The Central Valley Landscape Conservation Project: Summary

Prepared by the California Landscape Conservation Cooperative

CA LCC

THE CENTRAL VALLEY LANDSCAPE CONSERVATION PROJECT: SUMMARY

This report provides a brief summary of the methodologies and products associated with the Central Valley Landscape Conservation Project. For more information on this project please visit the project webpage (climate.calcommons.org/cvlcp) or contact Debra Schlafmann (debra_schlafmann@fws.gov).

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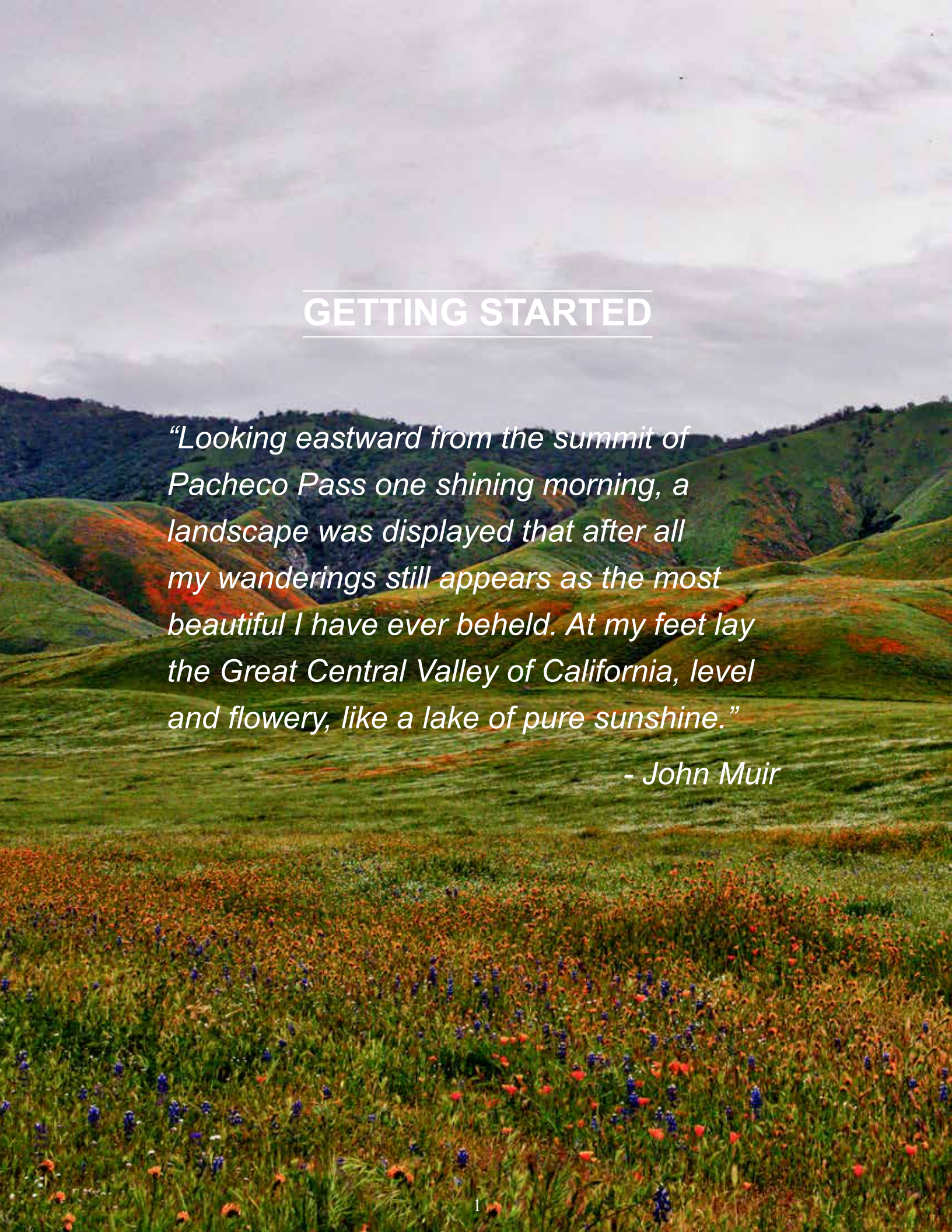


GETTING STARTED

“Looking eastward from the summit of Pacheco Pass one shining morning, a landscape was displayed that after all my wanderings still appears as the most beautiful I have ever beheld. At my feet lay the Great Central Valley of California, level and flowery, like a lake of pure sunshine.”

- John Muir

INTRODUCTION

The history of the Central Valley is a story about a landscape shaped by people residing within. Before European colonization Native Americas were able to sustainably manage and harvest enough resources to support over 300 Native American Tribes. Each new culture, Spanish, European, and finally American, arriving in the Central Valley left a mark on the landscape as they extracted increasing amounts of wealth and resources from its lands and waters. The most rapid changes to the Central Valley occurred in the 1900's, during which time dams and levees made it possible to harness the dynamism of the rivers and streams that once flowed unencumbered through the valley. Without restriction, those rivers expanded and contracted with the seasons supporting a variety of ephemeral and unique habitats, hundreds of miles of riparian habitat and millions of acres of wetlands. Plumbing the Central Valleys' waterways has ultimately supported expansive agricultural and urban development, and caused the modification or destruction of large swaths of natural lands.

Today, the Central Valley is a mosaic of agricultural, urban, and natural lands. The Valley produces a quarter of the nation's fruits, nuts and vegetables, and homes for over six and a half million Californians. Ninety four percent of land in the Central Valley is privately owned, but through the cooperation of private and public landowners it still is able to support a surprising amount of biodiversity. Sixty percent of the Pacific Flyway bird population relies on rice and managed wetlands in the Central Valley to fuel their annual migration. Three species of anadromous fish pass through the Central Valley on their journey from the Pacific Ocean to the headwaters of the San Joaquin, Feather, and Sacramento Rivers. And the vernal pool, serpentine shrub lands, and San Joaquin desert habitats support many plants and animals that are found nowhere else on Earth.

As we move into the 21st century, the humans and wildlife that depend on the Central Valley will face many new and familiar challenges. As a result of climate change, the Central Valley is highly vulnerable to numerous stressors such as increasing temperatures and drought. In addition, the population of the Central Valley is projected to double by 2040 (PPIC). These changes will put even more demand on California's limited water supply and will facilitate even more habitat loss. These challenges are complex and cannot be solved in isolation.

The Central Valley Landscape Conservation Project (CVLCP) was started to support existing partnerships in the Central Valley to ensure that public and private land managers have the resources needed to rise to these challenges and support an ecologically and economically viable Central Valley. The CVLCP is a partnership among a diverse set of state and federal agencies and non-governmental organizations (NGOs) committed to working together across the landscape. The planning effort described in this document was completed through the voluntary efforts of nearly 150 individuals, representing over 40 agencies and organizations.

Box 1. Projected Change in California's Central Valley

Climate change is already affecting Central Valley ecosystems, and the speed of these changes are expected to increase in the coming century. The observed and projected landscape scale changes in the Central Valley include:

- Increased frequency and intensity of wildfire
- Changes in stream flows
- More flooding
- Increased stream temperatures
- Less agricultural acreage
- Warming air temperatures
- More arid landscape
- Less snow, higher percent of precipitation as rain
- More intense droughts and extreme heat

Learn more

LAYING THE GROUND WORK - THE CLIMATE SMART CYCLE

The CVLCP partnership acknowledged early on that to ensure the success of this effort, any resulting plans or projects must address the impacts of climate change in concert with existing threats. To meet this challenge, the partnership chose to structure the CVLCP around the climate-smart cycle (Fig 1). The climate-smart cycle is a framework that builds on many of the foundational ideas of adaptive management, and also requires the consideration of the effects of climate change at each step. Specifically, the climate-smart cycle incorporates four overarching themes critical to achieving effective climate adaptation (Stein et al. 2014):

- Act with intentionality by linking actions to impacts
- Manage for change, not just persistence
- Re-evaluate goals for future conditions
- Integrate adaptation into existing work

The following sections of this report summarize the accomplishments the CVLCP partnership made while completing the first three steps of the climate-smart cycle:

1. Defined Goals and Identified Priorities
2. Assessed Vulnerability to Climate Change
3. Identified Adaptation Strategies and Actions

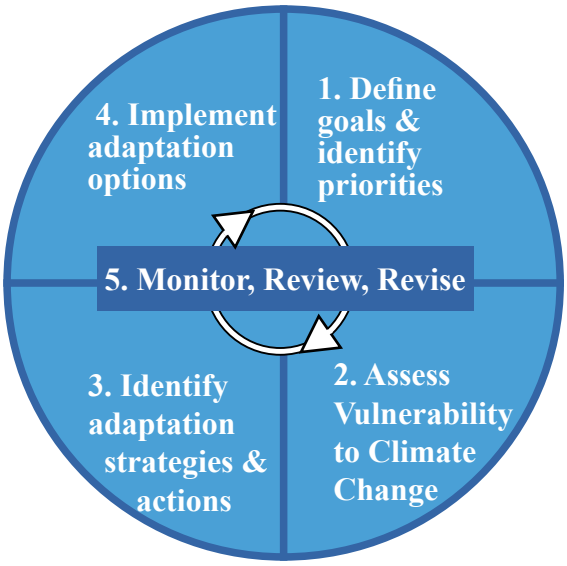


Figure 1. Climate smart cycle, adapted from Stein et al. 2014.

Box 2. Climate change adaptation & Landscape Conservation Design

Climate change adaptation planning and Landscape Conservation Design are two ideas that are foundational to the CVLCP.

Climate change adaptation -

Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2007).

Landscape Conservation Design -

Landscape conservation design (LCD) is a collaborative, transdisciplinary planning process that integrates societal values and multi-sector interests with the best available social and natural sciences to assess vulnerabilities, risks, and opportunities. It develops coordinated, spatially-explicit strategies that reduce land-use conflicts, enhance the adaptive capacity of the socio-ecological system, and maintain ecosystem function across the landscape for future generations (NAS, 2016).

DEFINING GOALS & IDENTIFYING PRIORITIES

"Do unto those downstream as you would have those upstream do unto you."

— Wendell Berry

DEFINING GOALS & IDENTIFYING PRIORITIES

There are many conservation actions that can be effectively and efficiently executed by a single entity. However, as the complexity and scale of conservation challenges increase, so does the need for collaboration across multiple sectors and jurisdictional boundaries. To facilitate collaboration and ensure that the CVLCP addressed challenges that spanned multiple partners, the participants worked together to review over 100 existing Central Valley plans. The partnership used the goals and objectives in the existing plans to develop inclusive goals for the CVLCP that were representative of the diversity of partnership. These are the resulting project goal and objectives used to guide this effort:

Project Goal

The goal of the Central Valley Landscape Conservation Project is to identify climate-smart conservation actions in partnership with scientists and natural resource managers that will maximize the adaptive capacity of priority species, habitats, and ecosystems to support an ecologically connected Central Valley landscape.

Project Objectives

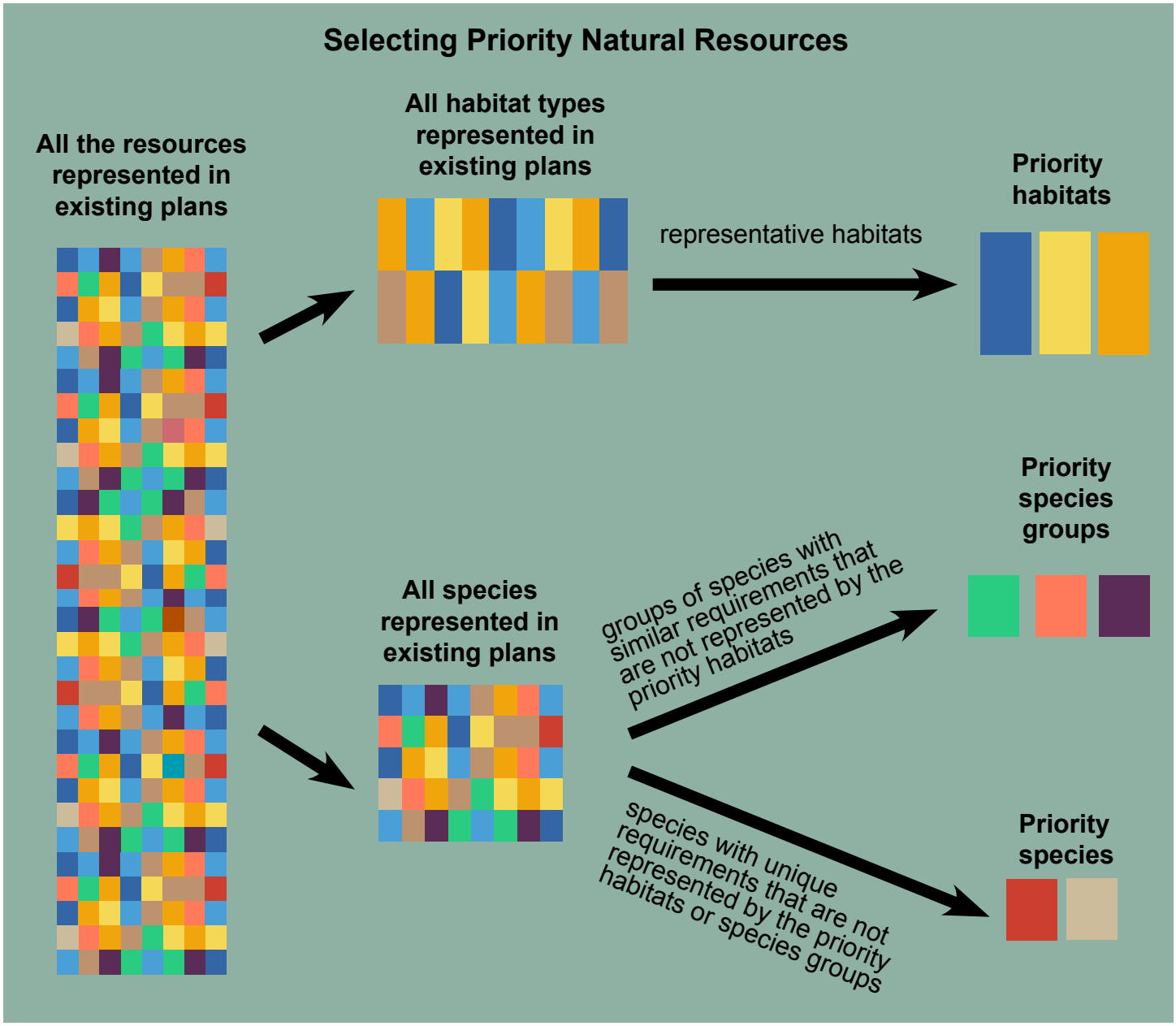
1. *Reduce the impacts of climate change and other co-occurring stressors to Central Valley ecosystems.*

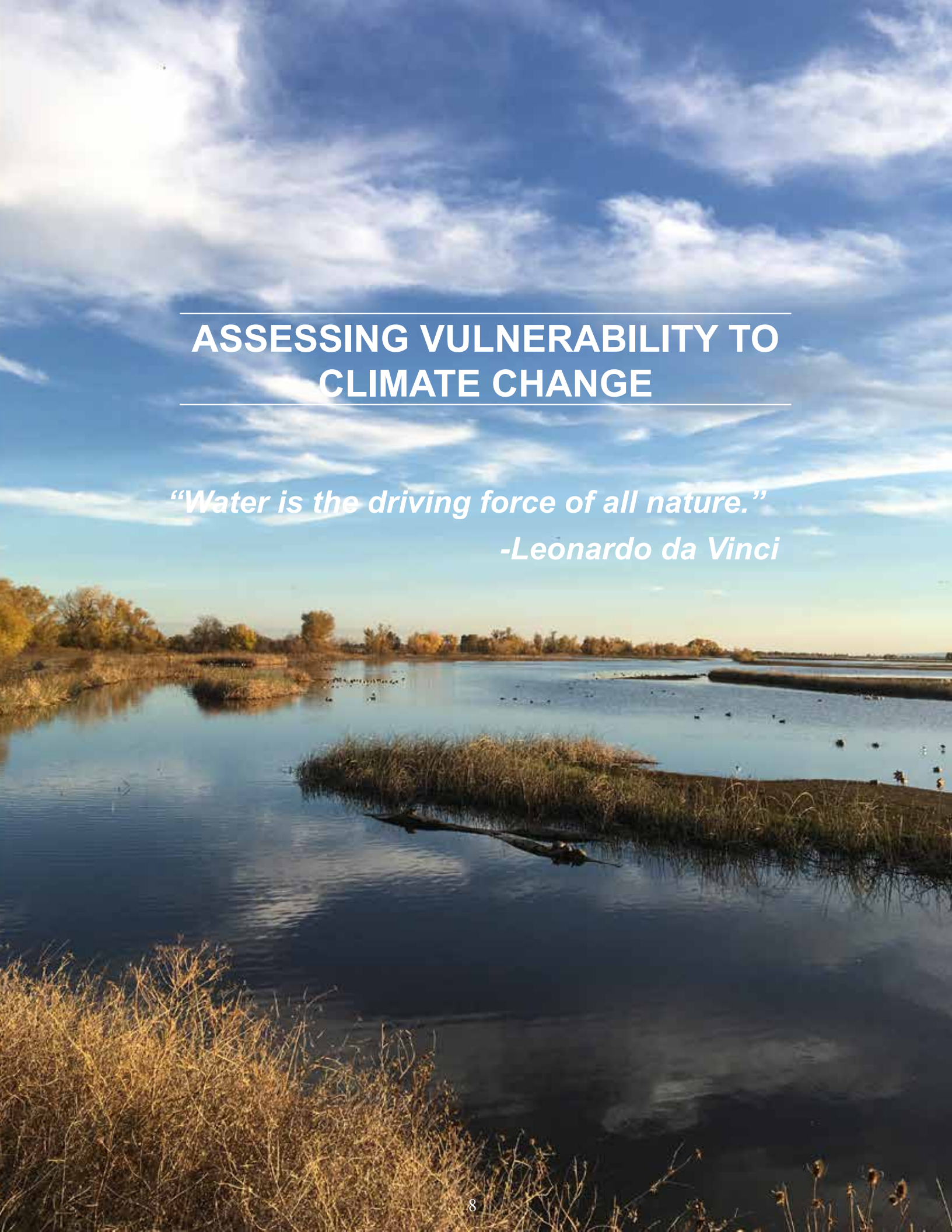
2. *Promote landscape-scale connectivity and ecological and physical processes that function within current and future ranges of variability to support a diverse and thriving Central Valley.*

3. *Conserve resilient and adaptable ecosystems that sustain future Central Valley biodiversity.*

Priority Natural Resources (PNR)

A total of 272 species and 24 habitats and/or ecosystems were identified as important in the 100+ plans used to develop the project goal and objectives. To provide more focus to the CVLCP, the participants identified a set of priority resources. To accomplish this, participants first ranked habitats using agreed-to criteria and then grouped as many species as possible under those habitat types. Some species were not represented under one habitat type and when that was the case, species groups were identified. If a species did not fit under a habitat type or a species group, then it was listed as its own PNR. Through this process, participants reduced the number of PNRs originally from 296 to a set of 35 PNRs (see pg. 11-22). These PNRs are those that face challenges that are most efficiently addressed through landscape scale collaboration, and that are indicators of an ecologically connected Central Valley.





ASSESSING VULNERABILITY TO CLIMATE CHANGE

"Water is the driving force of all nature."

-Leonardo da Vinci

ASSESSING VULNERABILITY TO CLIMATE CHANGE

Scenario Planning

Assessing vulnerability is a critical step in climate–smart conservation planning. Two ways to determine vulnerability to climate change is by conducting scenario planning and vulnerability assessments. The CVLCP did both to fully integrate climate change into the landscape planning effort.

Scenario planning is a structured way of developing narratives about potential futures based on key uncertainties. Once developed, scenarios can be used to analyze how various actions or policies would perform. As such, the use of scenarios can help identify strategies that are robust or are expected to perform well, regardless of which scenario is most accurate.

The CVLCP conducted a scenario planning workshop to develop a common understanding of the range of possible future conditions in the Central Valley, as a basis for assessing vulnerability and identifying adaptation strategies and actions for the PNRs. Workshop participants built the scenarios around two key uncertainties, **water availability and management for conservation**. Water availability represents the amount of water on the landscape and the amount of water available for use by natural resource managers. Management for conservation represents the amount of political and social support for natural resource conservation. Participants chose to focus on these two elements because they have a disproportionately large effect on the PNRs and there is a large amount of uncertainty about their future states.

With the two key uncertainties identified, the groups worked on four different scenarios around those uncertainties; Bad Business as Usual (high water availability and poor management for conservation), California Dreamin' (high water availability and good management for conservation), Everyone Equally Miserable (low water availability and good management for conservation), and Central Valley Dust Bowl (low water availability and poor management for conservation; Fig 2).

Participants' common assumptions across all four scenarios were: increasing temperatures, earlier timing of snowmelt runoff, and greatly reduced Sierra Nevada snowpack. Participants assumed population growth and associated pressures will continue to increase at the current rate statewide. However, participants assumed low water availability will decrease regional population growth. The four resulting scenarios were:

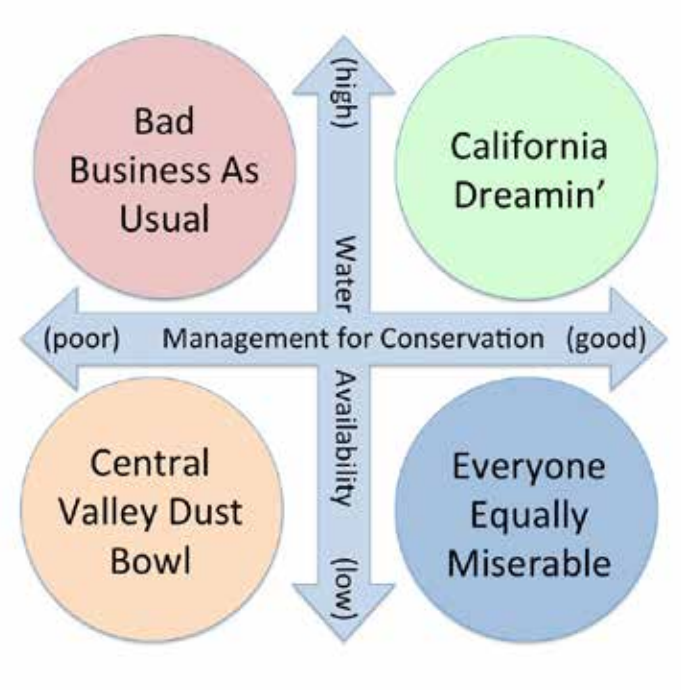
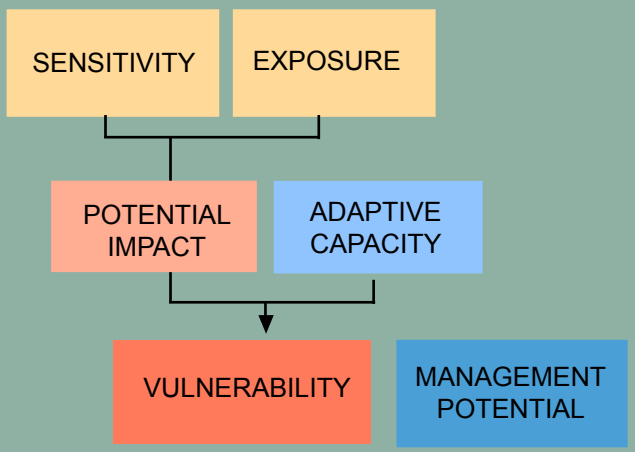


Figure 2. Graphical representation of the four scenarios developed considering different climate and management conditions.

Learn more here

Box 3. Measuring Vulnerability

Vulnerability is conceptualized as the interaction between sensitivity, exposure, and adpative capacity. Understanding the relationship between these factors provides the oppurtunity to better understand, and ultimately reduce vulnerability.



SENSITIVITY - A measure of how a priority natural resource is likely to be affected by or responsive to direct or indirect changes in climatic or non- climatic stressors, such as forest fires and drought.

EXPOSURE - A measure of how much of a change in climate and associated impacts (e.g., sea-level rise or ocean acidification) the target species or system is likely to experience.

POTENTIAL IMPACT - Potential impact is the cumulative impact of sensitivity and exposure.

ADAPTIVE CAPACITY - A measure of the PNR's ability to accommodate or cope with change, which includes both intrinsic and extrinsic characteristics associated with the conservation target, as well as relevant institutional factors.

VULNERABILITY - The extent to which a species, habitat, ecosystem, or other conservation target is susceptible to and unable to cope with direct and indirect impacts of climate change.

MANAGEMENT POTENTIAL - A measure of how well management actions can reduce vulnerability.

Adapted from Glick et al. 2011

Vulnerability Assessment

Vulnerability assessments can be used to identify populations or habitats that are most impacted and in greater need of management actions to reduce exposure or increase adaptive capacity. The CVLCP participants evaluated and scored the sensitivity, exposure, and adaptive capacity of each priority natural resource. These scores were used to calculate a vulnerability rating for each PNR. Each assessment provides insight into the unique set of current and future climate and non-climate stressors experienced by a particular PNR. Evaluated together, these assessments enable decision-makers to identify actions that might benefit multiple conservation targets and enhance the Central Valley ecosystems.

The results of these vulnerability assessments indicate that the Central Valley region's natural resources vary in their sensitivity, exposure, and ability to cope with projected climate change-related stressors. In many instances, non-climate related stressors might be equally important in driving vulnerabilities. Managers can choose to prioritize the most highly vulnerable habitats and species or focus on the habitats and species groups with the highest management potential. Taken as a whole, these results provide important information for a coordinated, partner driven effort toward increasing the Central Valley landscape's overall adaptive capacity and ability to support humans and wildlife.

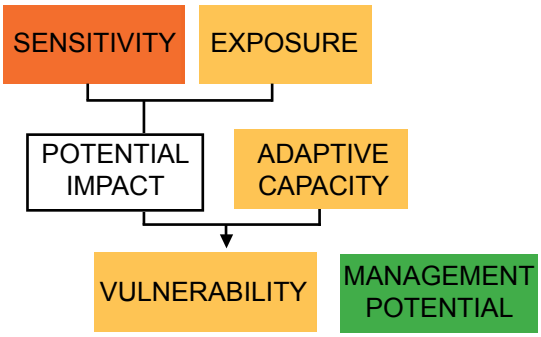
Learn more here

Vulnerability Assessment Results: Habitats

Click on a PNR to access the complete vulnerability assessment.

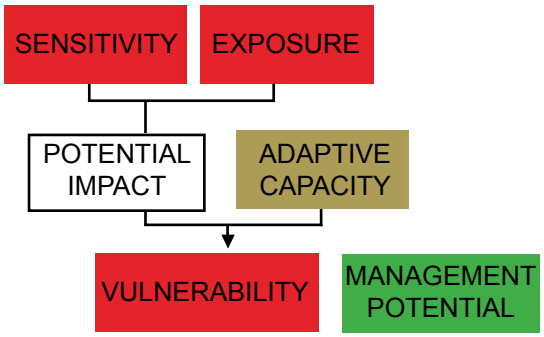
Chaparral & Serpentine Shrublands

Chaparral is characterized by evergreen, hard-leaved vegetation. Serpentine habitats occur on serpentine soils, which are characterized by low vegetative productivity due to high heavy metal levels, low calcium/magnesium ratios, and low levels of critical plant micronutrients, such as phosphorus and nitrogen.



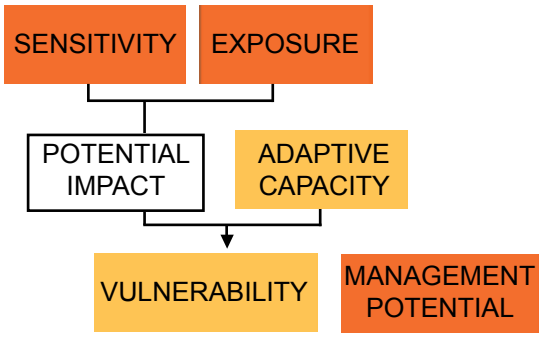
Dunes

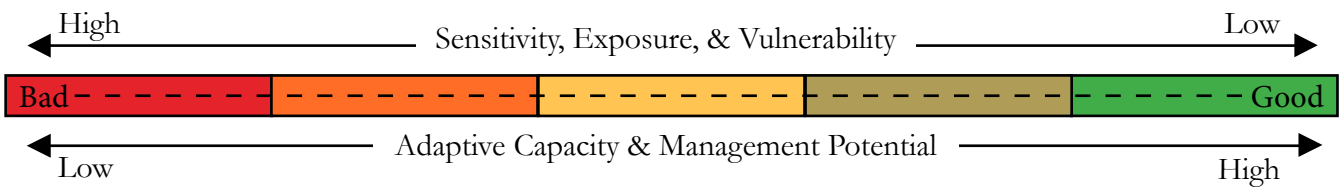
Central Valley dune habitats includes hill-shaped dunes, sandy washes, and alluvial fans; these are distinguished from the San Joaquin Desert habitat by the roles of wind and water in the system. Hill-shaped dunes are shaped by wind and this has a large effect on the ability of nonnative grasses to invade and generally shapes the vegetation. Washes and alluvial fan habitats are characterized by infrequent movements of large volumes of water. Species found in dune habitats include kangaroo rat (Dipodomys spp.), San Joaquin Valley giant flower-loving fly (Rhaphiomidas trochilus) and other Rhaphiomidas species, legless lizards (Anniella spp.).



Flooded Cropland

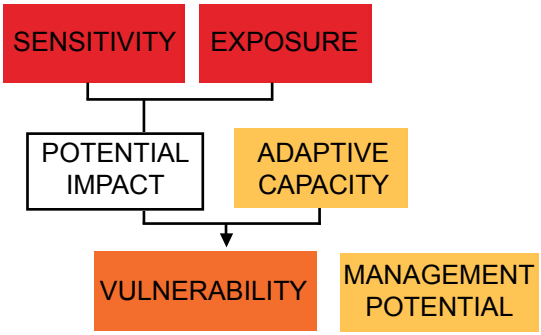
Flooded croplands are a habitat type characterized by active agricultural use, such as rice, corn, wheat, and alfalfa within the Central Valley. Rice fields comprise the largest percentage of flooded cropland, and are primarily grown within the Sacramento Valley. Corn, wheat, and other field crops are less likely to be flooded, and most non-rice flooded cropland is located in the Sacramento-San Joaquin River Delta and the Sutter Basin within the Sacramento Valley, and in small areas within the southern regions including the San Joaquin Valley and the Tulare Basin. Flooded cropland is inundated continuously or periodically with 1 to 25 cm of water for 5-10 months of the year.





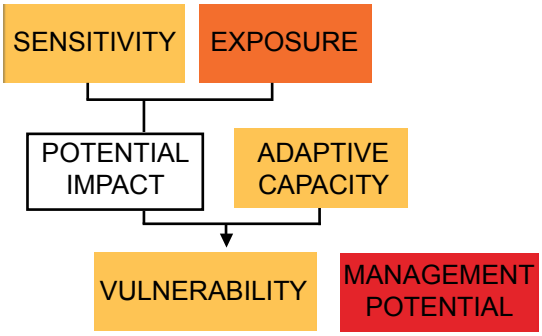
Grasslands

Central Valley grasslands are open grasslands that support a diversity of annual and perennial plant species. These grasslands are characterized by winter precipitation and seasonal summer drought, and exhibit high temporal and spatial diversity (Lulow & Young 2011a; Bartolome et al. 2014; Spiegal et al. 2014).



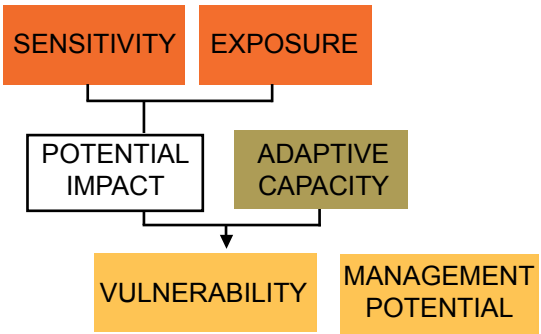
Oak Woodlands

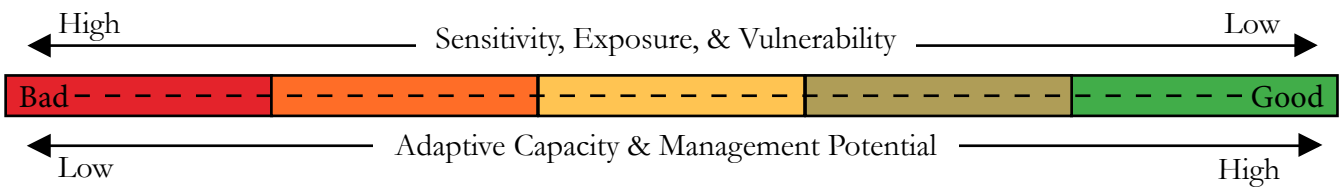
Oak woodlands in the Central Valley include valley oak woodlands, blue oak woodlands, and blue oak-foothill pine woodlands. These types often grade into each other, with valley oak woodlands occurring at the lowest elevations, and blue oak-foothill pine woodlands occupying higher elevations in the foothills.



Permanent Wetlands

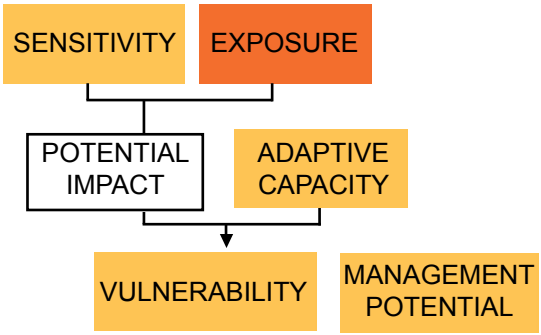
Permanent wetlands have standing surface water year-round, and include both managed and unmanaged wetlands. They are too wet for most terrestrial vegetation and tend to undergo wet and dry cycles due to fluctuating water levels. Presently, more than 90% of wetlands in the Central Valley are managed, two-thirds of which are in private ownership.





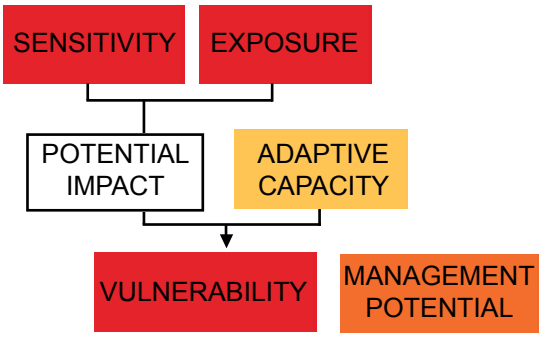
Rice Croplands

Rice croplands are a habitat type in active agricultural use, comprising the largest percentage of flooded cropland. Rice (Oryza sativa) is primarily grown within the Sacramento Valley, although some rice is grown in the Sacramento-San Joaquin River Delta as well. Rice fields are flooded to a depth of 8-15 cm for 5-10 months of the year as part of the agricultural practice and to provide habitat for wintering waterbirds and shorebirds. Finely-textured soils with poor drainage are most suitable for flooded croplands, and the depth and duration of flooding in rice croplands is carefully controlled.



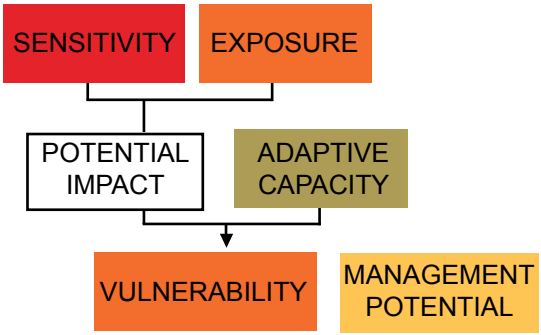
Riparian Vegetation / Natural Riverbank

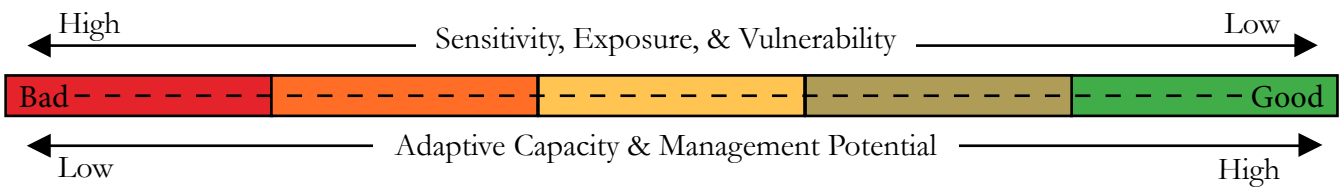
Riparian vegetation/natural riverbank refers to the vegetation that grows along the shores of freshwater rivers and lakes as well as the meander-belt processes that shape this dynamic habitat. As a river meanders, the bank on one side erodes while sediments accumulate on the opposite side, destroying old habitat and creating new substrate to be colonized, creating a constant succession of vegetation types adapted to this dynamic process. Riparian vegetation is commonly characterized by willow (Salix spp.), mulefat (Baccharis pilularis), Fremont cottonwood (Populous fremontii), valley oak (Quercus lobata), white alder (Alnus rhombifolia), California bay-laurel (Umbellularia californica), sycamore (Platanus racemosa), and walnut (Juglans californica), depending on location.



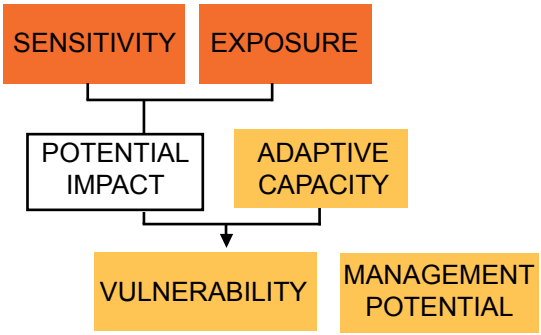
San Joaquin Desert

The San Joaquin Desert occurs in the southern and western portions of the San Joaquin Valley, as well as on the Carrizo Plain and Cuyama Valley. It is characterized by a spring herbaceous layer (mainly exotic) and distributed saltbush shrubs, and features many endemic species.



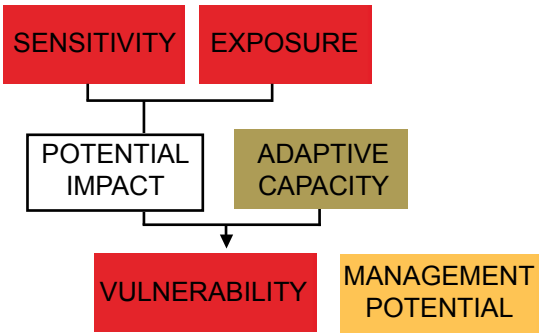


Seasonal Wetlands



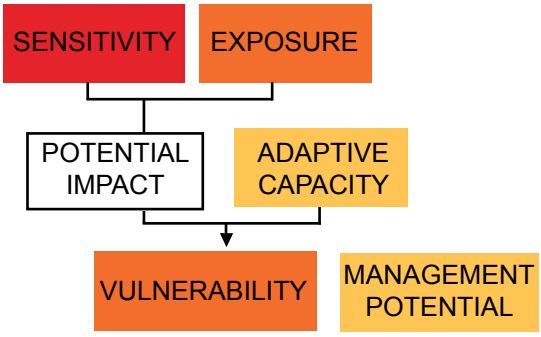
Seasonal wetlands are inundated part of the year and most are managed by flooding, disking, and burning. Typical hydrological cycles include fall flooding and drawdown in the spring followed by irrigation to maintain soil moisture. In the Central Valley, over half of the seasonal wetlands are located in the San Joaquin and Suisun basins. Seasonal wetlands are dominated by herbaceous vegetation, including sedges (Carex spp.), rushes (Eleocharis spp. and Scirpus spp.), bulrushes (Schoenoplectus spp.), cattails (Typha spp.), and other emergent hydrophytic species. Species composition is determined partially by water depth, and many wetlands are managed for seed production of swamp Timothy (Heleochloa schenoides) and smartweed (Polyganum spp.; Ortega 2009).

Stream Channel

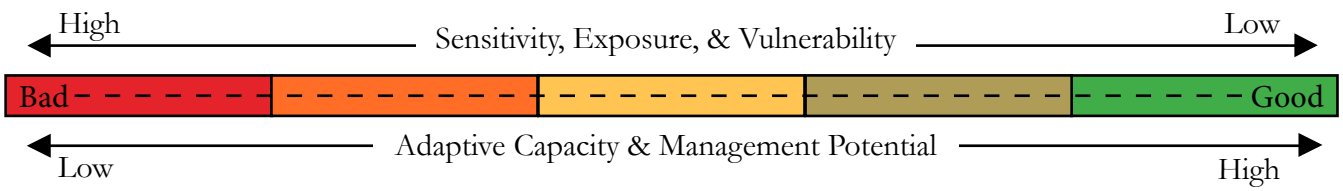


The dynamic aquatic habitat of streams and rivers support a wide range of plant and wildlife diversity as well as social, cultural, and ecological values, and agricultural and urban uses. Species depending on stream channels for all or part of their lifecycles are adapted to the seasonal changes dictated by precipitation and Sierra Nevada snowmelt patterns, and have been impacted by dams and other human alterations to the system.

Vernal Pools & Swales



Vernal pools and swales are ephemeral wetlands that form in landscape depressions where soil characteristics limit water infiltration. Vernal pools are characterized by a wet period in winter, drying during spring, and complete desiccation during late spring and summer. Swales connect or feed vernal pools, but typically experience less extensive inundation. This unique habitat is home to highly specialized plants, animals, and insects, many of them endemic to the region and listed as threatened or endangered.

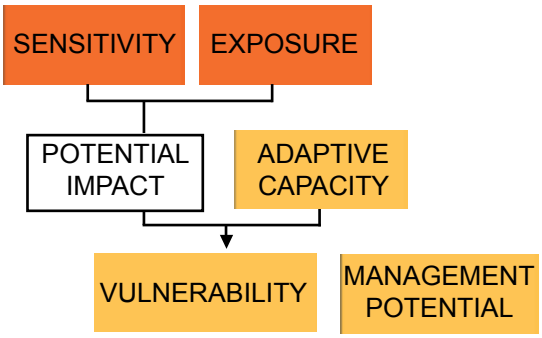


Vulnerability Assessment Results: Species and Species Groups

Click on a PNR to access the complete vulnerability assessment.

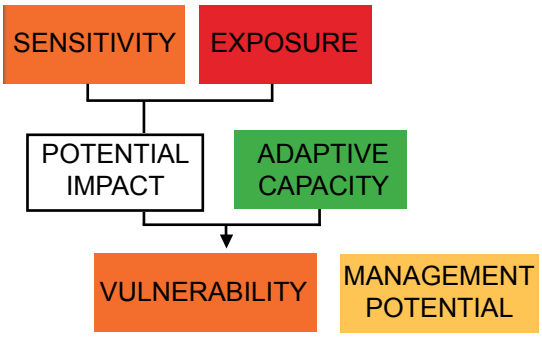
Amphibians

Amphibian species assessed include western spadefoot toad, western toad, and California newt, as well as red-legged frog, yellow-legged frog, and California tiger salamander. This species group has high management importance and is a good indicator of ecosystem health.



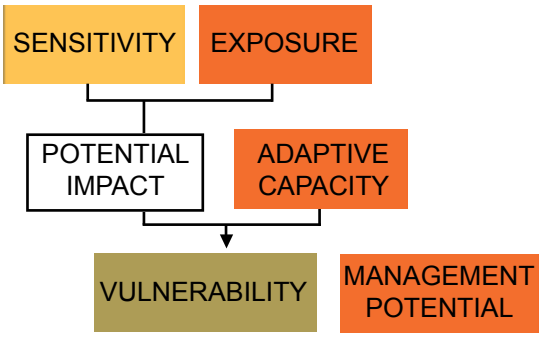
Blunt-nosed Leopard Lizard

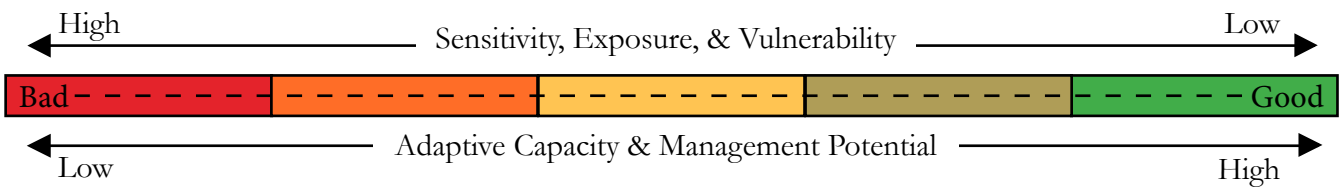
The blunt-nosed leopard lizard (Gambelia sila) is endemic to the San Joaquin Valley of California, including in the adjacent Coast Range foothills, Cuyama Valley and Carizzo Plain. It occupies desert grassland and shrub habitats.



Breeding Waterbirds& Shorebirds

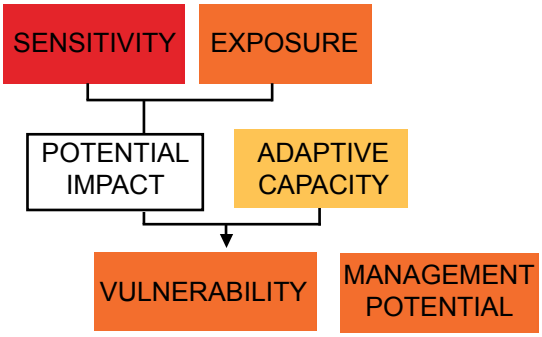
Breeding waterbirds and shorebirds species assessed as representative of this species group are mallard (Anas platyrhynchos), gadwall (Anas strepera), black-necked stilt (Himantopus mexicanus), American avocet (Recurvirostra americana), and killdeer (Charadrius vociferous).





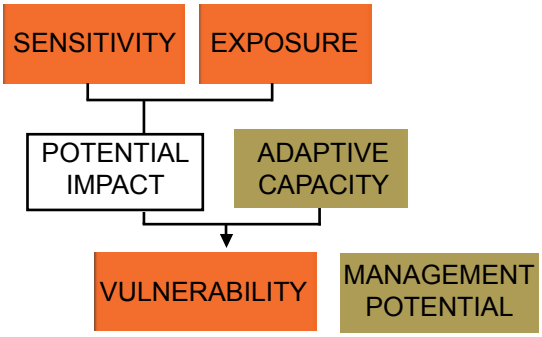
Bumblebee & Pollinators

Bumblebees (Bombus spp.) and other insect pollinators [e.g., monarch butterflies (Danaus plexipuss plexipuss)] inhabit a variety of natural landscapes in the Central Valley and provide critical pollination services to regional agriculture and native plants. Pollinators are highly diverse and they may nest below, on, or above the ground surface, can be forage generalists or specialists, and can be resident or migratory species.



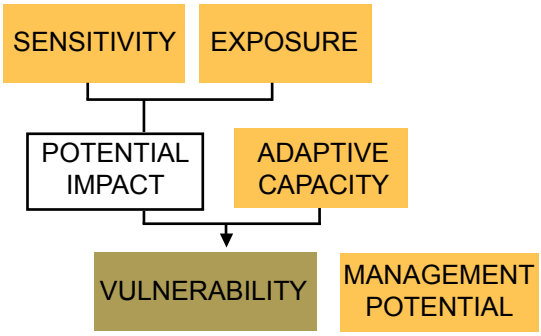
Burrowing Mammals

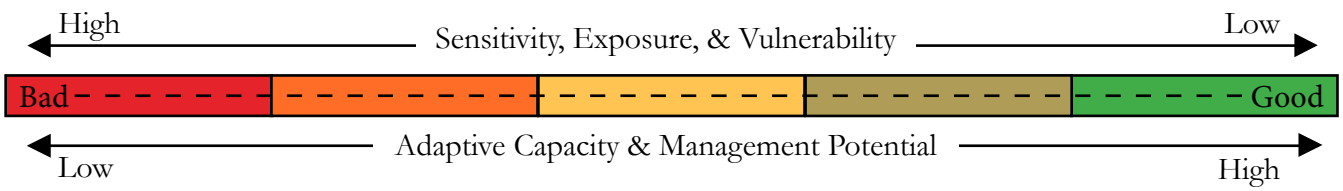
Central Valley burrowing mammals commonly inhabit arid ecosystems on the valley floor, including annual grasslands, scrub and shrubland, and desert systems. Species assessed as representative of this species group are California ground squirrels (Spermophilus beecheyii), kangaroo rats (Dipodomys spp.), the San Joaquin kit fox (Vulpes macrotis mutica), and the American badger (Taxidea taxus).



California Red-legged Frog

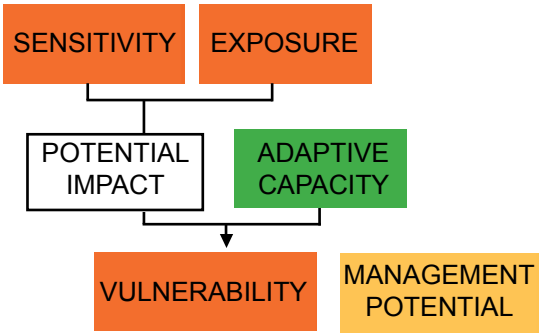
The California Red-Legged Frog (Rana draytonii), the largest frog native to the western United States, were among the most abundant amphibians in California until the late 19th century. The California red-legged frog is federally listed under the Endangered Species Act as a threatened species throughout its range in California.





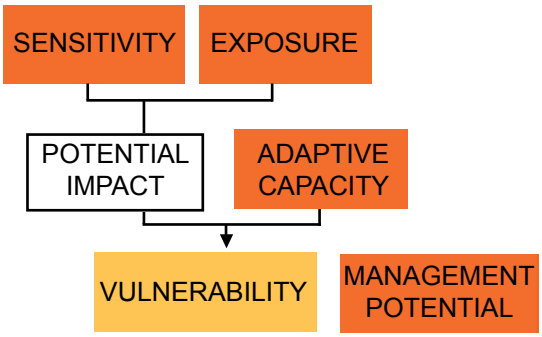
California Tiger Salamander

The California tiger salamander (Ambystoma californiense) utilizes a combination of aquatic breeding habitat and upland burrowing habitat, spending a majority of its life cycle underground. California tiger salamanders in the Central Valley are currently listed as threatened.



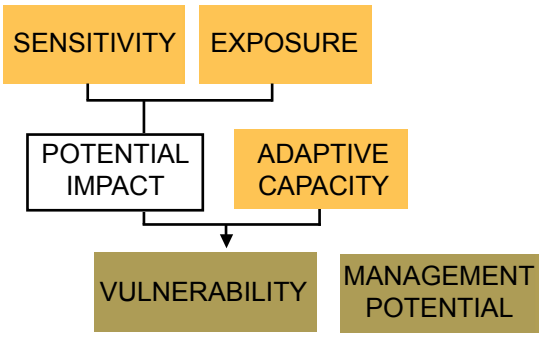
Cavity Nesters & Roosters

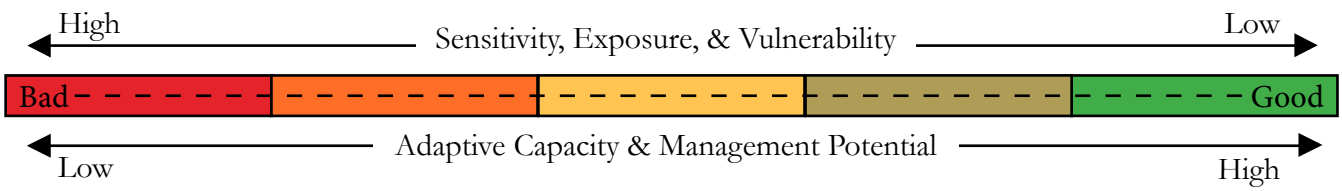
Cavity-nesting birds within the Central Valley primarily utilize riparian and oak woodland habitats; they include owls, woodpeckers (Picus spp., Sphyrapicus spp., etc.), nuthatches (Sitta spp.), chickadees (Parus spp.), wrens (Thryomanes spp.), tree swallows (Tachycineta bicolor), bluebirds (Sialia spp.), and wood ducks (Aix sponsa), among others. These include primary cavity nesters and secondary cavity nesters. This group also includes all species of cavity-roosting bats found in the Central Valley.



Dragonflies & Damselflies

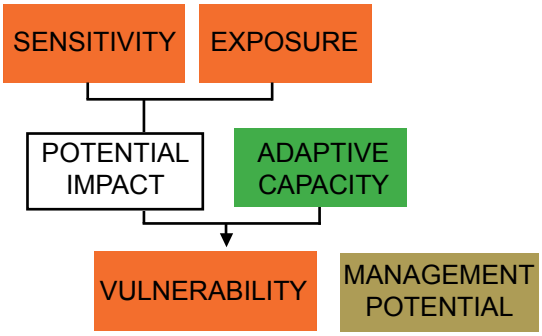
Dragonflies and damselflies (Odonata) are mobile insects considered to be sentinel species for aquatic systems, particularly wetlands, due to aquatic egg and larval life stages. Odonata species within the Central Valley include habitat specialists and generalists; dragonflies can be either resident or migratory, while damselflies do not migrate.





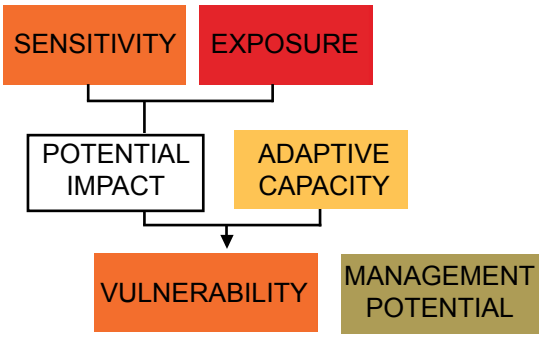
Foothill Yellow-legged Frog

Of the three species of yellow-legged frog, this assessment considers the foothill yellow-legged frog (Rana boylii). The foothill yellow-legged frog is a streamdwelling frog that can be found in the foothills of the Sierra Nevada and Coast Range.



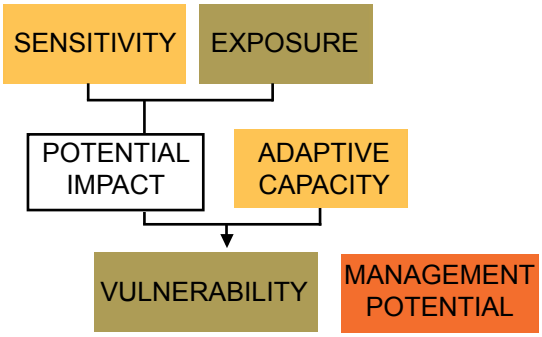
Green Sturgeon

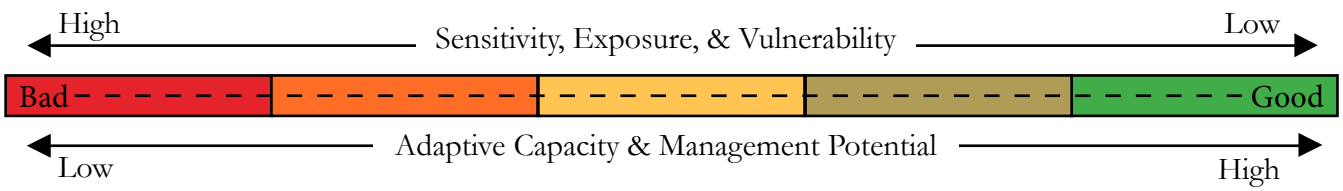
Green sturgeon (Acipenser medirostris) is an anadromous fish found in coastal watersheds along the Pacific Coast of North America. The southern distinct population of green sturgeon breeds only in the Sacramento River and is listed as threatened under the U.S. Endangered Species Act.



Large Wide-ranging Mammals

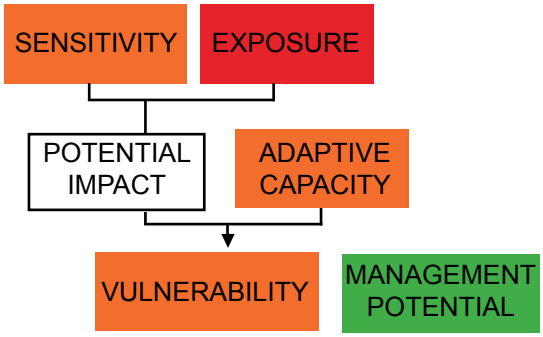
Species included under the vulnerability assessment of large wide-ranging mammals are tule elk (Cervus canadensis nannodes), mule deer (Odocoileus hemionus), pronghorn (Antilocarpa americana), bobcat (Lynx rufus), mountain lion (Puma concolor), and gray fox (Urocyon cinereoargenteus). These species require connected landscapes over large areas.





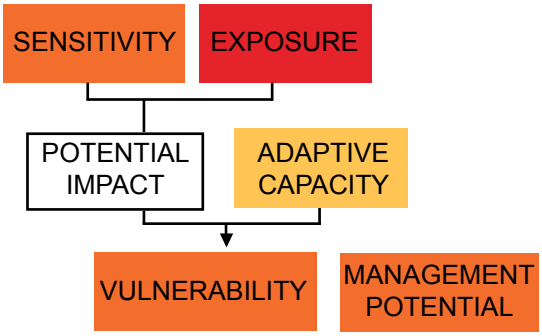
Pacific Lamprey

The Pacific lamprey (Entosphenus tridentatus) is an anadromous parasitic species that was historically distributed from Mexico north along the Pacific Rim to Japan. They are culturally important to indigenous people throughout their range, and play a vital role in the ecosystem as a food source for mammals, fish, and birds, nutrient cycling and storage, and a prey buffer for other species, such as salmonids. Recent observations in the reduction of abundance and range of Pacific lamprey have spurred conservation interest in the species with increasing attention from tribes, agencies, and others.



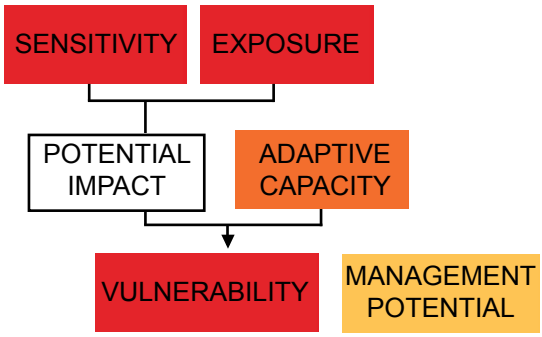
Riparian Birds

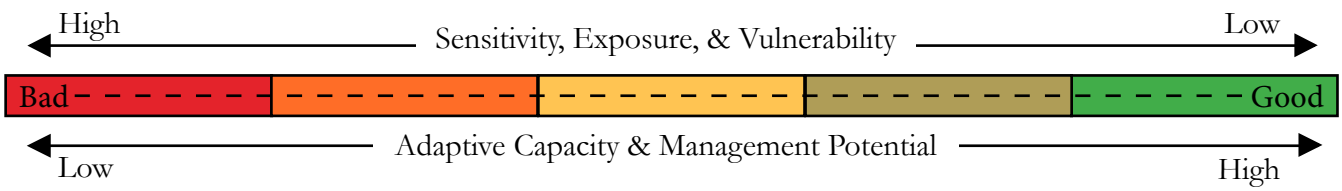
Over 130 species of riparian birds are present in the Central Valley, including yellow-billed cuckoo (Coccyzus americanus), Least Bell's vireo (Vireo bellii pusillus), yellow warbler (Setophaga petechial), black-headed grosbeak (Pheucticus melanocephalus), bank swallow (Riparia riparia), willow flycatcher (Empidonax traillii), Wilson's warbler (Cardellina pusilla), and yellowbreasted chat (Icteria virens).



Salmonids

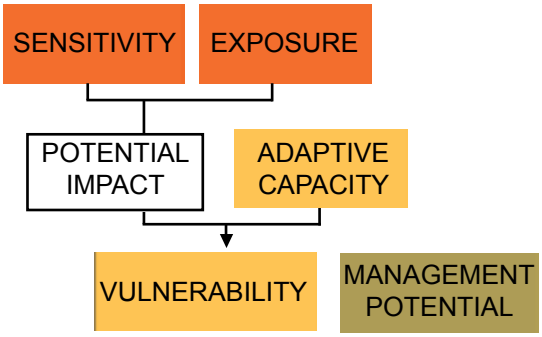
Salmonids (Oncorhynchus spp.) in the Central Valley, including steelhead (O. mykiss), Chinook salmon (O. tshawytscha), and coho salmon (O. kisutch), depend on stream channels for spawning and nursery habitat, as well as freshwater and marine environments utilized by anadromous adults.





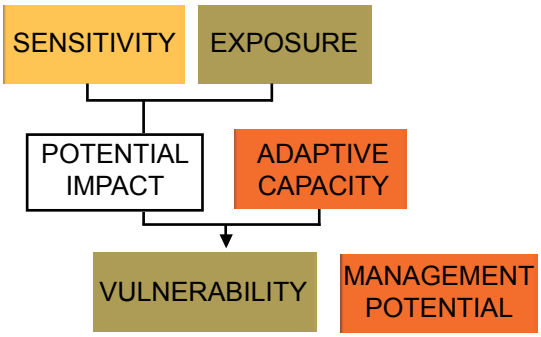
Tricolored Blackbird

The tricolored blackbird (Agelaius tricolor) is primarily a resident bird species in the Central Valley, breeding in cattail (Typha spp.) or tule (Schoenoplectus acutus) emergent wetlands, thickets of Himalayan blackberry (Rubus armeniacus) or California wild rose (Rosa californica), agricultural fields, and dairies, where it nests and feeds in large colonies. The tricolored blackbird has been listed as both a California and USFWS bird species of special concern.



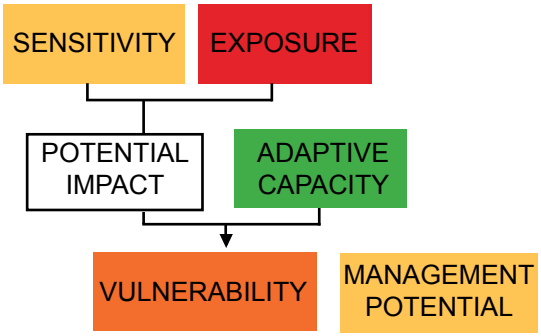
Valley Oak

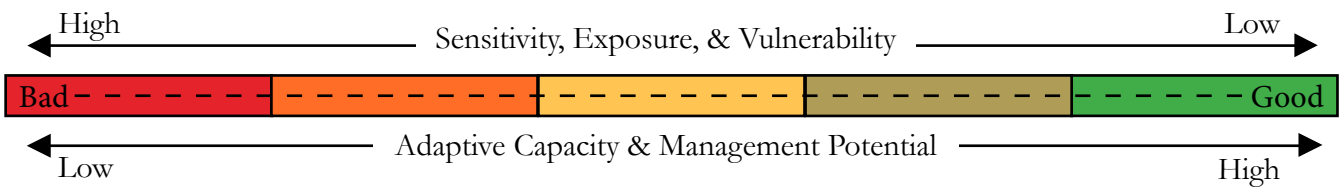
Valley oak (Quercus lobata) is endemic to California, and is commonly found in areas with high water tables, including in oak woodland forests and valley oak riparian woodlands. This iconic and keystone species can be found from the coast through the Central Valley and into the Sierra Nevada foothills.



Vernal Pool Crustaceans

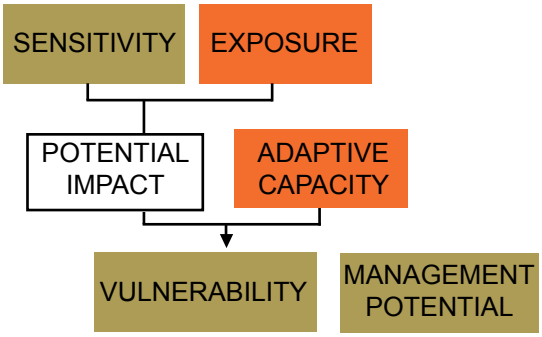
Vernal pools contain more than 34 crustacean species, many of them endemic to California. These obligate aquatic organisms have evolved to accommodate the ephemeral and highly variable hydroperiod of vernal pools in California's Mediterranean climate. Species assessed include vernal pool fairy shrimp (Branchinecta lynchi), vernal pool tadpole shrimp (Lepidurus packardi), California fairy shrimp (Linderiella occidentalis), and longhorn fairy shrimp (Branchinecta longiantenna).





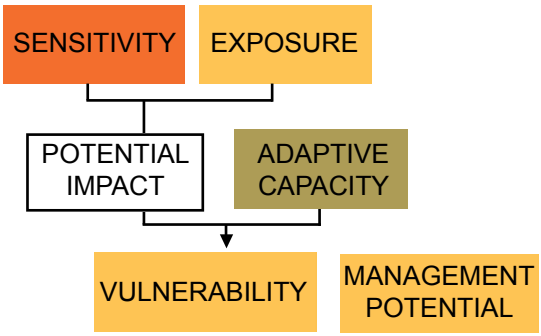
Wetland Dependent Mammals

The Central Valley's wetlands provide critical habitat for many species of wetland dependent mammals, including the North American river otter (Lontra canadensis), American beaver (Castor canadensis), common muskrat (Ondatra zibethicus), and American mink (Neovison vison). These mammals face the combined threat of severe habitat loss and fragmentation due to changes in land cover and climate.



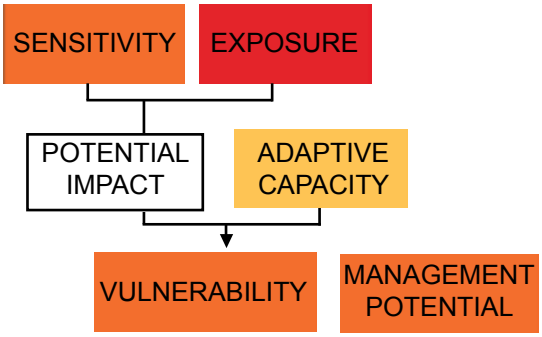
Wetland Dependent Reptiles

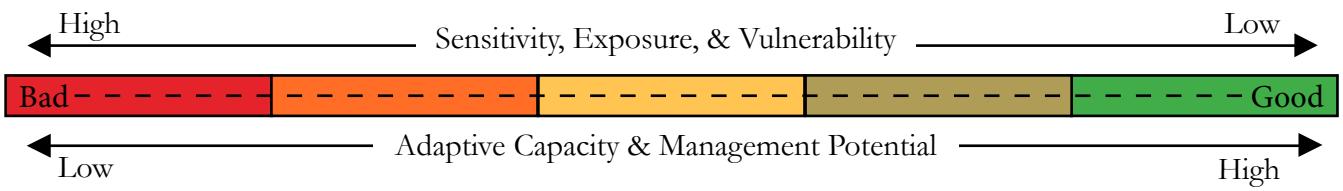
Wetland-dependent reptiles in the Central Valley include the giant garter snake (Thamnophis gigas) and the western pond turtle (Clemmys marmorata), among others. These species are typically aquatic and highly dependent on wetland habitats, such as marshes, canals, ponds, streams, and flooded croplands for some or all of their lifecycle stages.



Wetland Obligate Plants

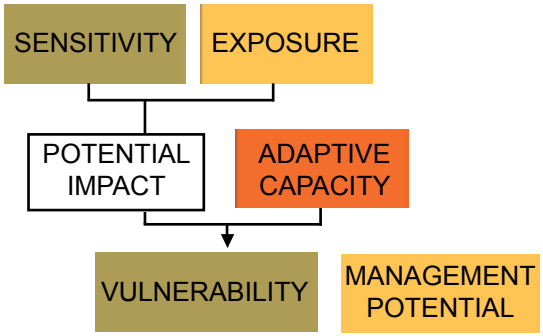
Wetland obligate plants are diverse, ranging from annuals to perennials and from generalists to extreme specialists. Within a given wetland, plant species composition and diversity is dependent on how much water is available, how long during the year that water persists, and whether or not the wetland is managed for hunting, as well as wetland size, water source, and geomorphology.





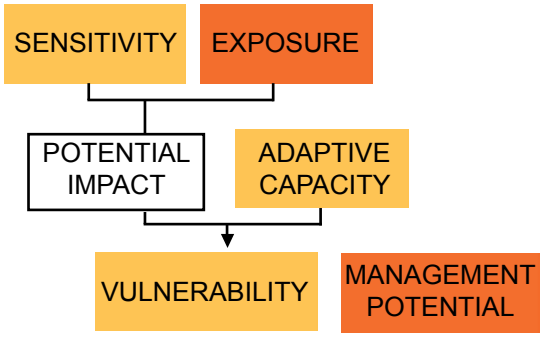
Wintering Waterbirds & Shorebirds

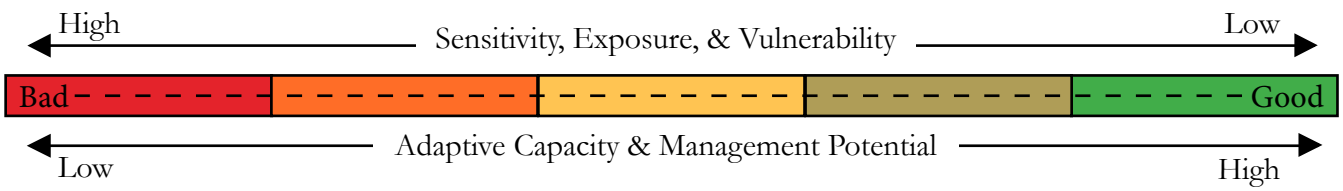
Waterbirds and shorebirds wintering in the Central Valley are migratory species that often breed across the Arctic and sub-arctic regions of Alaska and Canada, as well as in the Prairie Pothole Region in North and South Dakota. Between 10 and 12 million waterfowl pass through the Central Valley annually, comprising 60% of waterfowl within the Pacific Flyway, and 20% of the entire continental population.

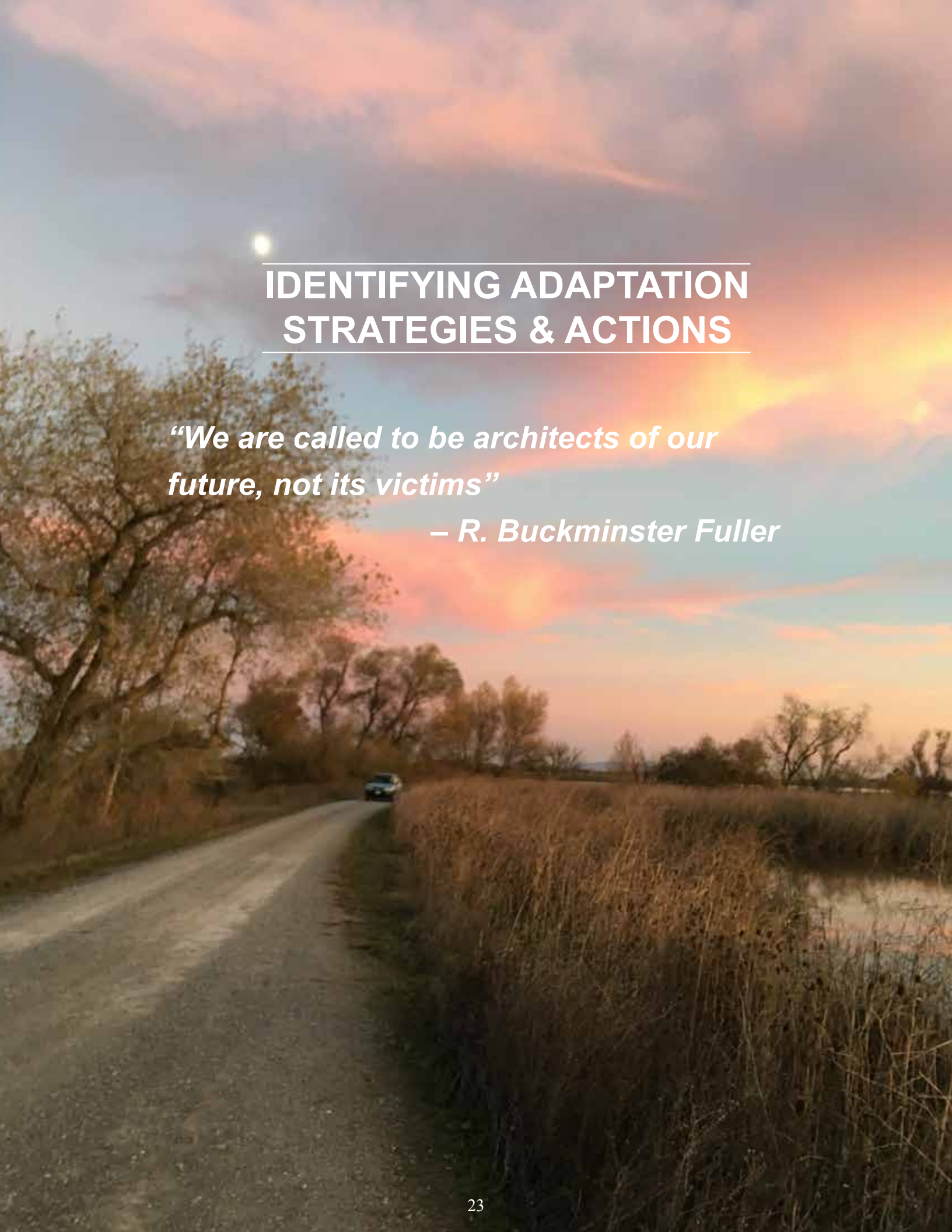


Yellow-billed Magpie

Yellow-billed magpies (Pica nuttalli) are endemic to California, found primarily in the Central Valley and central coastal regions. They are year-round residents in the Central Valley, nesting in open oak woodlands and roosting in riparian and oak woodland habitats during cold periods and commonly seen in urban parks and backyards.







IDENTIFYING ADAPTATION STRATEGIES & ACTIONS

"We are called to be architects of our future, not its victims"

– R. Buckminster Fuller

IDENTIFY ADAPTATION STRATEGIES & ACTIONS

CVLCP participants used information provided by the vulnerability assessments and scenario planning to brainstorm potential actions that would decrease the priority natural resources' vulnerability to climate and non-climate stressors. Initially participants brainstormed over 300 potential management actions that would be beneficial to the 35 Priority Natural Resources (PNRs) in the Central Valley. The next step was to develop a set of criteria to prioritize those actions. Participants organized in groups based on their expertise of the PNRs and whittled the long list down to a few priority actions. Applying these actions across the Central Valley will help meet the projects objectives by reducing the impacts of climate change and other co-occurring stressors, promoting landscape-scale connectivity, and conserving resilient and adaptable ecosystems that sustain future Central Valley biodiversity.

Learn more here

Criteria Used to Identify Priority Strategies and Actions

Action is an existing priority for multiple partner agencies (with the authority to implement the action)
Action is feasible and has a high certainty of success
Action has support in the local community and among landowners, including partnerships
Action accomplishes at least one of the 3 project objectives
Action works for all 4 future scenarios identified
Action provides multiple benefits
Action addresses multiple objectives
Action limits imminent threat of irreversible harm (e.g., urban development on endangered habitat such as vernal pools)
Action has built in capacity to be flexible and adaptable
Action provides quantifiable ecological benefits to the project's identified priority natural resources

Develop off-channel storage (new storage infrastructure). For example: Use agricultural fields and wetlands for storage during high flows, release later in the season.
Mimic natural flooding regimes to encourage new groundwater recharge and sustain viable groundwater levels and maintain and restore streamflow.
Develop and enforce criteria to ensure water release from dams meet species needs. In particular, work with dam operators to shape hydrographs and create pulse flow in winter and spring in support of breeding frogs and to meet life stage requirements (including passage as a life stage) for water flow and water temperature for multiple fish species in existing fish habitat (salmonids, sturgeon, lamprey).
Enhance wildlife habitat quality in riparian areas. In particular, enhance habitat to increase shade and genetic and phenotypic diversity.
Manage riparian corridors to protect water and habitat resources (e.g., install fences as one possible tool).
Develop practices to restore hydrology in local complexes to maintain or augment vernal pool hydro-periods.
Protect/restore large vernal pools, including higher elevation pools that attract waterfowl which are important to facilitate dispersal of cysts and eggs.
Restore meadows (both mountain and valley meadows).
Coordinate and improve water management across management units to increase water use efficiency in support wildlife and wetland ecosystem; and within wetland management units for better water use efficiency and wildlife support.
Develop, promote, and encourage Best Management Practices for grazing for multiple benefits: restoration of drought and fire resilient native plant communities, vernal pool and grassland conservation, oak woodland regeneration/conservation, riparian corridors, soil water retention, groundwater recharge, bat and burrowing mammal habitat.
Experiment with fallowed lands for drought and fire resilient native plant community restoration.
Improve agricultural and road maintenance practices to reduce water contaminants (heavy metals, fertilizers, pesticides).
Promote habitat in July and August to support non-breeding shorebirds through agricultural lands enhancement (flooding, vegetation management for wintering bird needs).
Plant variety of native habitats for pollinators (e.g. grasslands & meadows); plant hedgerows/ backyard/parks of native plants in agricultural/urban areas.
Manage invasive plants to reduce impacts on ecosystem processes and restore natural communities.
Plant diverse composition of native species to restore drought and fire resilient communities; manage specifically for shrubs as plant refugia (e.g., moderate air temperature) and perennial grasses (food source); Restore perennial grasses and forbs.
Plant vegetation buffers to increase soil water retention and groundwater recharge, and improve water quality (conjunctive use, slow-it-spread-it-sink-it).

Identify and prioritize movement corridors for PNR's; Focus on preserving north-south and east-west gradients of habitat types and associated connectivity. Identify and protect current & future habitat of large wide-ranging mammals.
Identify and prioritize unprotected wetlands in areas important for future resilience. Implement acquisition with priority to enhance wetland connectivity.
Identify and prioritize opportunities to improve adult fish passage into existing, and future habitats; Create fish access to current/ future suitable habitat by providing passage above dams, and past other impediments. Remove dams where appropriate (for all reasons including sediment).
Provide open, natural, connected landscapes that are resilient to climate change: Identify climate refugia and suitable habitat, prioritize, and protect linkages to increase size of suitable habitat, protect varied topography, maintain meta-populations, and increase resilience. For example; Protect and restore natural stream systems to ensure a mix of open and shaded areas (combine with riparian restoration and Salmonid strategies where there are co-benefits). Buy property that comes with riparian water rights to acquire sufficient water to sustain riparian resources.
Easements and acquisitions to maintain/protect/restore existing habitat to reduce fragmentation and create new space for species migration. In particular; oak woodland habitat (especially, old growth oaks), riparian habitat, floodplain habitat (for early life stages of fish and other wildlife), active riverbeds, promote and acquire easements or fee title, at market rates, to protect existing and future wetland habitat, and maintain wildlife-friendly agriculture and ranching.

MOVING FORWARD

This time of rapid change is creating new and unexpected threats to California's landscapes and the people and wildlife that depend on them. Such complex issues cannot be solved by individual organizations--they require the synergy of a diverse group who share knowledge, insights, and abilities to create sustainable solutions for the benefit of the Central Valley.

The products developed by the CVLCP partnership can serve as a guide to addressing climate change and future pressures on our Central Valley's natural resources. They can help inform conservation by providing; 1) summaries of observed and projected climate trends in the Central Valley, 2) a list of natural resources that have been defined as most important to the majority of natural resource agencies and conservation groups in the Central Valley, 3) how the natural resources may respond to future changes across the valley through vulnerability assessments, and 4) an agreed-to approach of strategies and actions that will help maintain a connected Central Valley landscape.

Perhaps one of the most valuable products that has emerged from this effort is the CVLCP partnership developed across multiple agencies and organizations. Strong partnerships will be critical for sharing and exploring novel approaches to conservation as climate change progresses.