can address intertwined climate challenges while maintaining agricultural identities, restoring Native lands, and improving local economies.

The path forward requires farmers, communities, Indigenous peoples, environmental organizations, water managers, and policymakers to develop collaborative solutions that protect disadvantaged communities from environmental hazards, preserve agricultural economies, and diversify rural socioeconomic opportunities. When implemented with non-extractive community engagement, nature-based solutions can yield lasting benefits in terms of enhanced social cohesion and sense of belonging, reduced taxpayer costs, and improvements to public health and long-term food security.

The local efforts described here advance California toward its climate, energy, and water goals. Strategic cropland repurposing supports mandates for groundwater sustainability under the Sustainable Groundwater Management Act, contributes to the goal of a 100 percent transition to clean energy, and helps advance the 30×30 initiative, with the goal of conserving 30 percent of California's lands and coastal waters by 2030.

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The Allensworth Progressive Association (APA) was established in 1908 by the township's founders as the official form of government, conducting the community's business and fostering civic engagement. Reestablished in 1997 as a 501(c)3 nonprofit, the APA is the community's development organization, serving a largely Latinx population but with the same vision and founded on the original living legacy cultivated by the APA's founders.

The statewide support entity for California's Multibenefit Land Repurposing Program (MLRP) is a single entity funded to provide technical assistance, coordinate collaboration, and ensure meaningful engagement with historically underserved communities to facilitate the transition of agricultural lands into uses that provide groundwater sustainability and community benefits. This entity provides support to block grantees implementing MLRP projects and directly supports Tribes in their repurposing efforts.

The Union of Concerned Scientists puts rigorous, independent science into action, developing solutions and advocating for a healthy, safe, and just future.

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