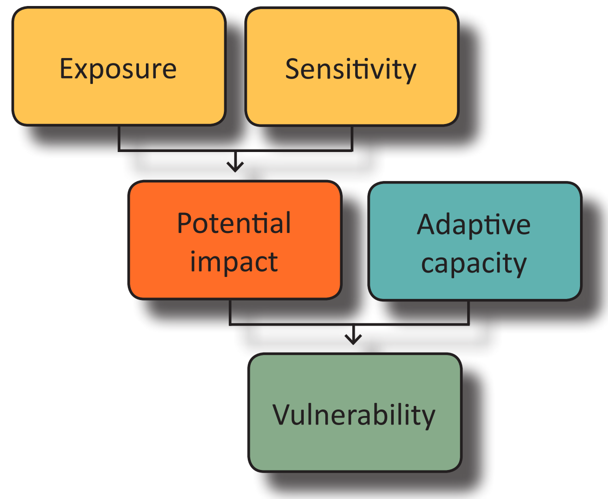
Central Valley Landscape Conservation Project

CA LCC

Vulnerability Assessments for Priority Natural Resources in the Central Valley

Assessing vulnerabilities is a critical step in climate–smart conservation planning. The Central Valley Landscape Conservation Project (CVLCP) participants evaluated the vulnerability of a group of selected priority natural resources by discussing and answering a series of questions for sensitivity, exposure, and adaptive capacity at a workshop held in October of 2015. The vulnerability scores presented in this summary were calculated based on the expertise of the CVLCP participants and are accompanied by a comprehensive literature review (for more details visit http://climate.calcommons.org/cvlcp).



Above: The components of a vulnerability assessment , from Glick et al. 2011.

These assessments were conducted as a step toward the Central Valley Landscape Conservation Project's goal of a coordinated, partner-driven effort to promote a healthy and sustainable Central Valley landscape. While each assessment provides insight into the unique set of current and future climate and non-climate stresses experienced by a particular priority natural resource, evaluated together these assessments enable decision-makers to identify actions that might benefit multiple priority natural resources and enhance the Central Valley ecosystem as a whole.

Future Changes in the Central Valley

Higher temperatures, increasingly unpredictable precipitation patterns, increased aridity and water scarcity in the dry season, and land-use changes are among the most important stressors to consider in the Central Valley.

Accelerated warming combined with increasingly unpredictable precipitation patterns and more severe and frequent extremes is the overall projection for the future climate of the Central Valley region. The average mean annual temperature in the Sacramento–San Joaquin basin is projected to increase by 5 to 6°F during this century, though associated with substantial spatial variability. In addition, a significant rise in the frequency, intensity, and duration of heat waves is expected.

Future projections of average annual rainfall (precipitation) span a broader range; some models project more overall average rainfall and others project less. The north-south precipitation gradient, with greatest precipitation in the northern part of the Central Valley and less in the south, is expected to continue. California is expected to receive a larger portion of its annual rainfall in extreme storm events (atmospheric rivers), and more rain-on-snow events in the Sierra Nevada mountains. These changes could result in more frequent and severe floods.

Regardless of precipitation trends, aridity during the spring and summer dry season is expected to increase. Surface water availability in the summer is expected to become increasingly limited and unpredictable due to the combination of higher temperatures in the summer, earlier spring snowmelt, and potentially reduced snowpack. Population growth and land-use changes are likely to increase competition with environmental needs for water resources.

Land use in the Central Valley is changing in response to local and global economic drivers, urban planning policies, and changes in the human population of the region. Conversion of agricultural lands and open space to urban use is anticipated. Other potential land use changes include conversion from rangeland to agriculture, between crop types, and renewable energy development.

Other non-climate factors that present stressors to wildlife, habitat, and ecosystem function in the Central Valley include: invasive and problematic species; point-source and nonpoint source pollution; increased or new diseases; and largely human-managed disturbance regimes such as floodplain processes, wildfire, and grazing. Climate change may exacerbate non-climate stressors, such as the potential for an increase in the spread of diseases or invasive species, and the challenges of managing conflicting in-stream and wetland water allocations.

Vulnerability Assessments for Priority Habitats

CVLCP participants agreed on priority natural resources, which included the list of priority habitats shown in the table below.

All priority Habitats were assessed as having moderate, moderate-high, or high vulnerability.

Table. Each of these habitats was assessed by the participants for its vulnerability to a range of climate and non-climate stressors as determined by sensitivity, exposure, and adaptive capacity, and for its management potential for reducing the impacts of these stressors.

Habitat	Sensitivity	Exposure	Adaptive Capacity	Vulnerability	Management Potential
Dunes	High	High	Low-moderate	High	Low
Stream channel	High	High	Low-moderate	High	Moderate
Riparian vegetation	High	High	Moderate	High	Moderate-high
Grasslands	High	High	Moderate	Moderate-high	Moderate
San Joaquin desert	High	Moderate-high	Low-moderate	Moderate-high	Moderate
Vernal pools & swales	High	Moderate-high	Moderate	Moderate-high	Moderate
Flooded cropland	Moderate-high	Moderate-high	Moderate	Moderate	Moderate-high
Permanent wetlands	Moderate-high	Moderate-high	Low-moderate	Moderate	Moderate
Seasonal wetlands	Moderate-high	Moderate-high	Moderate	Moderate	Moderate
Rice croplands	Moderate	Moderate-high	Moderate	Moderate	Moderate
Oak woodlands	Moderate	Moderate-high	Moderate	Moderate	High
Chaparral & serpentine	Moderate-high	Moderate	Moderate	Moderate	Low

For all habitats in the Central Valley participants identified changes in timing and amount of precipitation as well as changes in snowpack and timing of snowmelt as key factors in contributing to high or moderate-high climate change exposures and sensitivity. Similarly, all habitats were identified as sensitive to changes in amount and timing of water availability. Stream channel and riparian vegetation were the only habitat types that were assessed to be sensitive and exposed to storms. Key non-climate exposure factors for most of the Central Valley habitats include land-use change, primarily urban/suburban development, and non-beneficial agricultural and grazing practices.

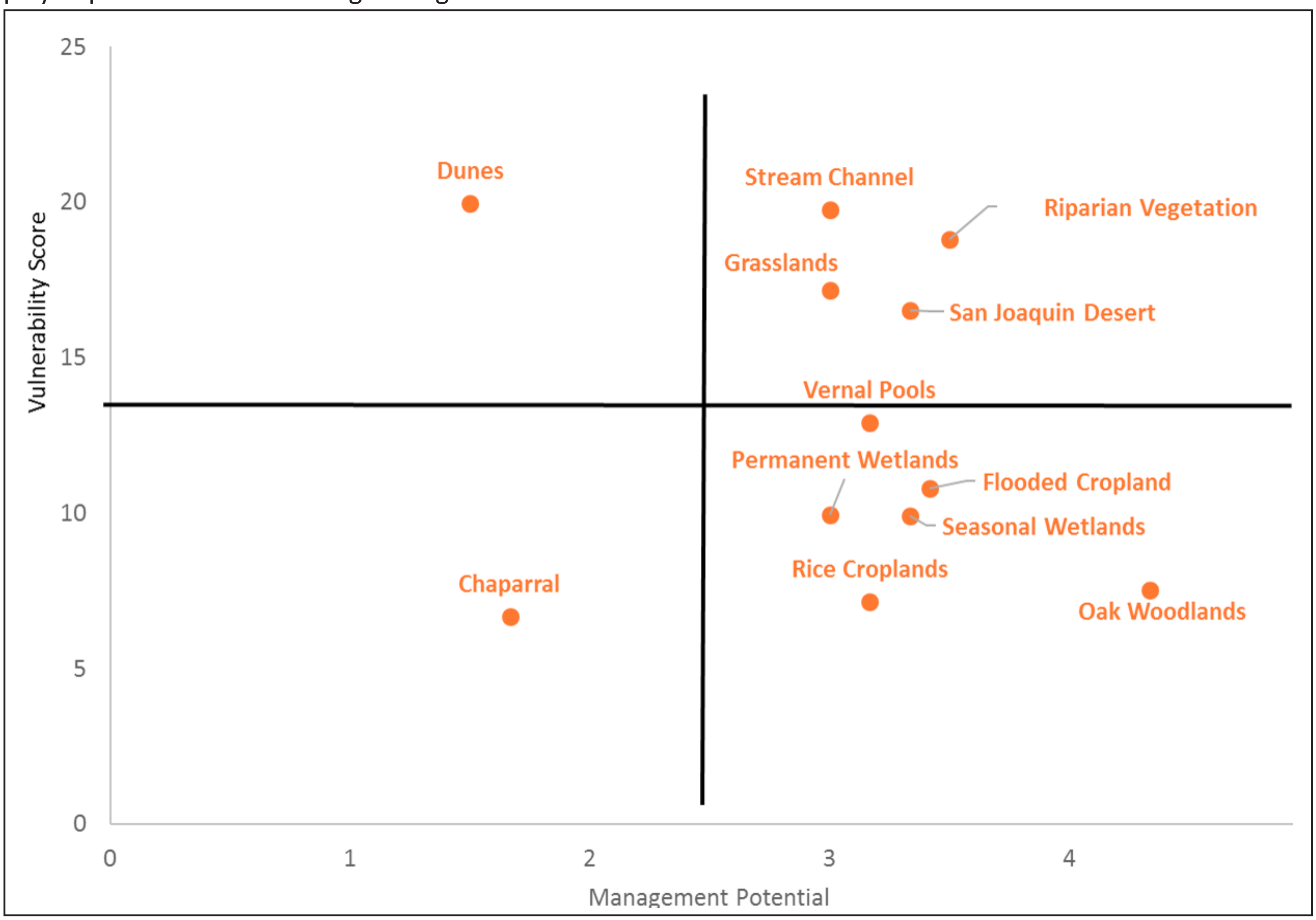
In most cases the condition of Central Valley habitats has been degraded, resulting in reduced adaptive capacity to climate and non-climate related stressors. The capacity for habitats to adapt to climate and non-climate stressors varies from low-moderate to moderate, and is influenced by the condition (extent, integrity, and continuity) of the habitat, its diversity, barriers to movement into new suitable regions, and inherent ability to recover from stress or disturbance. Also considered were the sensitivities of component species and functional groups within the habitat to climate change, and the presence and function of keystone species.

Management Potential for Priority Habitats

Management potential scores for Habitats range from low to high, with lower scores reflecting a narrower range of options and resources available to managers.

Management potential is the ability and likelihood for successful intervention to protect Central Valley habitats from the impacts of climate change by reducing exposure to stressors and enhancing adaptive capacity. For example, reducing non-climate stressors such as minimizing human-caused disturbances and controlling invasive species can increase adaptive capacity. The social and political climate influencing support for conservation was considered, including regulatory legislation, the value of the resource to people, and the likelihood of converting land into habitat. CVLCP participants ranked management potential for habitats from low to high, with lower scores reflecting a narrower range of options and resources available to managers and decision makers, as is the case for the dunes habitat.

Initiatives and incentives that involve land owners play a critical role in management potential for all Central Valley habitats because most of thew acreage is in private ownership. Successful outcomes have already been realized by programs encouraging habitat-enhancing rangeland management practices, timely flooding of fields, and avoiding disturbances during reproductive seasons. For habitats dependent upon water allocations, such as rice croplands, there will likely be a reduction in management potential in the future due to rising costs of water and economic incentives to convert to other crops. Availability of funding for incentive programs, restoration, and easement or fee acquisition, as well as land and crop values driving landowner decisions, all play important roles in making management feasible.



Above: Habitat Vulnerability and Management Potential scores plotted together

Vulnerability Assessment for Priority Species Groups and Species

The CVLCP partners selected species groups and species for assessment in addition to the habitats discussed above because they have requirements beyond a single habitat, play a key role in their ecosystem, or have high management priority.

Vulnerabilities of the Species Groups and Species range from low-moderate to high.

Table. Each of the priority species groups and species listed in the table below was assessed by the participants for its vulnerability to a range of climate and non-climate stressors as determined by sensitivity, exposure, and adaptive capacity, and for its management potential for improving resilience to the impacts of these stressors.

Species Group or Species	Sensitivity	Exposure	Adaptive Capacity	Vulnerability	Management Potential
Salmonids	High	High	Moderate-high	High	Moderate
Blunt-nosed leopard lizard	Moderate-high	High	Low	Moderate-high	Moderate
California tiger salamander	Moderate-high	Moderate-high	Low	Moderate-high	Moderate
Green sturgeon	Moderate-high	High	Moderate	Moderate-high	Low-moderate
Riparian birds	Moderate-high	High	Moderate	Moderate-high	Moderate-high
Vernal pool Crustaceans	Moderate	High	Low	Moderate-high	Moderate
Bumblebees and other insect pollinators	High	Moderate-high	Moderate	Moderate-high	Moderate-high
Pacific lamprey	Moderate-high	High	Moderate-high	Moderate-high	Low
Wetland-obligate plants	Moderate-high	High	Moderate	Moderate-high	Moderate-high
Yellow-legged frog	Moderate-high	Moderate-high	Low	Moderate-high	Low-moderate
Burrowing mammals	Moderate-high	Moderate-high	Low-moderate	Moderate-high	Low-moderate
Tricolored blackbird	Moderate-high	Moderate-high	Moderate	Moderate	Low-moderate
Wetland-dependent Reptiles	Moderate-high	Moderate	Low-moderate	Moderate	Moderate
Cavity nesters and roosters	Moderate-high	Moderate-high	Moderate-high	Moderate	Moderate-high
Yellow-billed magpie	Moderate	Moderate-high	Moderate	Moderate	Moderate-high
Amphibians	Moderate-high	Moderate-high	Moderate	Moderate	Moderate
Breeding waterbirds and shorebirds	Moderate	Moderate-high	Moderate-high	Low-moderate	Moderate-high
Dragonflies and damselflies	Moderate	Moderate	Moderate	Low-moderate	Low-moderate
Wetland-dependent Mammals	Low-moderate	Moderate-high	Moderate-high	Low-moderate	Low-moderate
Red-legged frog	Moderate	Moderate	Moderate	Low-moderate	Moderate
Valley oak	Moderate	Low-moderate	Moderate-high	Low-moderate	Moderate-high
Large wide-ranging Mammals	Moderate	Low-moderate	Moderate	Low-moderate	Moderate-high
Wintering waterbirds and shorebirds	Low-moderate	Moderate	Moderate-high	Low-moderate	Moderate

Changes in climate and non-climate factors can cause a variety of types of stressors (threats) for species groups and species. Stressors caused by these factors can be direct (eg., causing mortality) or indirect (by causing increased fragmentation or degradation of habitat). The combination of sensitivity and exposure determine the potential severity of the impact, and adaptive capacity is the species' ability to avoid or survive the impact.

Species dependent upon surface water for all or part of their life-cycles were assessed as sensitive to altered flow regimes, water temperature, precipitation timing, and storms. Wetland-dependent species are sensitive to changes in the amount of precipitation and snowpack, and the timing of snowmelt and runoff, which affect the availability and distribution of wetland habitat. Many species groups were identified as moderately to highly sensitive to increases in air temperatures and heat waves, and drought is a key climate factor for all species groups and species. Non-climate factors that cause fragmentation of terrestrial or aquatic habitat were identified as important across all resources, including dams, levees, and water diversions, agricultural and rangeland practices, and land use change and urban development. Nutrient loading and pollutions and poisons were important for aquatic and bird species.

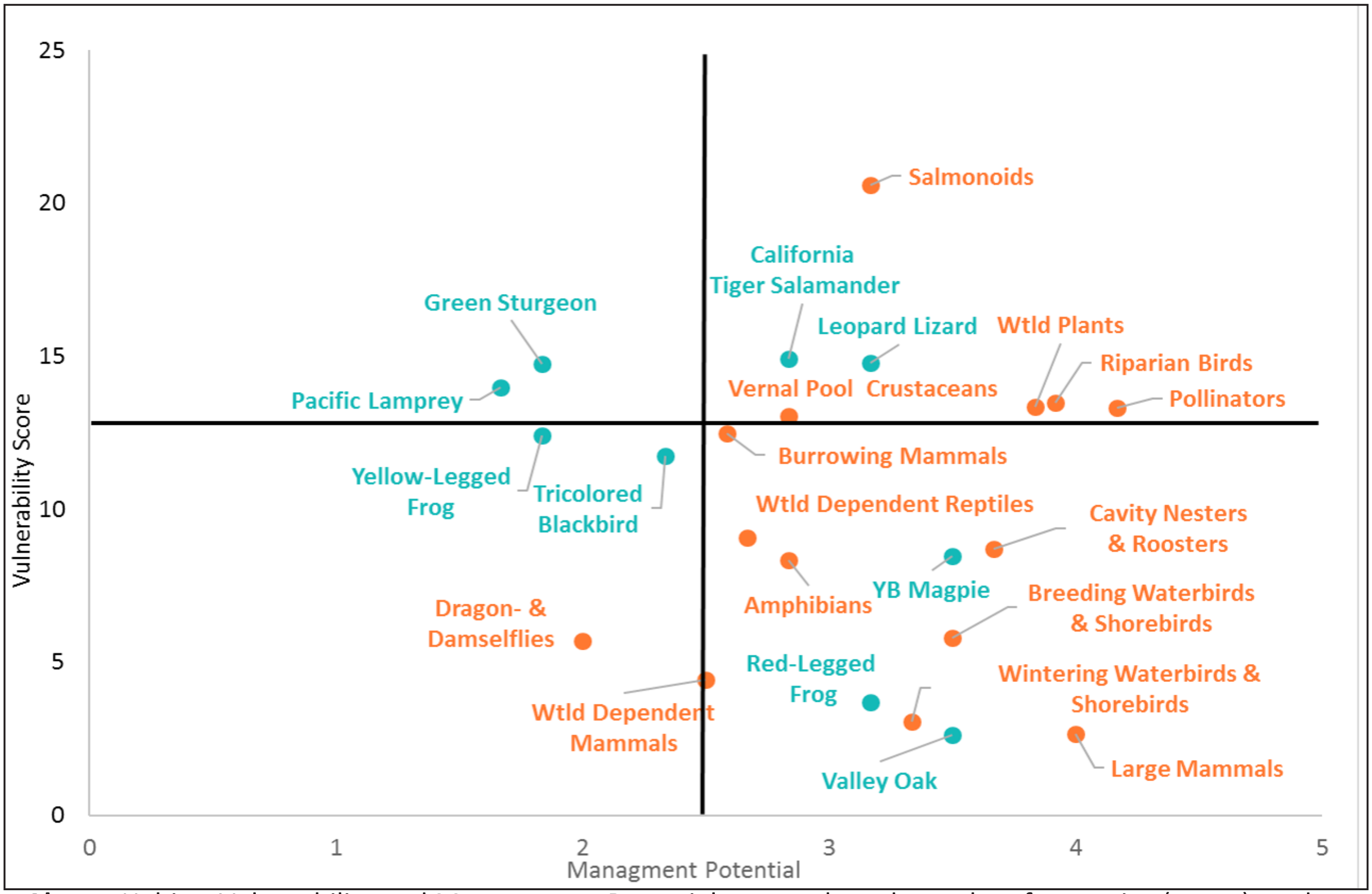
Climate-related factors that reduce the availability and distribution of water were among those scored as high for exposure for many species groups and species. Urban and suburban development, damaging agricultural and rangeland practices, land-use change, and roads and highways were among the non-climate factors that terrestrial as well as aquatic species groups and species are most exposed to.

About half of the species groups and species received low or low-moderate adaptive capacity scores, mostly due to degraded condition of population diversity or reduced and fragmented geographic range. Salmonids and wintering waterbirds were assessed as having the highest adaptive capacity mainly due to the high diversity of these species groups and their large geographic extent.

Management Potential for Priority Species Groups and Species

Of the species groups, pollinators and large wide-ranging mammals scored the highest with regard to their management potential owing to the high societal support and the species' high perceived value. Most bird species groups also received relatively high management potential scores for their value to society and consequently, the societal support to improve management practices. Management potential for the individual species is low to moderate, depending mainly on opportunities for restoring habitat and ability to mitigate the impacts of climate change.

High societal support increases overall Management Potential.



Above: Habitat Vulnerability and Management Potential scores plotted together, for species (green), and species groups (orange)

In Summary

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.

These results can be used by resource managers to help identify priority actions to reduce exposure and increase the habitats' or species groups' adaptive capacity and thereby reduce their overall 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 guidance for a coordinated, partner-driven effort toward increasing the Central Valley landscape's overall adaptive capacity and ability to sustain biodiversity as well as human uses.

Central Valley Landscape; photo by P. Huber

More Information

For the individual vulnerability assessments as well as a detailed methodology, climate projections, and other supporting information, please see the Central Valley Landscape Conservation Project website at http://climate.calcommons.org/cvlcp.

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Oak woodland

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San Joaquin Desert

California Tiger Salamander

Western Bluebird