Southern California Riparian Habitats

Climate Change Adaptation Actions Summary

An Important Note About this Document: *This document represents an initial effort to identify adaptation actions for riparian habitats in southern California based on stakeholder input and existing information. Specifically, the information presented below comprises stakeholder input during a two-day adaptation workshop, peer-review comments and revisions, and relevant examples from the literature or other similar efforts. The aim of this document is to expand understanding of possible adaptation actions for southern California riparian habitats in response to climate change.*

Riparian Habitat Vulnerability

Moderate Vulnerability

The relative vulnerability of riparian habitats in southern California was evaluated to be moderate by habitat experts due to moderate-high sensitivity to climate and non-climate stressors, high exposure to future climate changes, and moderate adaptive capacity. Within arid and semi-arid regions such as southern California, riparian habitats are critically sensitive to changes in hydrologic and flooding regimes, which influence the amount, source, and duration of water within a system. Habitats that rely solely on precipitation are most sensitive to changes in the amount or timing of rain and snow, while groundwater-dependent systems such as springs may be less immediately responsive to changes in water availability. Drought conditions have widespread effects on all ecosystems and may shift species composition towards vegetation that can tolerate drier conditions. Severe flooding can cause erosion and channel entrenchment that may alter habitat structure and function, and wildfire greatly increases the risk of flash flooding and debris flows. Climate vulnerabilities in riparian habitats are further exacerbated by habitat degradation or loss due to human activities. Many riparian habitats have already been lost or heavily degraded by factors that alter their hydrological regime, including development, invasive species, grazing. Although riparian habitats are adapted to variable conditions as a whole, degraded systems may be unable to recover from disturbance and management intervention may be needed to restore normal system processes (e.g., flooding regimes and sediment transport). Riparian habitats support very high numbers of endemic and threatened/endangered species due to their unique conditions and isolated nature. They provide valuable ecosystem services including the provision of clean water, flood control, and sediment transport.

Adaptation Strategies and Actions

Table 1 presents a summary of possible adaptation strategies and actions for riparian habitats, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation.

Adaptation strategies and actions are grouped according to one of five categories:

1. **Enhance Resistance**. These strategies can help to prevent the effects of climate change from reaching or affecting a resource.
2. **Promote Resilience**. These strategies can help a resource withstand the impacts of climate change by avoiding the effects of or recovering from changes.
3. **Facilitate Transition (or Response)**. These strategies intentionally accommodate change and/or enable resources to adaptively respond to changing and new conditions.

4. **Increase Knowledge**. These strategies are aimed at gathering more information about climate changes, impacts, or the effectiveness of management actions in addressing climate change.
5. **Engage Coordination**. These strategies may help coordinate efforts and/or capacity across landscapes and agencies.

Table 1. Summary of possible adaptation options for riparian habitats.

Adaptation Category	Adaptation Strategy	Specific Adaptation Actions
Enhance resistance	Reset tree succession by managing disturbance in meadows	• Use low-density grazing to prevent woody plant encroachment and reduce non-native herbaceous species[1]
	Preserve native riparian habitat and maintain habitat connectivity	• Establish protective land designations (e.g., wilderness, wild and scenic rivers), focusing on intact riparian habitat[1] • Use vegetation to increase shading of riparian habitat and maintain cool, wet areas[2] • Manage vegetation (e.g., mechanical treatments) to reduce fire severity and subsequent erosion and sedimentation[3]
	Reduce the impact of public use and infrastructure	• Redesign trail system infrastructure to minimize impacts from trails in popular areas[1] • Barricade roads and motorized vehicle paths as needed to protect riparian systems[1] • Upgrade road crossings (e.g., install higher-capacity culverts) in areas that are prone to sedimentation and/or provide habitat for sensitive species[2] • Assess the location of roads and consider removing those within sensitive riparian systems[2]
	Manage grazing to reduce impacts on riparian vegetation and soil structure	• Focus grazing on non-native species in spring and prevent grazing on native species in summer[3] • Build livestock exclosures to protect riparian habitats that are easily damaged by grazing[3] • Implement moderate grazing around vernal pools to maintain vernal pool hydrology[4]
	Reduce water extraction from springs	• Decrease the number of permits for water extraction[1] • Do not renew expired permits for water extraction[1]

[1] Denotes adaptation action identified by workshop participants.
[2] Halofsky, J. E., Peterson, D. L., O'Halloran, K. A., & Hawkins Hoffman, C. (Eds.). (2011). *Adapting to climate change at Olympic National Forest and Olympic National Park* (No. Gen. Tech. Rep. PNW-GTR-844). Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
[3] Actions were sourced from the Climate Adaptation Project for the Sierra Nevada and/or the Northern Rockies Adaptation Partnership.
[4] Pyke, C. R., and J. Marty. (2005). Cattle grazing mediates climate change impacts on ephemeral wetlands. *Conservation Biology 19*:1619–1625.

Adaptation Category	Adaptation Strategy	Specific Adaptation Actions
	Reduce impact of invasive species	• Remove invasive plants (e.g., arundo, tamarisk) to reduce competition with native species for water[1] • Manage invasive species that may increase during drought events (e.g., grasses, bullfrogs)[1]
Promote resilience	Identify and restore key ecosystem functions	• Restore floodplain function by establishing setbacks, stabilizing banks and headcuts, and employing plug-and-pond techniques to support current and future hydrology[3] • Use prescribed fire and/or stop suppressing fire to allow a return to historical fire regimes[1]
	Increase floodplain resilience to high peak flows and erosion	• Remove or modify infrastructure to allow channel migration within the floodplain[3]
	Increase habitat heterogeneity to support species diversity	• Enhance breeding sites by providing microhabitat structure (e.g., woody debris) for nesting and egg deposition[3]
Facilitate transition	Establish local seed banks for future restoration projects	• Collect seeds from plants that have high value to wildlife and will be viable in the future[1] • Collect seeds from various locations and elevation bands, prioritizing species that are expected to tolerate future climate conditions[1] • Perform re-growth experiments to ensure that proper habitat restoration techniques are being used[1]
	Support species' survival under changing climate conditions	• Focus amphibian conservation activities in areas identified as climate refugia and/or areas that may be suitable habitat in the future[3] • Explore the potential for assisted translocation of obligate riparian species to suitable future habitat[5] • Manage land to create networks of riparian habitat to create corridors for wildlife movement[6]
Increase knowledge	Improve understanding of the spatial and temporal connection between surface flows and groundwater in order to increase water residence time	• Map water sources and aquifers to understand spatial and temporal connections between surface flows and groundwater[3]
	Prioritize springs for protection and monitoring	• Map known springs and land cover type in order to prioritize protection[1] • Monitor the water level in springs to detect changes over time[1]

[5] Millar, C. I., Stephenson, N. L., & Stephens, S. L. (2007). Climate change and forests of the future: managing in the face of uncertainty. *Ecological Applications*, *17*(8), 2145–2151.

[6] Lawler, J. J., Tear, T. H., Pyke, C., Shaw, R. M., Gonzalez, P., Kareiva, P., … Pearsall, S. (2010). Resource management in a changing and uncertain climate. *Frontiers in Ecology and the Environment*, *8*(1), 35–43.

Adaptation Category	Adaptation Strategy	Specific Adaptation Actions
	Prioritize the protection of riparian habitat and monitor the effects of changing climate conditions	• Rank the vulnerability of groundwater-dependent systems[1] • Map riparian habitat, climate trends and 50-year climate projections, surrounding native vegetation, and historical species ranges[1]
Engage coordination	Improve watershed health and functioning	• Develop partnerships with university programs that focus on hydrology, groundwater, and/or watersheds[1] • Develop partnerships with recreation users to educate and enhance public understanding of watershed health[1] • Incorporate boardwalks and educational features to offer the public information about watershed health[1]
	Reduce illegal take from springs	• Work with enforcement agencies to identify and eliminate instances of illegal take from springs[1]

Table 2 identifies the key riparian habitat vulnerabilities that may be reduced and/or addressed by various adaptation actions. These linkages are based on expert opinion.

Linking vulnerabilities to adaptation options can help managers decide which actions to implement and aid prioritization based on multiple factors (e.g., habitat type, observed or projected changes, ecosystem service). However, when selecting adaptation actions for implementation it is also important to consider secondary effects on other resources, both positive and negative. For example, trail or road decommissioning may benefit aquatic systems by limiting erosion impacts but could also remove important access points to fire-prone areas. For more information about riparian habitat adaptation strategies and actions developed by participants during the workshop, including where and how to implement adaptation actions, implementation timeframe, collaborations and capacity required, and secondary effects on other resources (both positive and negative), please see the report *Climate Change Adaptation Strategies for Focal Habitats of Southern California*.

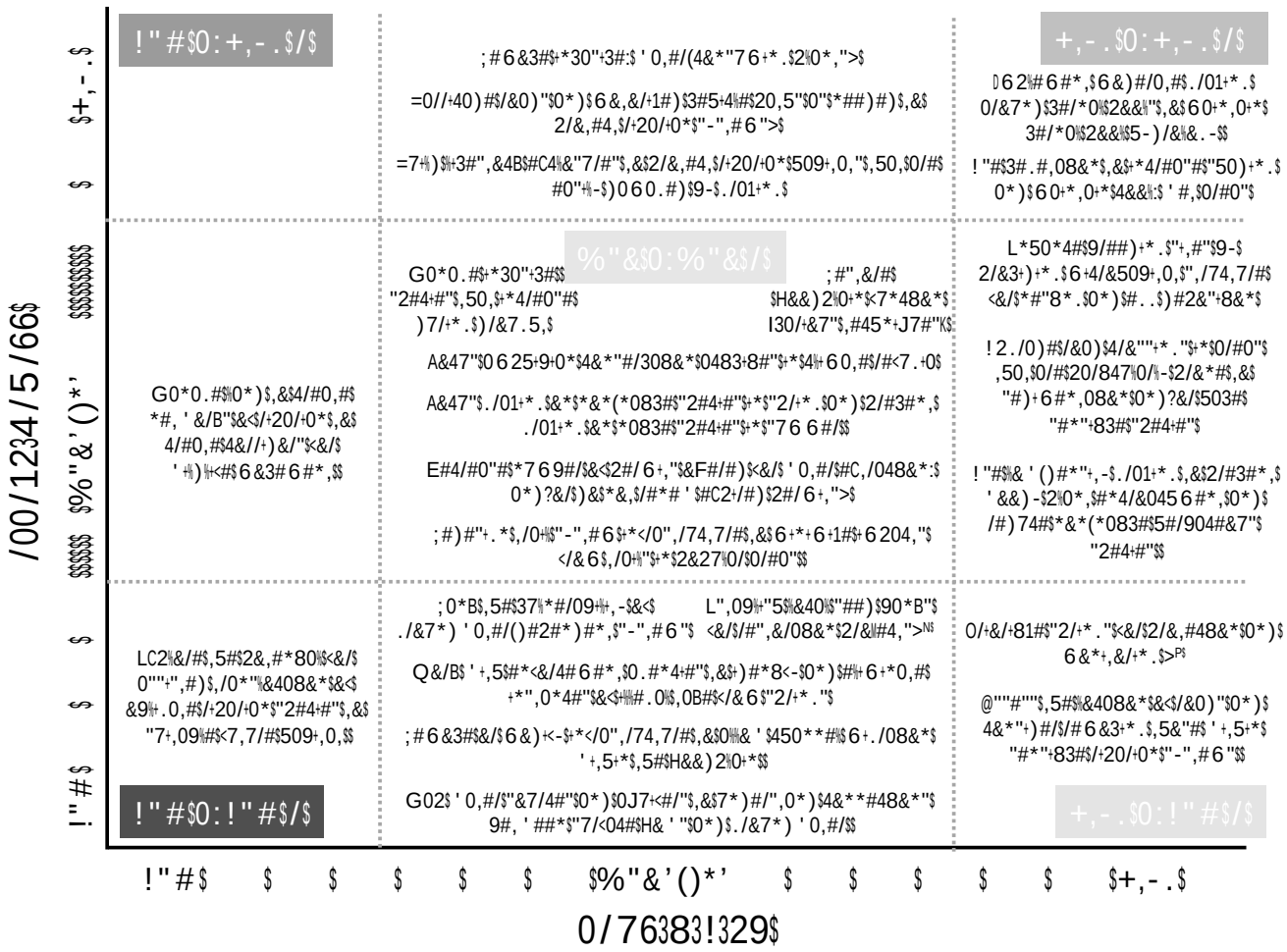

Figure 1. Riparian habitat adaptation actions plotted according to implementation feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability). Those actions having high feasibility and effectiveness appear in the upper right corner and low feasibility and effectiveness in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants, although in some cases the ranking was shifted based on expert opinion. All other adaptation action evaluations are based on expert opinion.

Recommended Citation

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This document is available online at the EcoAdapt website (http://ecoadapt.org/programs/adaptation-consultations/socal).

[7] This overall goal includes several specific adaptation actions (see Table 1).